Published since 1949

Exceptional service in the national interest

Sandia LabNews

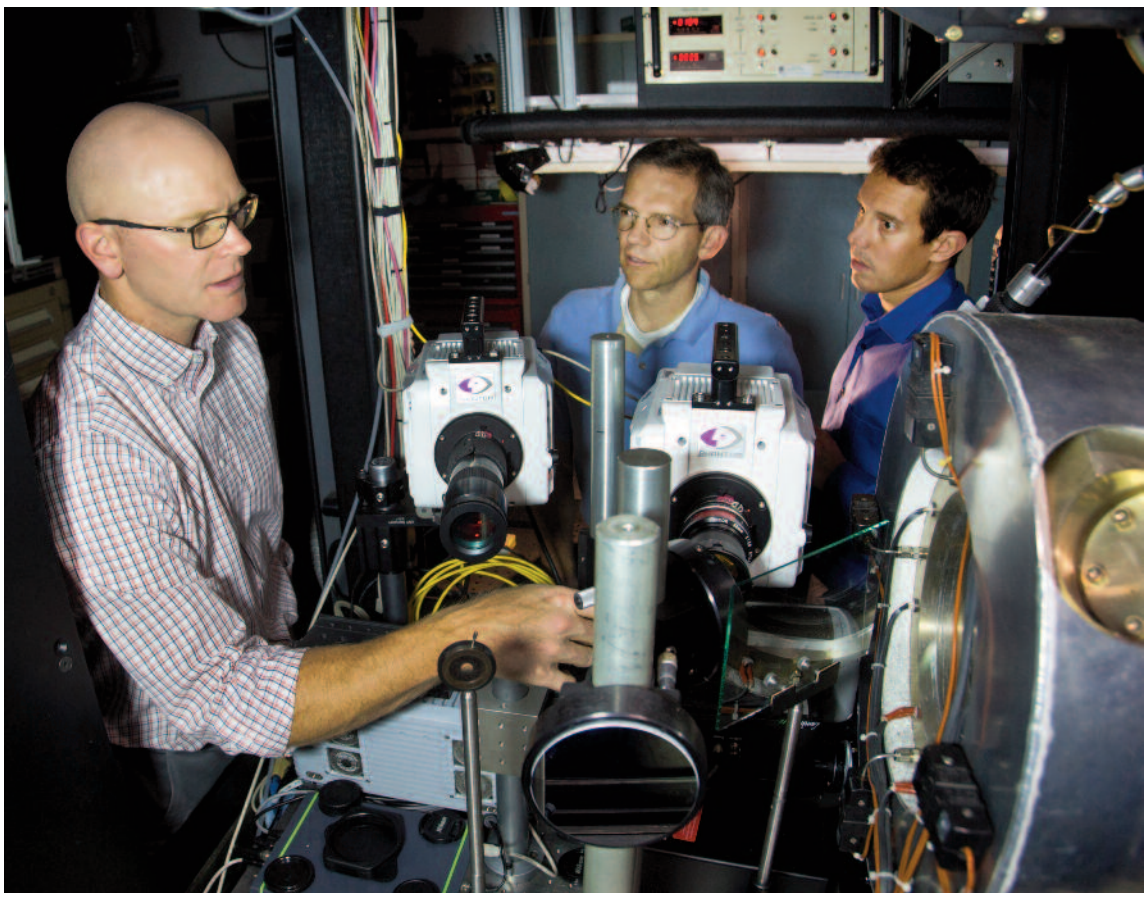
Vol. 69, No. 21
Oct. 27, 2017

Managed by Sandia Corporation for the National Nuclear Security Administration

Meet Mike Burns

Engineering in the genes . . . . page 12

New engine optics to fuel research



Sandia team develops optical diagnostic that helps improve fuel economy, reduce emissions

By Michael Padilla

A new optical device at Sandia that helps researchers image pollutants in combusting fuel sprays might lead to clearer skies in the future.

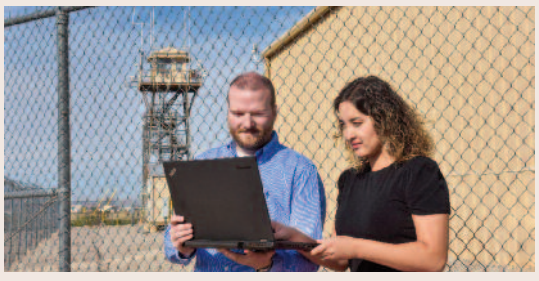
An optical setup developed by researchers at Sandia's Combustion Research Facility (CRF) and the Technical University of Denmark can now quantify the formation of soot — particulate matter consisting primarily of carbon — as a function of time and space for a variety of combustion processes. Initially, the researchers have focused on the combustion of liquid fuel sprays found in engines, where the extreme pres-

(Continued on page 3)

CLEAN ENGINE OPTICS — Scott Skeen, left, Lyle Pickett, and Julien Manin discuss a new optical device developed at Sandia that can quantify the formation of soot. In the Spray Diagnostics and Combustion laboratories the researchers study fuel injection and combustion processes relevant to modern compression-ignition and spark-ignition engines. Their diagnostic tools include high-power lasers, ultra-bright LEDs, long-distance microscopes, and high-speed cameras. The acquired data are frequently used by academia and industry to develop better spray combustion models. (Photo by Dino Vournas)

IMPROVING GLOBAL BIORISK MANAGEMENT 5

Inside . . .



CHOOSE YOUR OWN ARMY BASE 9

OPTIMIZING WAVE ENERGY

Robotics principles help wave energy converters better absorb the power of ocean waves

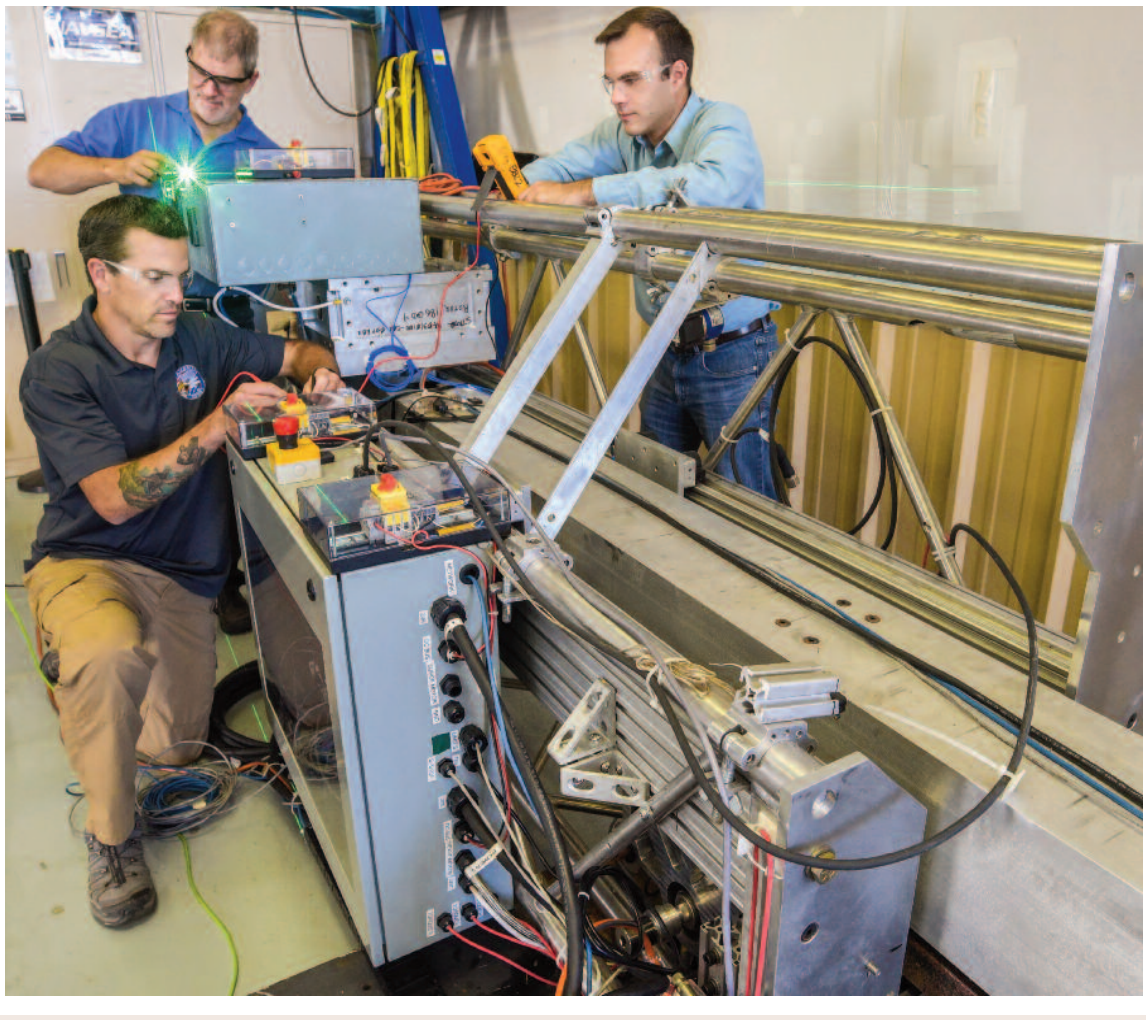
By Kristen Meub

Compared to wind and solar energy, wave energy has remained relatively expensive and hard to capture, but Sandia engineers are working to change that by drawing inspiration from other industries.

Sandia's engineering team has designed, modeled, and tested a control system that doubles the amount of power a wave energy converter can absorb from ocean waves, making electricity produced from wave energy less expensive. The team applied classical control theory and robotics and aerospace engineering design principles to improve the converter's efficiency.

During a multiyear project funded by DOE's Water Power Technologies Office, engineers from Sandia's Water Power program are using a combination of mod-

(Continued on page 4)



CONTROL POWER — Sandia robotics researchers, left to right, Clint Hobart, Kevin Dullea, and Steven Spencer prepare the wave energy converter's actuator for testing. (Photo by Randy Montoya)

HR

OPEN ENROLLMENT 2018

Active Employees: Wednesday, Nov. 1-Thursday, Nov. 16, 5 p.m. MT, 4 p.m. PT
PreMedicare retirees: Sunday, Oct. 15-Friday, Nov. 17
Medicare Retirees: Sunday, Oct. 15-Thursday, Dec. 7

DETAILS ON PAGES 6-7

Sandia National Laboratories
SANDIA EXTRAS

That's that

Perhaps it's a bit unseemly to be quoting Karl Marx in the *Lab News* — his theories about how society should be ordered, after all, found their fullest expression in this laboratory's greatest historical adversary, the Soviet Union — but from time to time, I see things in the world that call to mind his comment that "History repeats itself, first as tragedy, then as farce."

To Marx's observation, I think there's an apt corollary: In the field of technology, history repeats itself, first as science fiction, then as marvel, then as ho-hum day-to-day commodity item. What brings this to mind is a news item I saw a few days ago about the first battle of giant robots, a challenge match between "robots" (actually, human-piloted rock 'em, sock'em-type vehicles) built by US-based Megabots Inc. and Japan's Suidobashi Heavy Industry. The fight was streamed over the Twitch gamers' website. Twitch, a subsidiary of Amazon, promoted the fight heavily and generated a lot of media interest.

This Clash of the Titans — the Megabots entry, Eagle Prime, weighed in at several tons and stood 15 feet tall, while the smaller Japanese entry was still plenty big — was prerecorded and edited; apparently the fight took place over several days as the robots' engineers needed a lot of downtime to repair their combatants between rounds. I won't offer any spoilers here, but there was a clear winner and the by all accounts everyone had a grand time. I haven't had a chance to watch the stream but it sounds like it was not unlike that staple of rural county fairs, the demolition derby, of which I have seen a few. And they're a gas, a real only-in-America spectacle in which the crowd is fully in on the joke, the sheer, crazy absurdity of the whole thing.

Battling robots have been a staple of science fiction for decades. Recent examples are embodied in the megahit *Transformer* movie series and the franchise-wannabe *Pacific Rim* series. And for me, the most memorable scene in *Aliens*, the best of the movies in that perennial franchise, is where Ripley takes control of a (still-fictional but soon to be real?) Caterpillar P-5000 powered work loader in a *mano-a-mano* fight to the finish with the alien queen bee (or whatever it was).

The point is, science fiction writers were, as they often seem to be, ahead of the curve, providing the inspiration for lots of engineering breakthroughs.

As Sandia embarks on an ambitious new strategic planning initiative — Steve wrote about it in a recent message to all hands — I wonder if we ought to put a couple of sci-fi writers on payroll. The synergy of dreamers and doers could be transformative.

* * *

I'm not a great world traveler, but I've been around a bit and I've been struck by how my preparation for a trip has evolved over the years. When I was 17, the year between my junior and senior year in high school, I traveled from the D.C. area to Powder River, Wyoming, to work on a sheep ranch, packing everything I needed in a small backpack; actually, I packed more than I needed because that summer I don't think I ever actually changed clothes at all — by August, my Levis were so full of lanolin and grime they could stand up in a corner of the bunkhouse all by themselves.

The following year, I returned to the West, this time to matriculate at the University of Albuquerque. I was still traveling light: a Trapper Nelson wooden-framed backpack and a guitar were all I needed. Things went on apace over the years, the necessary "stuff" increasing incrementally: A carry-on suitcase instead of a backpack, then a full suitcase, then a suitcase and one of those wardrobe bags.

Everything changed, packing-wise, with the advent of the digital era.

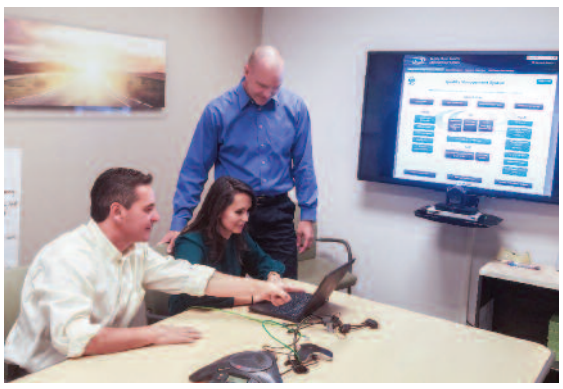
Time was, when our forebears struck out on their own they'd carry along everything they needed to survive in the rough: a bedroll, an axe, rope, tools, flour, rifle and gunpowder, a plow, seeds, and whatnot. In this brave new world, my travel needs include: a phone, a smart watch, a DSLR, an underwater camera, a tablet, a Bluetooth speaker, an Echo Dot, a Kindle, a Chromecast, a dedicated GPS unit, a starfinder, and the accompanying cables, wall warts, and power strips to accommodate them all. I know this is all a bit excessive, even ridiculous. For a big upcoming trip we've got planned, I'm going to cut back. I'm going to rough it, by George. I'm leaving behind the watch. I'll just do without.

See you next time.

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

Supply Chain leads the charge to standardize quality across the Labs

By Holly Marie Vargo



SUPPLY CHAIN MANAGER Jimmy Romero, left, Leann Jenkins, and Dallas Theobald strategizing for the ISO 9001:2015 audit. Dallas helped Supply Chain prepare for the ISO 9001:2015 audit by planning and coordinating its transition from the 2008 standard to the current 2015 version.

In July 2017, Integrated Supply Chain Management Center became the first Sandia organization to achieve ISO 9001:2015 certification, the latest version of a prestigious and globally recognized international standard for measuring the effectiveness of an organization's Quality Management System. In doing so, Supply Chain has paved the way for Sandia to fulfill the Sandia Leadership Team's goal of achieving corporate-wide ISO certification within the next three years.

For the past four years, Supply Chain has shaped its business practices to meet ISO quality standards, and the center has sought and achieved ISO recertification each year from external, independent auditors. Supply Chain manager Jimmy Romero says he appreciates the annual ISO audits.

> *"It's not just a certification to us. Supply Chain is driven to deliver quality services that meet our customers' needs."*
>
> **— Jodi Maheras**
> **Supply Chain Director**

"They force us to analyze our processes and documentation, which helps us identify ways to improve and run more efficiently," he says, adding that he's proud of how Supply Chain's Quality Management System has matured over the years.

"It's rewarding to see how our employees have taken ownership of Supply Chain's quality program and integrated it into their daily operations," he says.

Supply Chain decided to conduct its business according to ISO standards to demonstrate to its partners, customers, and stakeholders (including suppliers, DOE/NNSA, and the NNSA Sandia Field Office) that it is committed to fairly, reliably, and efficiently executing Sandia's procurement transactions and logistics-related operations in support of Sandia's mission.

According to Supply Chain Director Jodi Maheras, "It's not just a certification to us. Supply Chain is driven to deliver quality services that meet our customers' needs. Achieving ISO recertification validates that we have successfully woven our QMS into the very fabric of how we do business."

Dallas Theobald, Supply Chain's quality systems professional, helped the center prepare for the ISO 9001:2015 audit by planning and coordinating Supply Chain's transition from the 2008 standard to the current 2015 version. Dallas partnered with a team from Sandia's quality assurance organization, which used the current ISO standards to assess Supply Chain's QMS months before the official ISO auditors arrived. According to Dallas, "Our cross-organizational partnership not only helped Supply Chain review the overall health of its quality processes, but it gave the quality assurance team members a chance to sharpen their own ISO-auditing skills."

Together, the two centers were able to "test" Sandia's newly contracted third-party auditors, Orion Registrars Inc., which will provide the Labs with invaluable information and experience once Sandia begins pursuing SLT's strategic objective for achieving site-wide ISO certification.

In 2018, as part of the Sandia Leadership Team's efforts to increase efficiency, lean corporate processes, and ensure continued compliance with the prime contract, Sandia will begin a staged, three-year plan for the corporate-wide certification effort.

Exceptional service in the national interest

Sandia LabNews

http://www.sandia.gov/news/publications/labnews/

Sandia National Laboratories

Albuquerque, New Mexico 87185-1468
Livermore, California 94550-0969
Tonopah, Nevada • Nevada National Security Site
Amarillo, Texas • Carlsbad, New Mexico • Washington, D.C.

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

Bill Murphy, Editor 505/845-0845
Randy Montoya, Photographer 505/844-5605
Patti Koning, California site contact 925/294-4911
Michael Lanigan, Production 505/844-2297

Contributors: Michelle Fleming (Ads, Milepost photos, 844-4902), Neal Singer (845-7078), Stephanie Holinka (284-9227), Darrick Hurst (844-8009), Heather Clark (844-3511), Sue Holmes (844-6362), Nancy Salem (844-2739), Valerie Larkin (284-7879), Lindsey Kibler (844-7988), Tim Deshler (844-2502), Mollie Rappe (844-8220), Kristen Meub (845-7215), Michael Padilla (925-294-2447), Julia Bernstein (925-294-3609), Jim Danneskiold, manager (844-0587)

Classified ads 505/844-4902

Published on alternate Fridays by Internal & Digital Communications Dept. 3651, MS 1468

Retiree deaths

Kathleen Laycak (age72) . . . . . July 20
Phillip Cusenbary (59) . . . . . July 21
Joseph Trujillo (95) . . . . . July 22
Donald Bahrs (81). . . . . Aug. 5
Herbert Howe (97)) Aug.13
Donald Weldon (94) . . . . . Aug 16
Donald Flores (78) . . . . . Aug. 18
Charles Percival (80) . . . . . Aug. 19
Thomas Richardson (77) . . . . . Aug. 20
John James Marron (90) . . . . . Aug. 21
Winton Pafford (93) . . . . . Aug. 25
William Iorg (92). . . . . Aug. 25
Jesus Baca (90) . . . . . Aug. 26
Gordon Ross (94). . . . . Aug. 27
Lisa Polito (58) . . . . . Aug. 28
Joyce Willford (95) . . . . . Sept. 2
Herman Kaneshiro (92). . . . . Sept. 5
Joaquin Chavez (88). . . . . Sept. 7
Leo Arellano (93) . . . . . Sept. 9
Jay Newquist (71). . . . . Sept. 9
T. Baggett (92) . . . . . Sept. 14
R. Womelsduff (88) . . . . . Sept. 15
Raymond Goehner (72) . . . . . Sept. 18
Larry Neal Powell (83) . . . . . Sept. 20
Frank Jaramillo (76). . . . . Sept. 27

TIME SEQUENCE OF IMAGES showing extinction of light caused by the soot cloud formed during the injection of a diesel spray. The liquid fuel spray is seen at the bottom of the images and appears dark because the light passing through the combustion vessel is scattered by the liquid droplets. The soot cloud downstream appears dark mainly due to absorption of light by the soot particles.

New engine optics to fuel research

(Continued from page 1)

sures and temperatures create an environment that is optically challenging.

To meet future particulate matter emissions mandates without sacrificing fuel savings, engine developers need advanced combustion strategies to reduce the formation of soot in spray flames.

"The acquired data provides important insights into the fuel spray motion as well as the timing and quantity of soot formed under a wide range of conditions," says Sandia CRF researcher Scott Skeen. "Engine developers can use this information to validate computer models and design advanced engine combustion strategies that will improve fuel economy for consumers while also lowering tailpipe pollutant emissions."

The work, published in an *Applied Optics* paper titled "Diffuse back-illumination setup for high temporally resolved extinction imaging," was selected as a "Spotlight on Optics" by the Optical Society in July. Authors included Fredrik Westlye and Anders Ivarsson from the Technical University of Denmark and Sandia researchers Scott, Keith Penney, Lyle Pickett, and Julien Manin.

High-speed diagnostics will shed light on future research

The optical setup was developed to quantify soot formation in high-pressure, engine-relevant spray flames produced in Sandia's optically accessible, constant volume, pre-burn, combustion chamber.

Imaging flames at temperatures and pressures found in engines can be difficult because of a phenomenon called "beam steering," which occurs when light passes through a medium with varying refractive indexes. The phenomenon is commonly observed as a mirage on the highway in the summer time. The hot pavement heats up nearby air causing its refractive index to change. The sunlight changes direction as it passes from cooler air through hotter air, and these steered light rays give the impression that there is water in the road — a mirage. In a similar way, a flame causes beam steering because of adjacent high- and low-temperature regions. The magnitude of beam steering increases significantly in an engine because of the high pressures. With optimized lighting and imaging optics, however, the effects of beam steering can be eliminated.

The special lighting was enabled by a custom engineered diffuser large enough to fill the area of Sandia's spray combustion chamber window (100 mm). The engineered diffuser was specifically designed to emit light rays with the same brightness over a specified angular range. In this way, a light ray that gets steered as it passes through the flame will be replaced by another ray having the same intensity.

Sandia CaliforniaNews
Exceptional service in the national interest

The angle of the engineered diffuser is optimized based on the physical dimensions of the experimental facility, the magnitude of the anticipated beam steering, and the collection angle of the imaging system.

"In fact," Julien says, "without such a specific optical arrangement, quantifying soot via light attenuation in high-pressure spray flames, where beam steering is more severe, would not be possible."

Making cleaner engines

Scott explains that although new diesel vehicles are cleaner than ever before, some of the latest-generation gasoline engines emit as much particulate matter as older diesel engines. The increased particulate matter can be attributed to the adoption of a gasoline direct-injection fuel system, which results in improved fuel economy and therefore lower carbon dioxide emission per mile driven.

Gasoline direct injection involves spraying high-pressure liquid gasoline directly into the engine cylinder rather than mixing and vaporizing the fuel in the intake port outside the cylinder. This method reduces heat loss and allows for freer airflow. However, consumer savings at the pump come at the cost of higher particulate matter emissions. Unlike the much-maligned black smoke emitted from older diesel engines, soot emitted from gasoline direct injection engines is invisible to the naked eye because of the particles' very small size.

The diagnostic presented in this paper allows researchers to quantify the formation of particulate matter in combusting sprays with unprecedented temporal and spatial resolution. Insights gained and data acquired from the use of this diagnostic will inform and guide researchers and automotive manufacturers toward designs that maximize fuel efficiency while minimizing harmful tailpipe emissions.

A standardized method

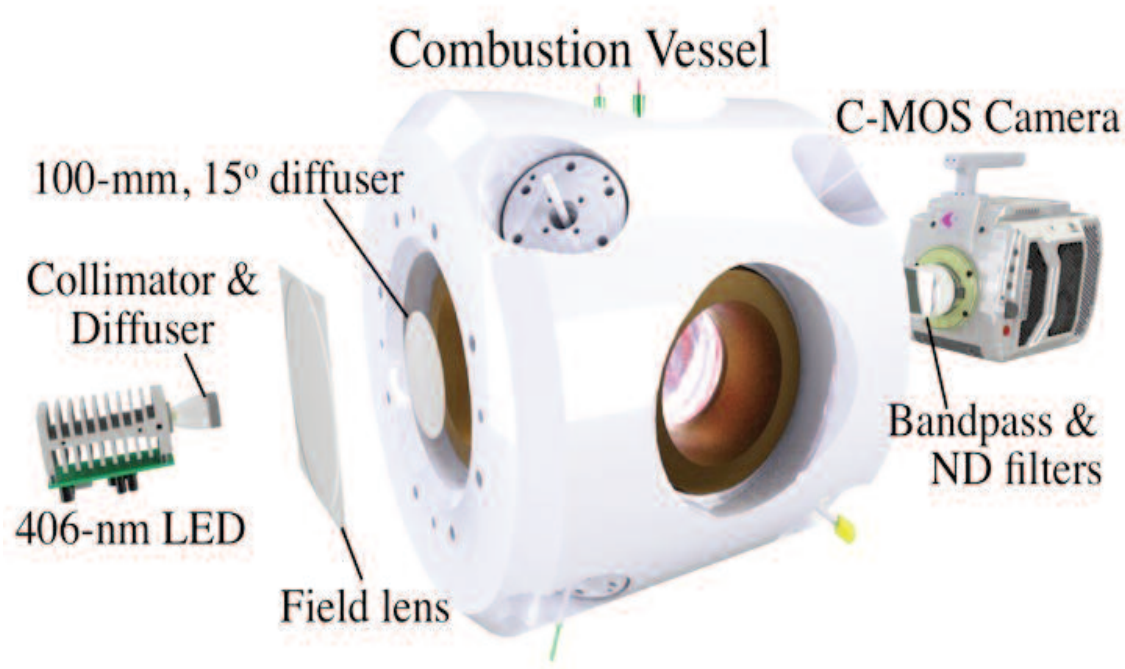
The work is a significant contribution to Engine Combustion Network which was established in 2010 by Sandia researcher Lyle Pickett. The network promotes collaboration among engine researchers around the world. Although participation is voluntary and the network provides no financial support, more than 15 institutions have contributed experimental data.

"The network represents the power of a grass-roots movement," says Lyle. "We have accomplished 20 years' worth of research in one-fifth of the time."

One challenge of the wide-ranging collaborative effort within the network is the standardization of experimental diagnostics. "With so many researchers eager to participate, it is important to ensure that everyone contributes high-quality data acquired in a technically sound manner," Lyle says.

The optical technique developed in this work relies on light attenuation or extinction to quantify the amount of soot in a flame. As light enters the combustion vessel, it will be absorbed or scattered by soot particles. Light that is absorbed and some light that is scattered will not reach the camera sensor. This reduction in measured light intensity — relative to a clear optical path — can be related to the amount of soot present. To make implementation of this diagnostic tool convenient for network participants, the associated publication provides detailed guidance on the necessary equipment and instruction for dimensioning the illumination source and collection optics. The use of a Sandia-developed LED light source, as opposed to a high-speed laser, means the cost and complexity are significantly lower.

"This work aims to establish a standardized experimental method of extinction imaging that will increase the reliability and reproducibility of experimental measurements submitted to the network," says Westlye.



A 3D RENDERING of the combustion vessel and diffused back-illumination extinction imaging setup.

Wave energy

(Continued from page 1)

eling and experimental testing to refine how a wave energy converter moves and responds in the ocean to capture wave energy while also considering how to improve the resiliency of the device in a harsh ocean environment.

"We are working to create methodologies and technologies that private companies can harness to create wave energy devices that will enable them to sell power to the US grid at a competitive price," Sandia engineer Ryan Coe says. "By getting more energy out of the same device, we can reduce the cost of energy from that device."

Greater control of wave energy converters yields increased energy absorption

Sandia's wave energy converter is a large 1-ton ocean buoy with motors, sensors, and an onboard computer built at a scaled-down size for a testing environment. Commercial wave energy converters can be large and are generally part of a group of devices, like a wind farm with multiple turbines.

"These devices can be in open ocean and deep water, maybe 50 to 100 miles off the coast," Ryan says. "An array of wave energy converters, maybe 100 devices, connected to an underwater transmission line would send the wave energy back to shore for consumption on the grid."

To capture energy from the ocean's waves, a wave energy converter moves and bobs in the water, absorbing power from waves when they generate forces on the buoy. Sandia's previous testing focused on studying and modeling how the devices moved in an ocean-like environment to create a numerical model of their device.

Using the model they developed and validated last fall, the team wrote and applied multiple control algorithms to see if the converter could capture more energy.

"A control algorithm is a set of rules you write that prompts an action or multiple actions based on incoming measurements," Sandia engineer Giorgio Bacelli says. "The sensors on the device measure position, velocity, and pressure on the hull of the buoy and then generate a force or torque in the motor. This action modifies the dynamic response of the buoy so that it resonates at the frequency of the incoming waves, which maximizes the amount of power that can be absorbed."

The control system uses a feedback loop to respond to the behavior of the device by taking measurements 1,000 times per second to continuously refine the movement of the buoy in response to the variety of waves. The team developed multiple control algorithms for the buoy to follow and then tested which control system yielded the best results.

"Controls is a pretty big field," Sandia engineer Dave Patterson says. "You can operate anything from planes to cars to walking robots. Different controls will work better for different machines, so a large part of this project is figuring out which control algorithm works and how to design your system to best take advantage of those controls."

WAVE ENERGY — Sandia water power engineers, left to right, Ryan Coe, Dave Patterson, and Giorgio Bacelli inspect the wave energy converter buoy. (Photo by Randy Montoya)

Giorgio says that while the primary objective of the control algorithm is to maximize energy transfer between the wave and the buoy, the amount of stress being applied to the device must also be considered.

> *"This year, the device can move forward, backward, up and down, and roll in order to resonate at the frequency of the incoming waves."*

"Resonance also stresses the entire structure of the device, and to expand the longevity of the device, we need to balance the amount of stress it undergoes," Giorgio says. "Designing and using a control system helps find the best tradeoff between the loads and stress applied to the buoy while maximizing the power absorbed, and we've seen that our systems can do that."

Theory becomes reality in the Navy's world-class wave tank

Results from numerical modeling with the control algorithms showed a large potential, so the team took the converter to the US Navy's Maneuvering and Sea Keeping facility at the Carderock Division in Bethesda, Maryland, in August to test the new control methods in an ocean-like environment. The wave tank facility is 360 feet long, 240 feet wide and has a wave maker that can generate precisely measured waves to simulate various ocean environments for hours at a time. Sandia used the wave tank to simulate a full-size ocean environment off the coast of Oregon, but scaled down to 1/20th the size of typical ocean waves to match their device.

"The accuracy of the wave they can generate and the repeatability is outstanding," Giorgio says. "The ability to recreate the same condition each time allowed us to conduct very meaningful experiments."

The team ran a baseline test to see how the converter performed with a simple control system directing its movements and actions. Then they ran a series of tests to study how the various control algorithms they had designed affected the ability of the device to absorb energy.

"This year, the device can move forward, backward, up and down, and roll in order to resonate at the frequency of the incoming waves," Giorgio says. "All degrees of freedom were actuated, meaning there are motors in the device for each direction it can move. During testing we were able to absorb energy in each of these modes, and we were able to simulate the operating conditions of a device at sea much more accurately." In fact, the tests showed that theory did match reality in the wave tank. The control algorithms were able to more than double the amount of energy the wave energy converters were able to absorb without a control system.

The team is currently analyzing the testing data and considering further options to refine the control systems to maximize energy transfer.

Real-time SuperLab demonstration

ENGINEER JACK FLICKER reviews simulation data during the Global RT SuperLab's first demonstration of a joint real-time simulation of an electrical grid.

By Kristen Meub

Engineers from Sandia's Distributed Energy Technologies Laboratory (DETL) joined a team of researchers based in the US and Europe to demonstrate the ability to jointly perform a real-time simulation of an electrical grid by using synchronized hardware-in-the-loop capabilities. This demonstration, the first one under the Global RT SuperLab partnership, entailed exchanging high-speed power system data with other national laboratories and universities over secure communication channels. Hardware-in-the-loop simulation is a process that allows for real-time testing of hardware and control systems embedded in a simulated power system environment.

"The ability to perform this type of joint analysis using hardware-in-the-loop capabilities at various locations creates new capabilities, increases opportunities for collaboration, and makes research infrastructure investment more cost effective," Abraham Ellis, manager of the Renewable and Distributed Systems Integration group, says.

During this first demonstration, Sandia simulated the behavior of a distribution network with embedded photovoltaic power by using an actual solar inverter with advanced grid-support capabilities at DETL while researchers at other labs and universities simulated other elements of a power grid.

"The power of the real-time hardware-in-the-loop simulation capability with transmission and distribution co-simulation is understanding how emergent behaviors of distributed energy resources affect the bulk power system," Sandia engineer Jay Johnson says. "For instance, under fault conditions for a system with very high penetration of PV, if all photovoltaic inverters disconnect from the grid, there can be serious consequences including load shedding or system stability issues."

The Global RT SuperLab initiative was led by Idaho National Laboratory and included the National Renewable Energy Laboratory in addition to Sandia. The group plans to do more demonstrations in the future to tackle a range of grid-related research questions.

"The ability to do a simulation with geographically disparate locations that requires temporal resolution is really powerful," says Sandia engineer Jack Flicker. "It also means that we can do real-time simulations leveraging resources at other institutions, and that other labs and universities could use Sandia's resources. It allows the participating labs and universities to work together to harness our different capabilities and solve difficult large-scale problems."

International peer mentorship program improves global biorisk management

By Mollie Rappe

The world is becoming increasingly interconnected. While this has definite advantages, it also makes it easier to spread disease. Many diseases don't produce symptoms for days or weeks, far longer than international flight times. For example, Ebola has an incubation period of two to 21 days.

Improving biosafety practices around the world to prevent the spread of diseases to health care workers and biomedical researchers is an important part of halting or minimizing the next pandemic, says Eric Cook, a Sandia biorisk management expert.

In mid-October, during the American Biological Safety Association annual conference, Eric gave a plenary talk on Sandia's biosafety peer mentorship program.

This mentoring program, called the Biosafety Twinning program, pairs experienced biosafety professionals from developed countries with their counterparts in the developing world. The twins work together over six months on self-selected projects to improve the biosafety and biosecurity of the Middle East and North Africa regional twin's home institution or country. Posters on five of the twinning projects were also presented at the annual conference.

Experts from Sandia's International Biological and Chemical Threat Reduction group have been working for more than 15 years to enhance global biosafety and biosecurity through this innovative mentoring program, other training programs, and biorisk manuals.

EMAD RIZKALLA ZAKI from Egypt's Animal Health Research Institute explains his twinning project at the 2017 American Biological Safety Association conference in Albuquerque. (Photo by Will Pinard)

Six-month projects with substantial impacts

The Biosafety Twinning projects are planned to achieve results in six months but often grow to impact whole countries, says Eric.

Bassel Mamdouh, from Egypt's Central Public Health Lab and a member of the second Twinning class, planned to develop a biorisk management structure for some of Egypt's Ministry of Health labs. His project expanded to include assigning biosafety coordinators for each of the 27 regional public health laboratories, getting ministry leadership approval, determining roles and responsibilities for biosafety coordinators and officers, and ensuring they were properly trained. In addition to laying down the biorisk management infrastructure for the whole country, this project also helped identify future twins, says Will Pinard, a Sandia biorisk management expert also involved in the program.

Omar Elahmer, from Libya's National Centre for Disease Control and a member of the third Twinning class, originally planned to survey researchers and health care workers from throughout Libya about gaps in recent university graduates' laboratory training. After designing the survey and receiving 450-500 responses, he saw there was a real need for basic biorisk management training. He worked with his twin, Angie Birnbaum, Tulane University's director of biosafety, to design a basic curriculum based on what the surveys said would be most necessary before starting to work in a lab. Based on this project, the US State Department provided the funding to train 20 Libyan professors to teach biosafety.

"I've been fortunate to help a few twins. Their projects have ranged from the development of a project to address a site-specific biorisk need to projects that will serve as the foundation for biorisk management education of all laboratories in that country under their respective ministries. The latter is mind-boggling," says Ben Fontes, a biosafety officer at Yale University.

Extensive network of biosafety professionals

The project's results are only one product of the Twinning program.

"For me, the primary purpose of the Twinning program is to create this large network that's going to survive for decades," says Eric, adding, "The networking doesn't just happen East-to-West. The networking happens within the region as well."

Having a network of biosafety experts to ask for help when he had questions was critical when Eric started out as a biosafety officer 20 years ago. He says, "Back then, there were no books and very few courses, so most of what I know about biosafety I learned directly from other people."

By involving biosafety experts from many different institutions, Eric is intentionally making the twin network as diverse and sustainable as possible. Some twins have experience with animal facilities, some with government research facilities, and many with universities. This increases the likelihood that someone within the network has experience with an unusual issue.

Another important outcome of the program is enhancing the credibility of biosafety as a profession around the world. Illustrating that biosafety can be a career instead of just extra hoops to jump through in the lab can prevent the spread of diseases to researchers and even reduce the chance that terrorists can gain access to hazardous biological agents, says Eric.

The US Department of State Biosecurity Engagement Program has funded five classes of Middle East and North Africa regional twins and two classes of African twins. The fifth Middle East and North Africa regional class will wrap up in mid-November. The first Defense Threat Reduction Agency-funded class will begin at the same time.

"The Twinning program has been the most gratifying program I've ever participated in," says Melissa Morland, assistant director and biosafety officer at the University of Maryland, Baltimore, who has been a twin in every class since the beginning. "It is amazing to know that as part of this program, we are part of the progress that is being made in developing biorisk management around the world. I love to see the excitement of the twins as they are part of something new at their facilities and often in their home countries."

Trinity Tower replica now dominates Heritage Park at National Museum of Nuclear Science and History

A new landmark now towers over Heritage Park at the National Museum of Nuclear Science & History. The museum earlier this month dedicated the newly erected Trinity Tower, a near full-scale replica that is just slightly smaller than the original historic 100-foot-tall tower built to hold the first atomic bomb — the Gadget — tested at the Trinity Site on July 16, 1945.

In remarks at the dedication, museum director Jim Walther said, "The Trinity Test was a monumental moment in history, one that resonates with people across the nation and very specifically with the people of New Mexico. We are proud to exhibit the largest collection of artifacts relating to the Trinity Test, and though the test site at White Sands Missile Range is only open to the public two times a year, we are open daily to bring this story to life for visitors of all ages and backgrounds."

The tower's benefactors, Clay Kemper Perkins and Dorothy Perkins, funded the entire project with in-kind support from many local organizations including Enterprise Builders, Harris Rebar, JB Henderson, and the Noel Company.

Many dignitaries were present to publicly acknowledge the legacy and historical significance of the Trinity Tower and its role in bringing an end to World War II.

Photos by Kyan Ramirez

HR Open Enrollment 2018

Open Enrollment is an annual opportunity to review your various benefit elections and make any needed changes or updates

2018 Active Open Enrollment

Open Enrollment is an annual opportunity to review your various benefit elections and make any needed changes or updates. You may enroll in certain Sandia benefits (medical, dental, vision, flexible spending accounts, etc.) and change dependent enrollments. This year's Open Enrollment also debuts Sandia Extras, a new suite of voluntary benefits and discounts for Sandia Labs employees. Sandia is committed to providing you with benefits that promote your health and well-being. If you have any questions about Open Enrollment, please contact HR Customer Service at 505-844-4237, option 2.

Open Enrollment Dates:

Active Employees: Wednesday, Nov. 1-Thursday, Nov. 16, 5 p.m. MT/ 4 p.m. PT

Changes for Employees

The changes listed below are effective Jan. 1, 2018. Details about each plan and the Open Enrollment newsletter can be found at hbe.sandia.gov.

- Sandia Total Health plan premiums are increasing between $0 and $13 depending on health plan and tier level.
- $500 per person annual out-of-pocket maximums increase
- Prescription drug benefit copay min/max levels changed for some drug categories.
- The Dental Care Plan will cover composite resin (tooth-colored) fillings on all teeth.
- The Dependent Care (Daycare) Flexible Spending Account (FSA) will now have a grace period for incurring and submitting claims.
- The Health Reimbursement Account (HRA) claim filing period has changed.
- The Adoption Assistance benefit has increased from $2,000 to $2,500 for non-represented employees.
- The Healthcare FSA annual limit will increase to $2,650. The Transportation Spending Accounts (California employees only) for Parking and Transit will increase to $260 per month.
- SPA-represented employees may purchase between eight and 80 hours of vacation.
- Non-represented and MTC-represented employees hired or rehired after Jan. 1, 2018, will vest in the Savings and Income Plan employer matching contribution after three eligible years of service. Current employees are not affected by this change.

Reminder

- Employees may opt to receive a 2017 electronic Affordable Care Act 1095-C tax form by December 22, 2017, which provides proof of health insurance coverage, in HR Self-Service in lieu of a paper form. By Jan. 31, 2018, all employees should receive a 1095-C form, which should be kept as supplemental documentation for your 2017 taxes.

Employee and Spouse Benefit Fairs

Date	Thursday, Nov. 2	Wednesday, Nov. 8	Saturday, Nov. 11 (Register for biometric screenings through hbe.sandia.gov)	Tuesday, Nov. 14
Location	Sandia Labs (CA) Bldg. 904 Auditorium 7011 East Ave. Livermore, CA	Sandia Labs Bldg. 825, Steve Schiff Auditorium Albuquerque, NM	Marriott Pyramid 5151 San Francisco Rd. NE Albuquerque, NM	Sandia Labs Bldg. 825, Steve Schiff Auditorium Albuquerque, NM
Audience	Employees and Spouses	Employees	Employees and Spouses	Employees
Fair Time	Noon-2 p.m.	9 a.m.-2 p.m.	8 a.m.-1 p.m.	9 a.m.-2 p.m.

2018 Retiree Open Enrollment

Open Enrollment Dates:

PreMedicare: Sunday, Oct. 15-Friday, Nov. 17
Medicare: Sunday, Oct. 15-Thursday, Dec. 7

Changes for PreMedicare and Medicare retirees

The changes listed below are effective Jan. 1, 2018:

PreMedicare:

- Albuquerque Health Partners changed its name to DaVita Medical Group.
- $500 per person out-of-pocket increase and various increases to prescription copays.
- Effective in July 1, 2017, Express Scripts has mandatory mail order for maintenance medications.
- The Dental Care Plan will cover composite resin (tooth-colored) fillings on all teeth.

Medicare:

- Increases to Your Spending Arrangement (YSA) funding
- BlueCrossBlueShield HMO members will move to Humana Jan. 1, 2018.
- The Dental Care Plan will cover composite resin (tooth-colored) fillings on all teeth.
- New personalized YSA forms will be sent to you to use with your YSA Health Reimbursement Account.

For info: Details about the Sandia retiree plans and OneExchange, including additional improvements, can be found in the 2018 PreMedicare and Medicare Benefit Choices and Open Enrollment Guides, which are posted online at:

PreMedicare: www.sandiaretireebenefits.com
Medicare: medicare.oneexchange.com/sandia

HR

Retiree and Spouse Benefit Fairs

Date	Thursday Oct. 26	Thursday Nov. 2	Wednesday, Nov. 15
Location	UNM Continuing Education Conference Center 1634 University Blvd. NE Albuquerque, NM	Sandia Labs Bldg. 904 Auditorium 7011 East Ave. Livermore, CA	UNM Continuing Education Conference Center 1634 University Blvd. NE Albuquerque, NM
Fair Time	9-11:30 a.m. PreMedicare 1:30-3:30 p.m. Medicare	8:30-11:30 a.m.	9-11:30 a.m. Medicare 1:30-3:30 p.m. PreMedicare
Presentation Time	10-11 a.m. PreMedicare 2-3 p.m. Medicare	9-10 a.m. PreMedicare 10-11 a.m. Medicare	10-11 a.m. Medicare 2-3 p.m. PreMedicare

Sandia National Laboratories
SANDIA EXTRAS

INTRODUCING SANDIA EXTRAS

New voluntary benefits for employees

Open Enrollment will mark the debut of Sandia Extras, a new voluntary benefits program providing eligible employees with secure access to group rate options for auto, home, and pet insurance, as well as identity theft protection. These benefits will be available with the convenience of payroll deductions.

Available Nov. 1, the mySandiaExtras.com website includes a Side-By-Side Auto Insurance Quote Comparison Tool, which gives employees the opportunity to complete a single application and then view competing rates from leading national carriers in a matter of moments. As an added convenience, the Comparison Tool will save an applicant's form as they are following the process in case they need to return and complete it at a later time.

Users can start a new plan as soon as the following day, or switch insurance providers to take advantage of a better price or coverage options. Additionally, employees can expand coverage to include homes and other vehicles or properties.

Perhaps the most exciting aspect of Sandia Extras, however, is that the cost of these benefits will be paid via payroll deduction. When enrolling in programs through Sandia Extras, employees will enjoy the convenience of paying for programs directly out of each paycheck, eliminating the risk of missed payments and the hassle of keeping up with more monthly bills.

As an added bonus, Sandia Extras includes a growing employee discount platform with savings on a wide range of products and services, including theme park tickets, computers and electronics, hotels, rental cars, sporting events, clothes, gifts, and more. Throughout the year, employees will find offers from more than 600 national and local vendors like Apple, Disney, Blue Apron, Target, Dell, AVIS, Wyndham, BMW, and many others. New discounts are added weekly, so employees are encouraged to visit mySandiaExtras.com often.

Also available through mySandiaExtras.com, Carpool World is a free carpool matching service that helps you connect with other employees to commute more efficiently and help to save the natural environment while you save on your transportation expenses.

The Sandia Extras website can be accessed anywhere and on any device. The mobile-compatibility offers all of the same function whether viewed on a desktop device or a mobile phone, allowing employees to enroll in new programs, manage existing plans, and explore shopping discounts from anywhere.

Registering for the site is free and only takes few moments. To register:

1. Visit the site (mySandiaExtras.com).
2. Complete the Sign Up To Access Your Benefits fields using your legal name and employee ID number.
3. Click the Access My Benefits button.
4. Complete field prompts for an email address, zip code, and password. Users will need to enter their preferred email address and zip code of their current residence, then create a password and enter that into the password field.
5. Click the Access My Benefits button at the bottom of the pop-up module to complete your registration and explore Sandia Extras.

For more information, employees should visit mySandiaExtras.com starting Nov. 1. For questions or to report access issues, users can contact customer care at 1-855-514-8800 or SandiaExtras@corestream.com.





Two Sandians named distinguished alumni of University of New Mexico engineering school

By Sue Major Holmes

The University of New Mexico School of Engineering has named two Sandia engineers as distinguished alumni for 2017.

Ireena Erteza was honored for electrical and computer engineering and Kenneth Armijo was selected for mechanical engineering. They will be recognized at an awards dinner Nov. 2.

The Distinguished Alumni Award, the School of Engineering's highest honor, goes to graduates whose outstanding professional work represents UNM and the School of Engineering in a positive and exemplary manner and who have made important contributions to their fields of expertise.

IREENA ERTEZA

Ireena Erteza wanted to be an engineer from young age

Ireena, who joined Sandia in 1993, loved math and science from a very young age. She says that as she grew older, "I realized engineering was a wonderful way to combine my love of STEM [science, technology, engineering, and math] with my love for creating things. I also knew early on, eighth grade, that I wanted to do research."

She learned about the UNM honor in a phone call from Christos Christodoulou, the school's Jim and Ellen King dean of engineering and computing. "It means a lot to get this recognition from my undergraduate institution," she says. "It feels like a celebration of my engineering career that started 35 years ago with my undergraduate studies at UNM. I have had an amazingly fun and fulfilling career, and it is a great feeling to be honored in this way."

Ireena earned a Bachelor of Science summa cum laude in electrical engineering from UNM in 1986 and was awarded the Breece Award for Academic Excellence for the highest standing among graduating engineers that year. She went on to earn master's and doctorate degrees in electrical engineering from Stanford University. She has a special connection to engineering at UNM since her father, the late Ahmed Erteza, was a professor in the electrical and computer engineering department from 1957 to 1983.

She originally specialized in optics and optical signal processing at Sandia but moved into other research, establishing expertise in radiation effects on optical processing systems, unattended ground sensor signal processing, synthetic aperture radar signal processing and algorithm development, and high performance computing.

This year, Ireena was named Asian American Engineer of the Year, a national award that honors outstanding Asian American professionals in engineering for technical achievements, leadership, and public service.

Kenneth Armijo's interest in space led him to engineering

Kenneth has been with Sandia about eight years, including time as a postdoctoral appointee and as a student intern. He says he was surprised, excited, and honored to be recognized.

"I feel honored as UNM really set me on my career path," he says. He'd been offered a track scholarship at another school, but decided not to go the sports route. UNM's School of Engineering had a NASA Training Project, which he credits with helping get him a NASA internship in his sophomore year.

He originally planned to major in astrophysics because of his interest in astronauts, space, and space vehicles while growing up in the small farming community of Sabinal in central New Mexico. But because of the internship, he decided he wanted to build the vehicles and develop the technology that helps astrophysicists. "I thought engineering was more fun," he says.

KENNETH ARMIJO

Kenneth earned a bachelor of science degree in mechanical engineering with a minor in mathematics from UNM in 2005. He then earned a master's degree and a doctorate in mechanical engineering from the University of California, Berkeley, with business credentials from Berkeley's Haas School of Business. At Sandia, his research consists of computational and experimental research involving molten metals and salts, falling particle receivers, and arc-fault plasma reliability physics pertaining to photovoltaic technologies and reliability research.

"The best part of being an engineer is it teaches you to address challenges and gives you a very substantive approach to address virtually any issue," Kenneth says. "It's nice at Sandia to get to address the most difficult challenges facing the nation. UNM gives you that mindset to address the hard problems."

Hope Michelesen, Jeff Tsao elected Fellows of the Optical Society

By Michael Padilla

HOPE MICHELSEN

Hope Michelsen, a distinguished member of the technical staff in the Combustion Research Facility at Sandia, has been elected as a Fellow of The Optical Society (OSA).

Hope is honored specifically for pioneering contributions to the fundamental understanding of laser-radiation interactions with soot particles through laser-induced incandescence (LII), absorption, and scattering, and using LII to assess environmental impacts of carbonaceous particle.

"It is an unexpected honor for me to be elected to be an OSA Fellow," says Hope. "It is an opportunity for me to remember and express gratitude for all of the great people I've worked with in developing the optical diagnostics for soot and black carbon that have brought me this honor. I have also been very fortunate to have stable funding through the DOE Basic Energy Sciences program to accomplish this work."

Hope's research program focuses on developing and using optical techniques for studying the chemistry of combustion-generated particles inside the combustor and their impact on climate when released to the atmosphere. Her research experience includes gas-surface scattering experiments, atmospheric modeling, soot-formation studies, combustion-diagnostics development, atmospheric black-carbon measurements, and greenhouse-gas source attribution.

She received a bachelor of arts degree in chemistry from Dartmouth College and a PhD in chemistry with a minor in physics from Stanford University. She completed a National Science Foundation postdoctoral fellowship at Harvard University and worked at Atmospheric and Environmental Research Inc. before joining the technical staff at Sandia in 1999.

OSA was founded in 1916 and is the leading professional association in optics and photonics, home to accomplished science, engineering, and business leaders from all over the world. Through world-renowned publications, meetings, and membership programs, OSA provides quality information and inspiring interactions that power achievements in the science of light.

Fellow membership in OSA is limited to no more than 10 percent of the membership and is reserved for members who have served with distinction in the advancement of optics and photonics.

By Neal Singer

Optoelectronics researcher Jeff Tsao has been elected a Fellow of the Optical Society.

The recognition was bestowed "for seminal, sustained contributions to solid-state lighting [SSL], and to its materials and optoelectronic device foundations."

Jeff is one of 101 society members, including fellow Sandian Hope Michelsen (see story at left) from 19 countries to achieve election.

JEFF TSAO

Jeff's career spans two national laboratories and brief stints in industry and academia. He has dedicated his career to optoelectronics, with more than two decades in SSL.

In the late 1990s, when the efficiency of phosphor-converted white light LEDs was only a few percent, few researchers thought these glowing white rocks might someday be used for general illumination. However, Jeff and colleagues at Sandia and HP co-authored a paper that predicted efficiencies as high as 50 percent, and the enormous energy-savings potential that would be realized if achieved. The white paper is widely credited with inspiring SSL activity all over the world.

He later served on DOE committees that roadmapped possible paths for improved LED lighting, and came up with new ways of improving LED efficiencies and usefulness. Although his SSL work was largely programmatic and of a community service nature, the published parts have accumulated 1,750 citations.

Groups he managed earlier in his career were pioneers in optoelectronic materials and devices, including the VCSELs that are now revolutionizing 3-D sensing and autonomous driving. He has delivered more than 100 invited technical and general talks, with a large fraction related to SSL.

Wrote colleague Igal Brener in a supporting letter, "[Jeff] treats others unfailingly with respect and works as hard at his community's success as at his own."

Says Jeff: "Really, the Fellow award is also recognition of the many wonderful colleagues at Sandia and elsewhere with whom I have been fortunate to have worked, and of Sandia as an institution, whose 'exceptional service in the national interest' inspires the kind of forward-looking research in the national interest that the award was for."

Choose your own Army base

Infrastructure optimization tool from Sandia helps design future bases

BUILDING BETTER BASES — Systems analysts Alex Dessanti and Karina Munoz-Ramos review the optimization criteria to select the best combination of equipment to create all the infrastructure for overseas Army bases. (Photo by Randy Montoya)

By Mollie Rappe

Where do you get your water? How do you generate electricity to cook your food and keep it fresh? What happens to your waste after you toss it or flush it? For soldiers overseas, the answers to questions about basic facilities and services are vital. Since 2013, Sandia has been helping the Army's Product Directorate Contingency Base Infrastructure identify the best equipment for temporary bases overseas. For the first time, a Sandia-designed software tool is being used to recommend the core set of equipment for bases to be built in 2020 and beyond.

Contingency bases are overseas camps intended to be used for less than five years. Traditionally, each base was designed in an ad hoc manner with individual camp planners and commanders selecting what they thought they needed. As part of a larger effort to standardize designs and make the bases more efficient, the Army asked Sandia to help determine the best combination of equipment to create all the infrastructure the bases need. Sandia's specialty in trade space optimization and exploration is being used to solve this complex systems of systems problem. The analytic tools leverage Sandia's fundamental safety, security, and reliability expertise and have been applied to a range of Department of Defense and nuclear weapons programs.

"A base is essentially a self-contained city. You have places for people to sleep. You've got places for people to eat. You've got places for people to work out and exercise," says Alex Dessanti, the systems analyst heading Sandia's Contingency Base Infrastructure computational optimization project. "You have a power generation infrastructure, you have fuel and water storage, and you have waste collection and disposal."

Optimizes five criteria simultaneously

Of course, what is the "best" isn't easy to define, especially when you have multiple, sometimes conflicting goals, says Karina Munoz-Ramos, another Sandia systems analyst on the project. Sandia's Contingency Base Infrastructure tool optimizes the whole system of systems based on five criteria: affordability, performance, risk, commonality, and scalability.

Affordability is a rather straightforward optimization criterion, one you likely use in your day-to-day life. However, affordability doesn't just include initial purchase cost, but also the cost to transport the equipment to the site and the cost of consumables, such as fuel or water, says Alex. Generator A might be cheaper than Generator B but if it requires more fuel per kilowatt-hour, it might not be worth it in the long run.

Performance takes into account setup time, maintenance, resupply needs, and the quality of life for the soldiers. For example, rigid-wall billeting is higher performing than tents as they block more noise, are better insulated, and are quicker to set up. Alex says, "If the soldiers have a better quality of life on the camp, then when they go do their mission, they'll be more effective. If they're better rested, better fed, and can shower regularly, then they're going to be able to do their job better."

Some of the equipment considered in the analysis involves new technologies that reuse water or supply electricity more efficiently to drive down the resupply cost for a base. However, there is a chance the new technology won't be ready when the Army needs to set up the camp in a few years. This is captured by the schedule risk criteria.

Commonality reflects the efficiency gained when the base uses the same kind of generators for the kitchens and laundry or uses the same structures to sleep, eat, and conduct administrative tasks. This synergy improves base set-up, maintenance, and repair.

The last optimization criterion is scalability. For example, can the base support another unit passing through the area for a few days, or will that deplete the base's water storage or strain the generators? Alternatively, how much additional equipment could the camp sustain if its mission changes at some point and it needs to support many more soldiers, adds Alex.

Provides select options to decision-makers

The Contingency Base Infrastructure optimization tool is an application of Sandia's Whole System Trades Analysis Tool, which is designed to solve these complex, multivariable optimization problems.

Sandia's optimization tool uses advanced evolutionary algorithms to search for the very best combinations of equipment. After scoring a few million of the roughly 10^{150} possible combinations (which is about the number of fundamental particles in the universe squared), the tool will keep several thousand of the best options it found across the five decision criteria. Army decision makers then use the tool to explore and understand the tradeoffs between the five decision criteria. After careful consideration of the tradeoffs, they select one recommended set of equipment that best meets the goals for the base camp being designed.

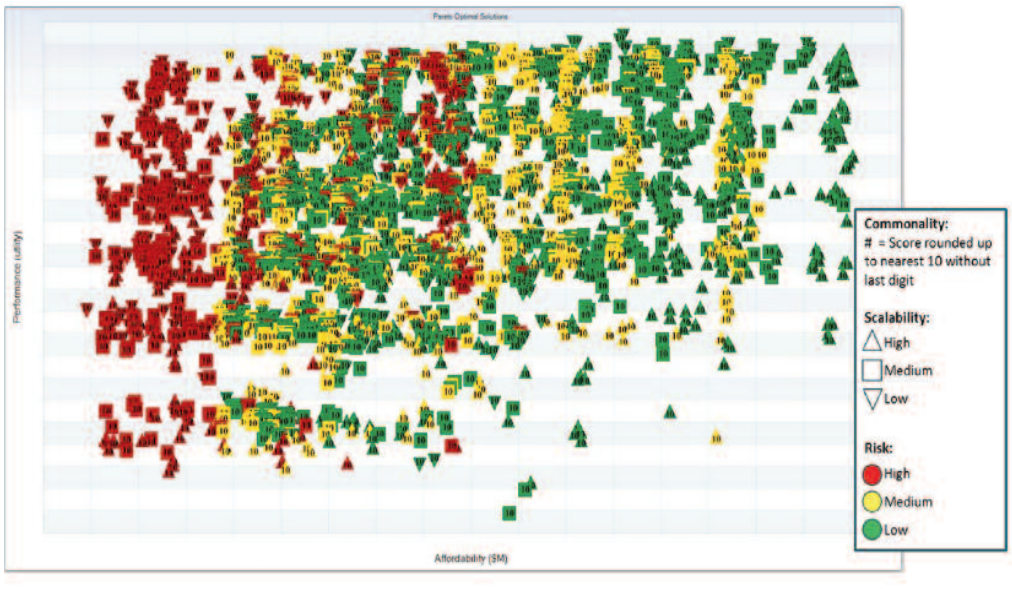
The project has focused on optimizing three different sized bases. Extra small base camps support 50 to 299 soldiers; small bases support 300 to 1,999; and medium bases support 2,000 to 5,999. The equipment needed for a cluster, defined as 12 extra small, five small, and one medium base that are all in the same geographic location and support each other, also has been optimized.

In addition, Sandia's analyses can help the Army evaluate investments in developmental technologies, says Alex. Perhaps technologies that drastically reduce the resupply cost of a base but are still "risky" can become viable with further investment in research and development.

In 2015, the joint Sandia/Army team received an Army Modeling and Simulation Award for "best applications of Army models and simulations in an era of fiscal austerity and rapid innovation," read the award citation.

One ongoing challenge is that the tool needs high-quality data to support the decision-making process. And it can be difficult to gather all the data, says Karina. For example, if the reliability estimate for a generator is too high, the analysis might incorrectly recommend that generator over other sources of power generation. The team is constantly working to improve the decision analytics expertise and tools and the data that support them.

Ultimately, the project can help save the Army a lot of money while enhancing the quality of life at its base camps. "Enabling dramatic improvements in base camp cost and efficiency for our soldiers instills a sense of pride in the work that you're doing and it really motivates you to make sure that you're getting it right," says Alex.



ARMY BASE SOLUTIONS — A graphic showing hundreds of possible contingency base infrastructure equipment options. Bases to the top left are less expensive while providing a good quality of life for the soldiers. Most of these bases depend on risky, new technologies that may not be ready by 2020. Almost all of the bases shown are less expensive with better performance than current Army bases.

Mike Burns

(Continued from page 12)

father was a mechanical engineer. My grandfather was a mining engineer. My brothers are engineers. So engineering was what we did."

He graduated from high school in 1979 and headed to New Mexico State University while Carol, a presidential scholar, headed to Rice. They were married after getting their undergraduate degrees in 1983.

Both had been accepted to grad school at the University of California Berkeley, so they packed all their worldly goods into what Mike recalls as a very small U-Haul and headed for California. Mike finished his master's and went to work at Lawrence Livermore while Carol finished her studies under a Hertz Foundation scholarship. Then as a postdoctoral student, she was offered an Oppenheimer Fellowship at Los Alamos. The couple moved back to New Mexico and went to work for Los Alamos.

"We bought a house and became like real people," Mike says. "Bought a house, bought a car, lived and stayed in Los Alamos."

When he first started in engineering, he wanted to build cool things — nifty machines and mechanisms. Then he realized it's even cooler to build cool things that have an effect. He became more interested in systems, and then with systems of systems.

A life in Brownian motion

He has bounced around in his career because of those goals coupled with what he likes to call Brownian motion — the theory of the random motion of particles.

Brownian motion began with his student days in mechanical engineering. Back then, Mike says, you actually sat down in front of a drafting board and drew lines, with some experienced old crusty mechanical engineer telling you how to do the artwork. Mike was doing that in an undergraduate student program at Los Alamos for an accelerator engineering group, which meant he learned what accelerators were. When he finished his degree at Berkeley and needed a job, Livermore lab was building a certain type of accelerator.

"I said, 'Oh, I can do that because I know what an accelerator is.' They were building a defense system, a ground-based laser for missile defense. So that let me think about a system for missile defense while working on an accelerator."

Brownian motion struck again with Carol and Mike moving to Los Alamos. The type of accelerator Mike worked on at Livermore turned out to have a specialized application for radiographic hydrodynamic testing — X-rays intense enough to see through a full-scale mockup of a nuclear weapon. Since Mike knew what that accelerator looked like, he went to work on what became the Dual Axis Radiographic Hydrodynamic Test facility, or DARHT, Los Alamos' stockpile stewardship facility after the end of underground nuclear testing.

He started out building components for DARHT and ended up as the project director in charge of construction for the facility. To date, he says, building that machine was probably the single most important thing he's done in his career.

"But to build a hydro testing facility like that, you end up talking to weapons designers, so you end up knowing how a nuclear weapon works pretty well. Then because you know how a nuclear weapon works pretty well, you also know how to diagnose them without underground nuclear testing," and that introduces you to another world, Mike says.

DURING THE GEORGE W. BUSH ADMINISTRATION, Mike Burns served in the White House as Special Assistant to the President for Nuclear Defense Policy on the Homeland Security Council staff. Mike recalls a conversation with Andy Card, Bush's chief of staff at the time: "Mike, you're a special assistant to the president and you can have access to the president of the United States whenever you need to," Card said. "I thought, 'Wow, that's amazing.' There was silence in the room for a moment, and then he said, 'Mike, I'm not going to tell you the difference between needing and wanting.' Turns out I never needed access when I worked in the White House." (Photo courtesy of Mike Burns)

One day, near the end of the first phase of Mike's DARHT work, Los Alamos' director asked him to do something.

"And I say, 'Well, I'm doing this.' He says, 'No, we need you to do something.' OK, what is it? 'We can't tell you, we just need you to do it,'" Mike recalls. "For me that was like a red flag in front of a bull. So OK, I'm going to drop everything I've been doing for the last 10 years and leave this facility just before it does its first test? And he says yes, you are."

Career veers from lab work and back

That introduced Mike to the intelligence and defense communities. Then, in a break from the lab, he went to Iraq as a weapons inspector, and returned to the US to become part of the world of Washington, D.C., where he helped stand up the Department of Homeland Security. "I tell people I had to go to Mesopotamia and understand really Byzantine things so I'd be ready for Washington," he says.

He bounced back to Los Alamos, but his work at DHS had gotten him noticed. The White House called to ask him to be a senior director of the Homeland Security Council. During his first tour in Washington Mike would, from time to time, run into Steve Younger, then with the Defense Threat Reduction Agency. It was Steve who called him last year about working at Sandia.

"So now I'm at the world's premier engineering lab as an engineer. How could anything be better than that?" Mike says. "My entire 33-year career, my entire upbringing, the son and grandson of engineers, 30 years at Los Alamos, was all preparing me to come be here in this place."

In this place, his office is decorated with mementos of his career. On a wall near his desk hangs a photograph of DARHT, the white mat surrounding the photo covered with signatures of those who worked on the project. Across the room is a signed photograph of President Bush with Mike and his family, along with a presidential commission naming Mike as a special assistant to the president for nuclear defense policy on the Homeland Security Council staff.

Engineering is in the genes, but if Mike hadn't become an engineer, he imagines himself as "a history professor in some small liberal arts school, and I would have become a cranky old man, with very opinionated, unreasonable positions. I know that because that's what my daughters sometimes think of me right now. Maybe I'll do something like that when I retire."

Mike enjoys history. When he grows up, he says, he might return to school for a degree in history. But he hasn't thought about where he'd study. "I'd probably end up picking a subject that really interested me and going to find a place or a school near source documents."

He's fascinated by the Renaissance, European history up to the Reformation, the formation of the United States, and its history from the Civil War up to the 20th century.

Love of history meets love of travel

In high school, daughter Shannon made 10-minute documentaries for National History Day. "Being her mother's daughter, she would go way over the top and we ended up having to take long, epic road trips so she could do field research," Mike says.

Topics had to do with the Civil War, particularly the Irish Brigade or Irish-related topics like the Molly McGuires, 19th century Irish coal miner activists in Pennsylvania. Carol once drove her through the Appalachian Mountains in Pennsylvania. Mike took Shannon on a road trip through Atlanta, Manassas, Gettysburg, and Carlisle Barracks, the latter an Army repository of documents such as handwritten letters from Gen. William Tecumseh Sherman.

In his free time, little enough now, Mike loves to read. Favorite novelists include Patrick O'Brian, who wrote a series about the British navy in the Napoleonic wars, and Alan Furst, who writes mid-20th century historically based spy novels. Mike's reading, of course, includes history, particularly the Civil War. "There's a huge number of books like that laying around the house," he says.

He and Carol enjoy musical theater and they love to travel in the sense they enjoy being at a destination, but don't necessarily enjoy getting there. Mike describes himself as 5-foot-18, so airline seats don't fit.

"I like seeing things on the far side but getting back and forth is one of those challenges of modern life," he says.

One solution is a cruise. The couple has taken cruises to Alaska and the Bahamas and think they'd like a river cruise down the Rhine or the Danube. They've taken two trips to Venice, and he remembers the church bells and bird songs in the mornings.

Mike talks about a perfect day, which would be doing something with Carol. That brings to mind a dream of free time with her in Rossnowlagh, County Donegal, a small town on the northwest coast of Ireland, near Donegal Bay, where there's "a little old hotel, a gorgeous, quiet place."

MIKE BURNS, associate Labs director, poses in Baghdad in February 2003 with a UN vehicle he drove around while working as an International Atomic Energy Agency weapons inspector just before the start of the second Gulf War. (Photo courtesy of Mike Burns)

SANDIA CLASSIFIED ADS

NOTE:
The Classified Ad deadline for the Nov. 24 issue of the Lab News *will be Thursday, Nov. 16 at noon instead of Friday, Nov. 17. This deadline change applies to this issue only.*

MISCELLANEOUS

CAMPER SHELL, ATC cab-high, 6-ft., fiberglass, insulated, wired, excellent condition, $1,500. Bertsch, 505-873-0925.

LOUNGE CHAIRS, $20 ea.; solar lights, battery backup, $2 ea.; indoor rug, 8' x 10', $20; pill containers, various sizes, $1 ea.; metal cans w/lids, free; glass jars, 32 oz., free. Lewis, 505-323-7268.

FIREWOOD, 3 tall pinon trees down on N14 property, bring chainsaw, free. Padilla, 286-4466.

CAPPUCCINO CREAMER, Frabosk, frother, stainless steel, 8 oz., w/instructions, $10; plush stuffed turkey, "Jeb" by Gund, 8-1/2"T x 8"W, $16. Wagner, 505-504-8783.

'A GENTLEMAN'S GUIDE TO LOVE AND MURDER' TICKETS, 2, Sunday, Dec. 10, 1 p.m., mezzanine, $99. Beck, 239-3237.

EXERCISE EQUIPMENT, Bowflex XTL, $250 OBO; Ab Lounge Ultra, $50 OBO; Gazelle supreme, $50 OBO. Aaronscooke, 505-550-8217.

GARAGE OPERATOR, Liftmaster, commercial grade, lightly used, on 8-ft. tall door, $25. Turner, 281-4264.

FEMALE DOG, rescued from Grants, beautiful, ~30 - lbs., ~ 1 yr. old, well-behaved, available after spay on Nov. 4, $150 covers medical. George, 505-440-0606.

BEDROOM SET, Ethan Allen, vintage, solid maple, queen bed, nightstand, desk, chair, 2 dressers, $1,500. Hughes, 806-676-3584, lindseygloe@gmail.com.

HOT TUB, seats 4-6, w/cover, needs work, photos available via email, you move, free. Martinez, 292-4585.

COUCH/LOVESEAT, faux leather, Espresso, $400/both; heavy wrought iron/inlaid tile coffee table, $200. ndreoni, 505-400-9563, text.

CHEST FREEZER, Sears, heavy-duty, 8.8-cu. ft., black, top loading, new condition, $175. Sturgeon, 505-975-6565.

COLLECTIBLE HOLIDAY SNOW VILLAGE PCS., many, varied prices. Gould, 268-9080.

COVERED CARGO TRAILER, white, w/windows & roof vents, double door located in back, $5,000 OBO. North, 505-514-7878.

ENTERTAINMENT CENTER, light oak, 8 sections, Southwestern w/built-in light fixtures, good condition, paid $7K, asking $1,800 OBO. Garcia, 505-280-5815.

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: From Techweb search for 'NewsCenter', at the bottom of that page choose to submit an ad under, 'Submit an article'. If you have questions, call Michelle at 844-4902. Because of space constraints, ads will be printed on a first-come basis.**

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.

SEWING CENTER, sewing table, Bernina machine w/carrying case & tools, Baby Lock serger, both used w/manuals, $300. Reis, 856-1138.

DOG KENNEL, 6' x 10', you haul, $125; entertainment center, large, oak, $1,250. Buck, 353-2667.

TABLE, glass-top, 42-in., w/4 upholstered chairs, neutral colors & design, perfect for any décor, excellent condition, $1,500. Wells, 505-292-0179.

TRANSPORTATION

'98 CORVETTE CONVERTIBLE, AT, new tires, car is clean, only 36,900 miles, $16,000. Montoya, 505-507-7980.

VOLKSWAGEN JETTA SEL, white, 2-toned leather, heated seats, navigation, sunroof, premium Fender stereo, 67K miles, $12,000. Herig, 505-205-5606.

'06 GMC SIERRA, extended cab, dark teal, new tires, bed liner, 1 owner, accident free, 164K miles, $6,000. Barnes, 505-263-5426.

'06 TOYOTA COROLLA LE, AT, 137K miles, new tires, maintenance up to date, drives great, $4,500. Martinez, 505-238-6385.

'09 SUBARU FORESTER, silver, 46K miles, very good condition, great tires, $9,000. Pregenzer, 505-217-9150.

'10 HONDA CIVIC HYBRID, 1 owner, blue, 78K miles, excellent condition, $9,300. DuBay, 268-0307.

'11 JEEP WRANGLER SAHARA, tan, 2-dr., 4x4, 6-cyl., 3.8 fuel injected, excellent condition. Ramos, 972-951-0290.

'99 SUBARU IMPREZA OUTBACK SPORT, 2.0L, manual, 187K miles, recently serviced, good commuter, tires <1 yr. old, $1,400 OBO. Wolfgang, 505-414-1483.

RECREATION

'14 LITTLE GUY TEARDROP TRAILER, new tires & TV, solar generator for power, $10,000 negotiable. Padilla, 505-270-1503.

'02 HARLEY-DAVIDSON ROAD KING, 21K miles, new carb kit, brake pads, photos available, $9,300. Lucero, 977-8174.

'04 FLEETWOOD POPUP CAMPER, sleeps 6, refrigerator, furnace, water heater, 2 stoves, new tires, electric brakes, excellent condition, $4,500 OBO. Winowich, 238-6184, text for photos.

'16 HONDA SHADOW AERO MOTORCYCLE, 750 cc, almost new, 1 owner, 2,340 miles, 4-yrs. left on transferable premium care warranty w/roadside assistance. Schaub, 299-3785, ask for Joe.

REAL ESTATE

VIEW LOTS, 2, near Soda Dam in Jemez, total 1.25 acres, county-maintained road, water, electricity at boundary, Madera-Verde subdiv., $46,000. Thompson, 505-292-2877, rthompson144@comcast.net.

20 ACRES, 6 miles north of Edgewood, beautiful, MLS#879654. Stavros, 505-480-8110.

3-BDR. HOME, 2 baths, 1,803-sq. ft., Willow Wood gem, 5 minutes from Eubank gate, updated everything. Kaplan, 505-270-7425.

3-BDR. CUSTOM HOME, 2-1/2 baths, 4-1/2 car garage, 2,700-sq. ft., 3+fenced acres, http://themountainsnm.yolasite.com $349,000. Matthews, 505-980-4917.

Mileposts

New Mexico photos by Michelle Fleming


Mark Rosenthal 35


Bert Tise 30


Délene Cox 25


Lori Mann 25


Hazel Barclay 20


Beverly Eppinga 20


Susan Gonzales 20


Ron Manginell 20


Dean Martin 20


Kevin Austin 15


Robert Freddie Martinez 15


Cynthia Garcia 15


Luis Mendoza 15


Troy Skousen 15

Recent Retirees


John Mareda 36


Tom Polachek 15

Engineering in the genes

Mike Burns' whole career prepared him to come to Sandia

By Sue Major Holmes

It's awesome becoming a special assistant to the president of the United States, but it wasn't hard for Mike Burns to gain perspective in his job as an adviser to President George W. Bush.

He describes an early meeting with Andy Card, Bush's first chief of staff: "I remember he brought me into his office in a corner of the West Wing and said, 'Mike, you're a special assistant to the president and you can have access to the president of the United States whenever you need to.'

"I thought, 'Wow, that's amazing.' There was silence in the room for a moment, and then he said, 'Mike, I'm not going to tell you the difference between needing and wanting.' Turns out I never needed access when I worked in the White House."

Mike, associate Labs director for Div. 5000, lists Card among many people who have influenced his life. "We all build our essential self from a series of life experiences, and the most important life experiences are the interactions we have with other people," he says. "So lots of people have influenced me."

That starts with his father, a mechanical engineer for General Electric and later a weapons engineer at Los Alamos National Laboratory, and his grandfather, a mining engineer in Pennsylvania.

The influences on his professional life started with his first boss, Gary Deis at Lawrence Livermore National Laboratory. "First bosses are important because you actually think the way they work is the way everybody works," Mike says. "He was a great engineer and a great guy."

His mentors include two Los Alamos engineers, Val Hart and Ed Bush ("We're talking plaid shirts and pocket protectors. They could build anything."); magnet and accelerator design expert Klaus Halbach of Lawrence Berkeley National Laboratory, who taught Mike about particle accelerators; former Los Alamos National Laboratory Director Sig Hecker; and former Los Alamos weapons program director John Immele. "John let me do what I thought was best on a big project at Los Alamos. He gave me enough rope to hang myself, then he was there to cut me down every time I did."

ASSOCIATE LABS DIRECTOR MIKE BURNS heads up Sandia's National Security Programs Div. 5000. In that capacity, he manages Strategic Partnership projects for the DoD and other federal government departments and agencies, Strategic Intelligence Partnership projects for the US Intelligence Community, and industrial partnerships. In the background, garbed in "bunny suits" inside Sandia's silicon fabrication cleanroom facility, are Todd Sicola and Erin Sovey. (Photo by Randy Montoya)

People make life richer

Sandia Labs Director Steve Younger was part of Mike's professional life in Los Alamos when Steve was weapons program director there. He says Steve answered every time he needed to see him about the project Mike oversaw, despite Steve's business manager complaining it cost $2 million whenever Mike walked in.

Other inspirations include Bob Kelley, chief inspector for the inspection division when Mike was a nuclear weapons inspector in Iraq with the International Atomic Energy Agency just before the 2003 Iraq war; staff members of Los Alamos' Global Security Directorate, who helped open Mike's eyes to work beyond nuclear weapons; and Los Alamos' J Division, a field test division Mike helped re-create for the 21st century.

"The more people you get to interact with, the richer you are," he says.

The most influential person in his life is his wife, Carol, a senior executive at Los Alamos and "the most brilliant person I know."

He also credits his daughters, Shannon and Meagan. "They're influential in that you see the world through their eyes when they're young and you really want to adjust your lifestyle, your work-life balance, things like that, when you have children," Mike says.

FAMILY VACATION — Mike Burns' family, left to right, daughters Meagan and Shannon and wife Carol, enjoying a vacation in Venice. (Photo courtesy of Mike Burns)

LOVE OF TRAVEL — The Burns family, left to right, daughter Meagan, wife Carol, daughter Shannon, and Mike, pose in the Tuscany region of Italy while on a vacation. (Photo courtesy of Mike Burns)

His Sandia badge hangs from a lanyard that pays tribute to his daughters — half UCLA where Shannon studies social cognitive neuroscience and half Mercyhurst University in Erie, Pennsylvania, where Meagan is pursuing a biology degree with an environmental studies emphasis.

Mike was born in Pittsburgh and spent the first five years or so of his life in the nearby small town of Monroeville, Pennsylvania. Then his family moved to the prototypical suburb of Cherry Hill, New Jersey, just across the Cooper River from Philadelphia. There he attended Catholic school, and he's ready to assure anyone that whole thing with nuns and rulers is real, or at least it was in the '60s.

Arrived in New Mexico as a child

The family moved to Los Alamos in the late 1960s. His father had been working for GE in a job associated with the Minuteman missile program, which brought him into contact with Los Alamos engineers whose changes on the project kept interfering with the work for which Mike's father was responsible. Mike's dad invited the Los Alamos engineers to the GE plant so they could see what was happening. They in turn invited him to Los Alamos to see why he had to deal with their changes. Los Alamos then offered him a job, and he returned home to announce the family was moving to New Mexico.

"My family kind of knew there was something west of the Mississippi River but weren't quite sure what it was," says Mike, who was in a third grade at the time. His father bought a Conestoga travel trailer, perfect for the pioneer-moves-West-theme, hooked it up behind the Pontiac Catalina station wagon and started driving. Mike's memory of the trip is the car overheating while crossing the Great Smoky Mountains that straddle the Tennessee-North Carolina border.

Mike, his sister, two brothers, and parents lived in a mobile home until the family could find a house. He attended late elementary school, junior high, and high school in Los Alamos.

As a kid in New Mexico, Mike learned how to ride horses, fell out of trees and broke arms, hiked through canyons, learned what a rattlesnake was, caught horned toads. As he grew older, he played sports, stayed out late, and played Dungeons and Dragons. "So just a normal, regular, geeky national laboratory kid," he says.

Mike played in the high school band, and he and his friends listened to trumpet greats Maynard Ferguson, Doc Severinsen, Al Hirt, and Bill Chase.

As a high school junior in 1978, Mike met the "incredibly beautiful and brilliant student" who would become his wife. "We were high school sweethearts," Mike says, adding after a pause, "Either that, or maybe she simply tolerated me."

Mike had fun in high school, but turned serious when he decided to study mechanical engineering. "My

(Continued on page 10)