

Unexpected effect could lessen instabilities in fusion effort

Control of widely recognized distortion may allow greater output at accelerator

By Neal Singer

A surprising effect created by a 19th century device — the Helmholtz coil — has provided hints about how to achieve controlled nuclear fusion at Sandia's powerful Z machine.

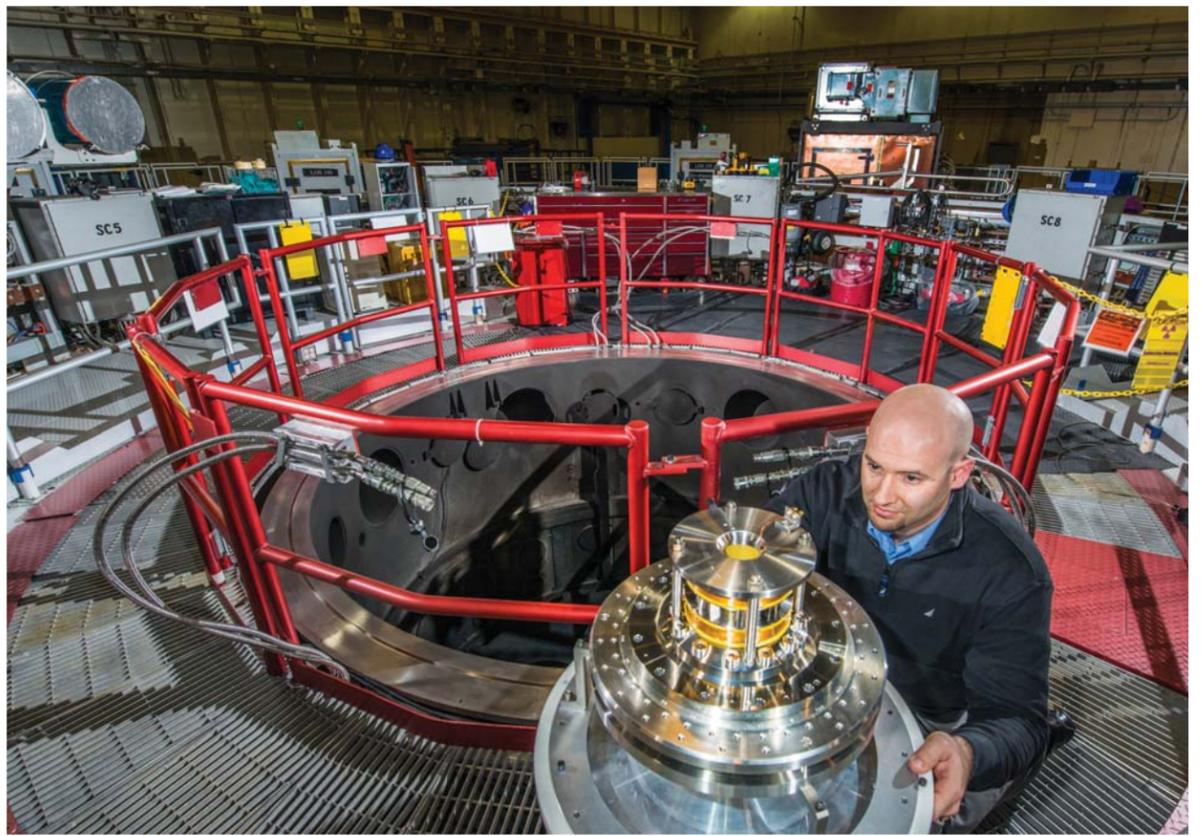
A Helmholtz coil produces a magnetic field when electrified. Two such coils, providing a secondary magnetic field to Z's huge one, unexpectedly altered and slowed the growth of the magneto-Rayleigh-Taylor instabilities, an unavoidable, game-ending plasma distortion that usually spins quickly out of control and has sunk past efforts to achieve controlled fusion.

"[Our recent experiments] dramatically altered the nature of the instability," says lead researcher Tom Awe (1688). "We don't yet understand all the implications, but it's become a different beast, which is an exciting physics result."

(Continued on page 4)

A MOMENT OF AWE — Sandia physicist Tom Awe (1688) examines coils that reduce plasma instabilities in the quest for controlled nuclear fusion at Sandia's Z machine.

(Photo by Randy Montoya)



Remembering Dr. King

"Dr. Martin Luther King Jr. opened doors and turned a dream into reality . . ."

In an essay on page 12, Sandian Ken Holley offers a deeply personal reflection on the profound impact Dr. King had on American society at large and on Ken's own life. Martin Luther King Jr. Day is observed this year on Jan. 20.



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Sandia's highest grossing patent, granted in 1996, ends its run

The simplest products sometimes offer the widest applications. So seems the case with lead-free solder, Sandia's simplest yet highest grossing patent. It was granted in 1996 to Sandia, Ames Laboratory, and Iowa State University, and brought millions of dollars back to taxpayers before it ran out in July.

According to Sandia senior manager Mark F. Smith (1830), US Patent 5,527,628 came about because government tests showed that lead-based solder in discarded materials "oxidized, turned to powder, was driven into the ground by rain and snow, and found its way to local aquifers."

But lead-free solders of the time put electronic fabrication techniques at risk because they required melt temperatures higher than Sandia, and industry, could tolerate.

Sandia researcher Fred Yost (ret.) mentioned this problem to his former PhD advisor, ISU professor J.F. Smith (and Mark Smith's father), visiting Sandia on a consulting contract. The elder Smith said that there was a region of the tin-silver-copper phase diagram that "looked funny" to him, and he asked Iver Anderson at Ames Lab to collect more data on this alloy. These new data revealed a melting point only slightly higher than the traditional leaded-solder melting point, 217°C vs. 188°C.

Sandia tested the properties of the new solder. When it appeared on the market — hardy, environmentally safe, and low-temperature — it was bought all over the world. —Neal Singer



SANDIA'S JERRY REJENT (1831) applies lead-free solder to a metal. The solder is hardy, environmentally safe, and low-temperature, and has been sold all over the world.

(Photo by Randy Montoya)

RESEARCH CHALLENGES

Resilient cybersystems is focus of latest initiative

By Sue Major Holmes

"This is not about making your desktop machine, this is not about making your iPhone itself resilient. This is really about making a large-scale network of multiply-connected devices resilient."

— Len Napolitano on cyber resiliency

The goal of Sandia's latest research challenge is to develop a trustworthy cybersystem despite having no control over the manufacture of components that could come under attack.

Computer Sciences and Information Systems Center 8900 Director Leonard Napolitano introduced the Cyber Resiliency research challenge last month, the seventh research challenge Sandia has rolled out since late June. It addresses the problem that current cybersystems are fragile and vulnerable to compromise at the weakest link.

Research challenges are programs that could take a decade or more to mature and that will highlight Sandia's unique national security capabilities with their results. The Labs began six challenges earlier: "Beyond Moore Computing," "Data Science," "Trusted

(Continued on page 5)

About 40 percent of Sandia employees responded to the 2013 Sandia Pulse survey and responses to the 15 questions show little change from the 2012 LM Voice survey on which the Pulse survey was based. For more about the survey, see page 9.

Pulse Survey



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That's that

Did you see where Amazon founder Jeff Bezos has unveiled plans to deploy his own air fleet, using UAVs to deliver packages to Amazon customers? It's really hard to tell if Bezos is serious or if the scheme is just a way to drum up publicity.

I don't know about that, but set skepticism aside and consider the merits. Even if the concept is technically feasible – and with modern computing and navigation technology it almost certainly is – the idea of swarms of drone aircraft buzzing around 24/7 just over our heads *seems* absurd. And there's this: Once Bezos unleashed his drone armada, every other retailer, every other shipping company in the country, would jump onto the same technology bandwagon. Talk about living in the cloud! The legal liabilities would be immense, wouldn't they? And the opportunities for malicious use of the technology would be almost unlimited.

For the record, some pretty savvy tech people are convinced that drone delivery is not just feasible but inevitable. You heard about the problems FedEx and UPS had over this past holiday season, right? They were simply overwhelmed. The volume of retail shipping is growing so fast that some sort of technology to augment conventional delivery is essential. Done properly, it's argued, a drone fleet that leverages current infrastructure is way cheaper and faster than adding more and more trucks to the nation's roads. Package deliveries will double in the next four years and there's no end in sight. That means twice as many delivery trucks and drivers – or fewer trucks doing more deliveries with the assistance of drones. The trucks would be like aircraft carriers, parking in a central location, one driver deploying UAVs to service a surrounding neighborhood. Could work. But would the public accept it?

My bet is yes. Experience shows that we can get used to some pretty crazy ideas. The late comedian George Carlin made this very point in one of his timeless skits: Seems Alexander Graham Bell has invented the telephone. When he describes how it works, a colleague is underwhelmed. "Gee, that's great, Alex, but how do you talk to somebody else?" The great inventor is quick with an answer: "Wire! We stick one end of a wire in the back of this thing and the other end in the back of another one. Someday, everybody'll have one. We'll hook 'em all up with wire, wire coming out of every house, wire strung up on big poles along every road across the whole country. Wire everywhere!"

Some very unlikely schemes, in other words, can and do become the new normal. Could be a sky full of service drones will be just another thing that we get used to . . .

* * *

Except, maybe, in Deer Trail, Colo. Did you hear about this? The little town east of Denver is poised to vote in April on whether to declare open season on drones. If the proposal passes – it got hung up in a tie vote at the town council level – the town is looking to make a lot of money selling hunting licenses to legally shoot down the dadgum things. Some of the town's biggest thinkers see great things ahead. "We're the home of the world's first rodeo, so we could be home of the world's first drone hunt," the town clerk is reported as saying. The townsfolk aren't rubes; they understand that the proposal is more than half in fun. Still, the mayor thinks the ordinance could be a nice tourist draw on the premise that (as one news report put it) who wouldn't want to shoot down a drone? Jeff Bezos, maybe?

* * *

Speaking of Bezos, did you know he has a New Mexico connection? Even – sort of – a Sandia connection? He was born in Albuquerque, where, according to Wikipedia, his maternal grandfather was a regional director of the Atomic Energy Commission, the predecessor organization to the Department of Energy.

Albuquerque thus has close ties to at least two of the great innovators of their respective generations. Bill Gates actually launched Microsoft, then called Micro-Soft, in the Duke City in 1976. The Massachusetts native had set up shop in Albuquerque because that's where the world's first personal computer was invented; Gates and Paul Allen had developed a version of BASIC to run on it. Gates is easily the biggest fish that ever got away from our little pond. The city's economic development professionals probably still have nightmares about the woulda, coulda, shouldas that might have enticed Microsoft to stay. But let's be fair: Who knew Bill Gates was going to become . . . well, Bill Gates?

Happy New Year.

– Bill Murphy (505-845-0845, MS0148, wtmurph@sandia.gov)

Sandia/AIST meeting highlights energy research collaboration between US and Japan

By Patti Koning

As part of a broader effort to coordinate clean-energy research across the Pacific Ocean, Sandia last month hosted a meeting with the Japan National Institute of Advanced Industrial Science and Technology (AIST). Attendees from AIST and the US national labs were joined by representatives from DOE and the Japan Ministry of Economy, Trade, and Industry.

"This meeting underscored progress in the existing partnerships between US national labs and AIST and explored new areas for potential coordination and collaboration," says Daniel Dedrick (8367), Sandia's Hydrogen and Combustion Technologies Manager and the meeting organizer. Topics covered included renewables integration, geothermal systems, solar photovoltaic systems, and hydrogen and fuel cells.

Further, the meeting highlighted a multiple-year AIST-Sandia project as an example of a successful energy research collaboration between Japan and the US. Focused on increasing understanding of how steel reacts to the harsh environment of high-pressure hydrogen, this project is helping create a foundation for durable and cost-effective hydrogen pressure systems, which are key to US and Japanese strategies for deploying commercial fuel cell electric vehicles and the supporting infrastructure.

Specifically, the project team has been conducting fracture tests on ferritic steels in high-pressure gaseous hydrogen and performing scanning probe microscopy of deformation and fracture in austenitic stainless steels. Through coordinated testing and methodology sharing, the collaboration has illuminated scientific findings that would not have been discovered in isolation.

For example, project data have shown that subtle differences in test methodology can have significant implications on a material's perceived performance — work that can inform/improve standardized test methods developed to characterize materials for hydrogen service. Results are already being provided to industry stakeholders: The team presented a paper at the American Society for Mechanical Engineers (ASME) conference last July, and two more papers are being prepared for the next ASME Pressure Vessels & Piping conference in July 2014.

The AIST-Sandia partnership exemplifies leveraging international capabilities to advance key DOE hydrogen and fuel cell program goals. For example, in addition to identifying characteristics of effective materials for hydrogen service, this project will influence harmonizing international codes and standards for hydrogen, as well as advance the build-out of hydrogen infrastructure by impacting hydrogen system cost, reliability, and safety. Further, by building a strong relationship with AIST that has included regular working meetings at the CRF and in Japan, the project helps to seed other key relationships with Japanese industrial and academic partners.



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Recent patents

Note: Patents listed here include the names of active and retired Sandians only; former Sandians and non-Sandia inventors are not included. Following the listing for each patent is a patent number, which is searchable at the US Patent and Trademark Office website (www.uspto.gov).

* * *

Lauren Rohwer (1718) and James Martin (1114): Hydrothermal Method of Synthesis of Rare-Earth Tantalates and Niobates. Patent No. 8,287,832.

Michael Wanke (1118) and Christopher Nordquist (1742): Integration of a Terahertz Quantum Cascade Laser with a Hollow Waveguide. Patent No. 8,213,476.

Michael Wanke (1118) and Christopher Nordquist (1742): Integrated Heterodyne Terahertz Transceiver. Patent No. 8,274,058.

Andrew Allerman (1126), Mary Crawford (1120), and Stephen Lee (1123): Aluminum Nitride Transitional Layer for Reducing Dislocation Density and Cracking of AlGaN Epitaxial Films. Patent No. 8,349,633.

Keith Underwood (1422), Ronald Brightwell (1432), and Karl Hemmert (1422): Message Passing with Parallel Queue Traversal. Patent No. 8,170,041.

Karl Hemmert (1422) and Keith Underwood (1422): Associative List Processing Unit. Patent No. 8,359,428.

Tina Nenoff (1114), and Terry Garino (1816): Low Sintering Temperature Glass Waste Forms for Sequestering Radioactive Iodine. Patent No. 8,262,950.

A career driven by engines: Bob Carling reflects on four decades at Sandia

By Patti Koning

Much better than I ever expected — how Bob Carling describes his long career at Sandia in six words. Bob, director of Transportation Energy Center 8300, at Sandia/California, will retire in February after 38 years of service.

"I never expected to have a job like this, with these responsibilities and the privilege of working with such quality people," he says. "That might sound trite, but it's true. Without question, the Combustion Research Facility is the premier combustion lab in the world. Running the CRF and Center 8300 was my dream job."

It's a job he has done well. "The CRF has a long and proud history characterized by exceptional science and visionary leadership. Bob exemplifies these CRF features," says Sandia President and Laboratories Director Paul Hommert. "He effectively increased the already significant profile of the CRF with industry and within the DOE science community. He leaves having positioned the CRF for continued unique contributions to a field that will remain important to the US energy landscape for decades to come."

Back in 1975, after finishing a PhD in physical chemistry at the University of Michigan, Sandia was Bob's "plan B." He was laid off after six weeks at his first job in a Chicago company's research department. With a 16-month-old son and another baby on the way, he needed another job, fast. He reached out to colleagues from graduate school and, on the day after his second son was born, received a job offer from Sandia.

Bob first worked on solar energy and later as part of a special project for the Strategic Defense Initiative.

He joined the Combustion Research Facility in 1983, first as a supervisor (the equivalent to today's level 1 manager) of the Exploratory Chemistry Division and then of the Combustion of Energetic Materials Division.

As part of a team to develop remote sensing programs, Bob helped start the first Atmospheric Radiation Measurement program at Sandia. "We created a program that is the foundation of much of the remote sensing work that continues today," he says. "That program applied diagnostic techniques that the CRF had developed over the years to a new problem, the day-time measurement of water vapor in the atmosphere."

Engines, engines, engines

In 1991, Bob became manager of the Engines & Furnaces Department and moved into a realm that would define the rest of his career — engine work. "At that time, our work was much broader than just engines," he recalls. "We had projects on furnace combustion and pulse combustion for water heaters. We had just one functional engine lab."

He took over that position from Dennis Siebers (8362), who wanted to return to research. "Right after Bob became manager, there was a reorganization at DOE and suddenly our group was in a lot of trouble," recalls Dennis.

"I had to start over, essentially, and build a whole new set of relationships in a completely different department at the DOE," says Bob. "That turned out to be vehicle technologies, which still provides a big chunk of our funding today."

One of Bob's critical decisions during this time was to aggressively push for funding for a new optical engine lab. "We had optical engines at the time but they were very unrealistic," says Dennis. "Under Bob's leadership, we built a new set of optical engines, multi-million dollar labs that are much closer to the physical geometry of a real engine on the road. That allowed us to work closely with industry and really propelled our research. It's the basis of our program now. There were many people involved in making this happen, but Bob's foresight and courage was really the driver."

With the increase in engine work in the department, research into other forms of combustion dwindled. But it was the ideal time for the CRF to become a leader in automotive engine research. With the formation of United States Council for Automotive Research LLC



BOB AND HIS WIFE SUE CARLING meet then-Vice President Al Gore at a celebration for the Partnership for a New Generation of Vehicles, an initiative of the Clinton administration to increase gas mileage in automobiles.

(USCAR) in 1992 and the Partnership for a New Generation of Vehicles (PNGV) the following year, increasing fuel efficiency became a national priority.

"This was an opportunity for the national laboratories to work with the Big Three automakers in a different way," says Bob. Under his leadership, Sandia created its first Cooperative Research and Development Agreement (CRADA) with USCAR.

In 1994, Bob spent 10 months at Ford's Scientific Research Lab in Dearborn, Mich., as a visiting researcher. "I'm not sure I can point to any particular project that came out of my time there, but it did allow me to develop relationships with many people at Ford and participate rather substantially with the four-stroke direct-injection technology team, which included researchers from the Big Three, the EPA, universities, and other national laboratories."

As an added bonus, Bob's second son — the one who was born the day before he got his job offer at Sandia — started college at the University of Michigan during his time at Ford. "It worked out really nicely for both of us," he says. "I'd see him on the weekends, he had a place to do laundry — it was a special time."

Plenty of reasons to be proud

Bob became a senior manager in 2000 and in 2005 became director of Center 8700, Physical and Engineering Sciences. In 2008, he landed his dream job of Center 8300 director. The last five years, he says, have been the best of his career.

"I'm especially proud of how the research coming out of the CRF has repeatedly changed the thinking on a particular topic," says Bob. "The first time was John Dec's [8300] research into what goes on inside a diesel engine and how fuel burns. It was a new picture of diesel combustion that completely changed how everyone in the industry thought about this process."

He also points to Craig Taatjes' (8353) identification of enols as a combustion product, Craig and David Osborn's (8353) first direct kinetics measurements of reactions of Criegee species, and the work of Paul Miles, Mark Musculus, and Lyle Pickett (all 8362) on low-temperature combustion.



BOB CARLING AND THEN DIV. 8000 VP Rick Stulen torch the ribbon at the grand opening for the Combustion Research Computation and Visualization building in January 2011.

(Photo by Randy Wong)

"CRF researchers continue to change the face of science in a number of areas by proving long-predicted concepts or countering the accepted way of thinking," says Bob. "It's very easy to be proud of these people."

That groundbreaking research has been well-recognized in the industry through awards, high-profile publications, and invitations. In 1998, John, Dennis, and Pete Witze (retired) were nominated for Fellowship in the Society of Automotive Engineers (SAE). All three became Fellows, which spurred Bob and other man-

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agers to continue positioning their researchers for prestigious national and international awards.

Since that time, Paul, Chuck, and Lyle have also become SAE Fellows; Dennis has become a Fellow of the American Society of Mechanical Engineers; and CRF researchers have won numerous awards for outstanding papers and presentations at conferences and have frequently been published in prestigious journals such as *Science*.

Bob attributes this success to three things: good people, resources, and a standard of excellence. "The staff know we have very high standards, but we also provide the support they need to excel, whether that is allowing our people to try new things, like taking experiments to the Advanced Light Source in Berkeley, or pushing for capital equipment investments or even new buildings," he says.

John Dec recalls receiving that kind of support when he wanted to work on homogeneous charge compression ignition (HCCI). "As the most fundamental low-temperature combustion process, HCCI emerged as a way to meet low-emission standards without aftertreatment while still giving the high efficiency of a diesel engine," he says. "I felt like we had to be working in HCCI if our engine program was to continue to lead the research needed by the engine community."

Bob championed John's proposal to DOE and secured the funding to build the lab that John still works in today. "Bob helped me make that vision a reality," he says. "This made a big difference for me as a researcher and helped our program stay in the forefront."



BOB SPEAKING at the Combustion Research Facility's 25th anniversary symposium in November 2005.

The Livermore Valley Open Campus (LVOC) falls under that broad umbrella of resources to enable success. "When the CRF began in 1980, DOE expected collaborative work and publications. Whether it is with students, postdocs, visiting faculty, or industrial scientists, the expectation was that you as an individual PI were not going to publish work with only your name on it," Bob explains. "It's an important part of the culture within the CRF. The LVOC really enables that collaborative work."

Leaving all of this will be hard for Bob. The decision to retire now, he says, was difficult. "It's time," he says. "Two of my three sons live out of state and I have six grandchildren with one on the way. I want to spend more time with them."

He will be greatly missed at the CRF, the California site, and across Sandia as a whole. "From his advocacy for science and engineering excellence to his leadership in advancing Sandia's national security mission and improving the quality of our work environment, Bob is a role model for us all. I know I speak for everyone in offering Bob our congratulations on this occasion of his retirement and in expressing our heartfelt gratitude for his nearly 40 years of service to the nation and Sandia National Laboratories," says Div. 8000 VP Steve Rottler.

"On a more personal note, I will miss my daily interactions with Bob and the opportunity to continue learning from him. He is blessed with many things, not the least of which is a terrific family, including numerous grandchildren, all of whom are looking forward to spending more time with him, and vice versa. I wish for Bob and his family good health, happiness, and good fortune as he enters this 'second' career."

Fusion

(Continued from page 1)

The experiment was reported in December in *Physical Review Letters*.

The purpose of adding two Helmholtz coils to fusion experiments at the Z machine (which produces a magnetic field a thousand times stronger than the coils) was to demonstrate that the secondary field would create a magnetic barrier that, like insulation, would maintain the energy of charged particles in a Z-created plasma. Theoretically, the coils' field would do this by keeping particles away from the machine's walls. Contact would lower the fusion reaction's temperature and cause it to fail.

Researchers also feared that the Helmholtz field might cause a short in Z's huge electrical pulse as it (and its corresponding magnetic field) sped toward its target, a small deuterium-stuffed cylinder.

Z's magnetic field is intended to crush the cylinder, called a liner, fusing the deuterium and releasing neutrons and other energies associated with nuclear fusion. Anything hindering that "pinch" or "Z-pinch," would doom the experiment.

In preliminary experiments of Tom's group, the coils indeed buffered the particles and didn't interfere with the pinch.

Enter, the coils

But unexpectedly, radiographs of the process showed that the coils' field had altered and slowed the growth of distortions known as magneto-Rayleigh-Taylor instabilities, which had been thought to occur unavoidably. (Unavoidably, because even the most minute differences in materials turned to plasma are magnified by pressures applied over time.)

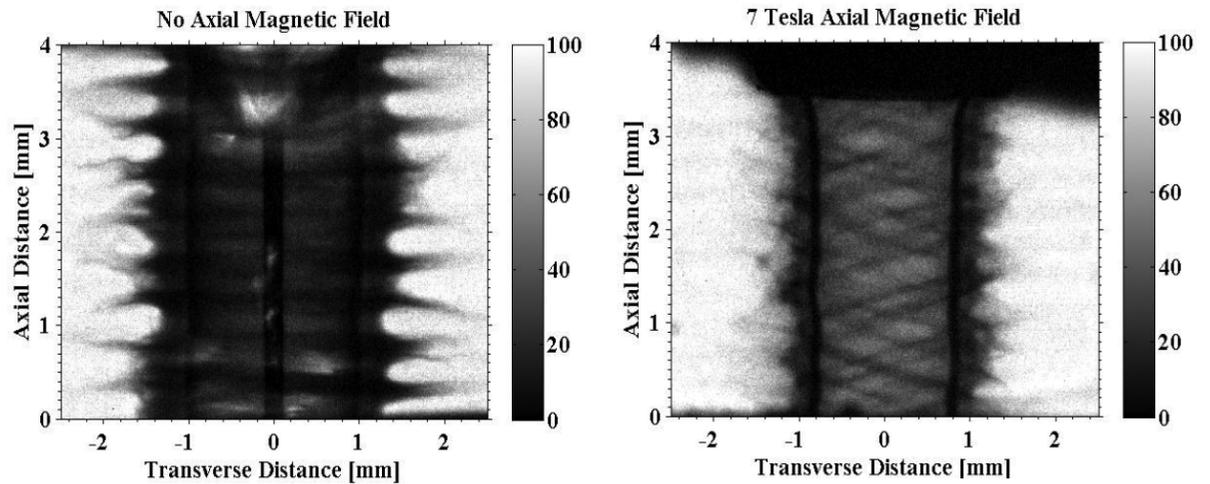
The strength of instabilities seen in hundreds of previous Z pinches were reduced, possibly significantly.

The typical distortion pattern had also changed shape from horizontal to helical.

The unexpected results occurred in a series of experiments to study a concept called Magnetized Liner Inertial Fusion, or MagLIF.

MagLIF: Like soaking bread in beaten eggs and milk

Researchers placed the Helmholtz coils around a liner containing deuterium so the coils' magnetic field lines soaked both container and fuel over a period of milliseconds. The relatively slow process, like soaking bread in beaten eggs and milk to make French toast, allowed time for the magnetic field lines to fully permeate the material. Then the liner was crushed in tens of nanoseconds by the massive mag-



THE IMAGE ON THE LEFT demonstrates the instabilities that grow on the surface of a liner without a secondary magnetic field. This "bubble and spike" structure is caused by the magneto-Rayleigh Taylor instability, which commonly plagues Z pinch experiments. The bubble regions give up their mass to the spike regions; eventually, the bubbles break through the liner wall, and the liner's ability to compress fuel is lost. By contrast, the image on the right shows the unique and unexpected helical instability structure that forms when the liner is premagnetized with a 7 Tesla field. Preliminary evidence suggests that this modified instability structure may work its way through the liner more slowly, enabling the liner to more effectively compress the fuel within. (Radiographs by Tom Awe)

netic implosion generated by Sandia's Z machine.

In previous attempts to use Z's huge field without the Helmholtz coils, radiographs showed instabilities appearing on the exterior of the liner. These distur-

The disturbances were a warning sign that the liner might crumple before fully completing its fusion mission.

bances caused the liner's initially smooth exterior to resemble a stack of metallic washers, or small sausage links separated by horizontal rubber bands. Such instabilities increase dramatically in mere nanoseconds, eating through the liner wall like decay through a tooth. Eventually, they may collapse portions of the inner wall of the liner, releasing microrubble and causing uneven fuel compression that would make impossible the fusing of significant amounts of deuterium.

The disturbances are a warning sign that the liner might crumple before fully completing its fusion mission.

But firing with the secondary field up and running clearly altered and slowed formation of the instability as the liner quickly shrank to a fraction of its initial diameter. Introducing the secondary magnetic field

seemed to realign the instabilities from simple circles — stacks of washers or rubberbands around sausages — into a helical pattern that more resembles the slanting patchwork of a plaid sweater.

A kayak's slanted track across the waters

Researchers speculate that the vertical magnetic field created by the helical coils, cutting across Z's horizontal field, may create the same effect as a river slanting a kayak downstream rather than straight across a channel. Or it may be that the kayak's original direction is pre-set by the secondary magnetic field to angle it downstream in its crossing. Whatever the reason, the helical instability created does not appear to eat through the liner wall as rapidly as the typical horizontal Rayleigh-Taylor instabilities. Flashes of X-rays that were released when material from the horizontal instabilities collided in the liner's center no longer appeared, suggesting more uniform fuel compression occurred, possibly a result of the increasing resistance of the implanted vertical magnetic field to the compression generated by the Z horizontal field.

The overall approach of Tom and colleagues uses a method described in two papers by theorist Steve Slutz (1984). In a 2010 article in *Physics of Plasmas*, Steve suggested that the magnetic field generated by Z could crush a metallic liner filled with deuterium, fusing the atoms. Steve et al then indicated, in a 2012 paper in *Physical Review Letters*, that a more powerful version of Z could create high-yield fusion — much more fusion energy out than the electrical energy put in.

The apparently simple method — switch on a huge magnetic field and wait a few nanoseconds — takes for granted the complicated host of engineered devices and technical services that allow Z to function. But, those aside, the process as described by Steve needed only two additional aids: a powerful laser to preheat the fuel, making it easier for the compressed fuel to reach fusion temperatures, and Helmholtz coils above and below the target to generate a separate, weaker magnetic field that would insulate charged particles from giving up their energy, thereby lowering the temperature of the reaction.

Results warmly received

Ongoing experiments on Z will determine how well reality bears out Steve's predictions, but for now, the reduction of distortions have been warmly received by fusion researchers, leading to an invitation to Tom to present his team's results at the world's largest plasma meeting.

The principle of the Z machine is simple: Z's magnetic force can crush any metal in its path. Possibly, then, it could force the fusion of ions like deuterium in a metal liner a few millimeters in diameter. The magnetic field would crush the liner's fuel to a diameter of a human hair, causing deuterium to fuse. This would release neutrons that could be used to study radiation effects, one of the key concerns of the National Nuclear Security Administration, which funds the bulk of this research. Additionally, in the far future, and with additional engineering problems solved, the technique, when engineered to fire repetitively, could be used as the basis for an electrical generating plant whose fuel is sea water, a carbon-free energy source for humankind.

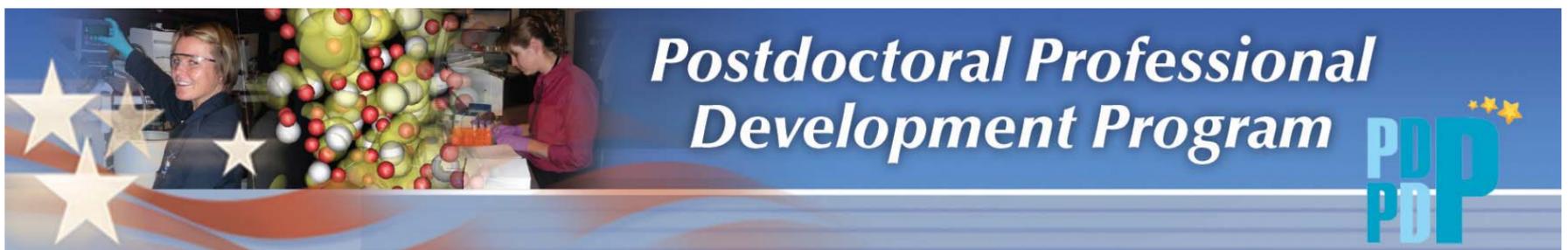
"Of course the reality is not that simple," says Tom, "but the new ability to modify the instability growth on the liner surface may be a step in the right direction."

It's Lights On for KAFB Youth Program



SANDIA'S COMMUNITY INVOLVEMENT DEPT. 3652 Manager Amy Tapia, acting on behalf of Sandia, presented the 1st-place prize for the Lights On Afterschool competition to students from the Kirtland Air Force Base Youth Program. The prize was a math kit that includes fun, hands-on math activities for students to enjoy in their afterschool program.

Inaugural distinguished mentor awards recognize three Sandians



By Sue Major Holmes

Sandia's 7th annual Postdoctoral Technical Showcase honored the winners of the inaugural PD2P Distinguished Mentorship Award as well as featured technical posters from postdoctoral appointees across the Labs.

The awards, started by Sandia's Postdoctoral Professional Development Program, or PD2P, spotlight the valuable role mentors play in developing postdocs and other Sandians, says VP and Chief Technology Officer Julia Phillips (7000), who announced the awards in New Mexico at the Dec. 12 poster session. Transportation Energy Center Director Bob Carling (8300), who recognized California's distinguished mentor at a simultaneous poster session at Sandia/California, told that gathering all Sandians should aspire to the mentorship qualities shown by the nominees.

Brad Boyce (1831) in New Mexico and Craig Taatjes (8353) in California were named distinguished mentors in the technical adviser category and Thomas Mattsson (1641) was named distinguished manager mentor. Jay Carroll (1831), John Sharon (1831), Brandon Rotavera (8353), and Martin French (1641) nominated the winners. A total of 16 people were nominated.

The award acknowledges the value Sandia places on postdoctoral mentorship and highlights outstanding mentorship.

The nominations "describe a Sandia I want to be part of and I'm proud to be part of," Julia said. Postdocs who made nominations said mentors gave them respect, created opportunities for give-and-take and to be equals on a team, credited them for their work, advocated for



EXPLAINING HIS WORK — Postdoc Ryan Douglas Murphy (1832) explains his research to VP and Chief Technology Officer Julia Phillips (7000) during the recent Postdoctoral Technical Showcase. (Photo by Stephanie Blackwell)

About PD2P

Sandia's Postdoctoral Professional Development Program, PD2P, was established in 2007 to foster a robust postdoctoral community by connecting young researchers and creating opportunities to advance professional skills for future success.

Goals

- To facilitate postdocs transitioning into careers as outstanding independent researchers by providing resources for professional development
- To formalize a visible program to organize and network postdocs and highlight postdoc work

For more information visit <https://prod.sandia.gov/pd2p/>.

them, provided a vision and context for their work, offered career advice and honest feedback, introduced them to key researchers and customers, and gave them chances to make presentations and attend conferences.

The poster sessions drew 31 entries in New Mexico and eight in California, five of them from Lawrence Livermore National Laboratory (LLNL), whose postdocs participated for the second year. PD2P sponsors the sessions each December to highlight postdocs' work, create opportunities for them to advance their professional skills, and help them move into research careers.

Poster winners, judged on scientific content, quality of the poster and the oral presentation, and how well the poster was presented, are Richard Harrison (5734) in New Mexico, for "Alternative Radiation Detector Technologies for Nuclear Forensics," and Robert Panas

(LLNL) in California, for "Lightfield Directing Array." Runners-up are Andrew Lohn (1748) and Nitin Kumar (1131) in New Mexico and Nicholas Be (LLNL) in California.

"This is a special time in your lives because you have the opportunity to spend the vast majority of your time doing technical work," Julia told the postdocs. She noted that postdocs are an important part of the fabric of Sandia and urged the audience of about 70 researchers, managers, and colleagues to view the posters to see "some of the coolest work here at the Labs."

PD2P is dedicated to postdoc career development and hosts monthly workshops and research seminars between the New Mexico and California sites. Non-postdocs who wish to receive event information should email Ed Matteo (6222) at pd2p-events@sandia.gov.

Cyber Resiliency Research Challenge

(Continued from page 1)

Systems and Communications," "First to High-Yield Fusion," "Engineering of Materials Reliability," and "Detection at the Limits."

Research challenges all have common features, including the idea of leaving a long-term science and engineering legacy for Sandia, VP and Chief Technology Officer Julia Phillips (7000) said in introducing the cyber resiliency session, which was videostreamed from California to New Mexico. Each challenge also must have a long but finite life, show impacts during the entire length of the work, and bring in a cross section of the Labs' disciplines.

The cyber resiliency challenge has bearing on Sandia's missions in nuclear weapons, global nuclear dangers, and cyberspace.

Resilient systems must be highly complex so they can perform complicated tasks.

Len says they must work as intended or degrade predictably under attack even though they're made of commodity parts of unknown provenance. Cyber-resilient systems must be diverse, to keep attackers guessing; redundant, with multiple paths to function to make them robust; and contained, to prevent any compromises from spreading or doing harm.

"If you are building a resilient system, it should be resilient to inadvertent as well as overt attacks. What's the difference between something that's got intelligence behind it and something that's just a random failure? How can you tell the difference?"

Center 8900 Director Len Napolitano



"If you are building a resilient system, it should be resilient to inadvertent as well as overt attacks," Len says. "What's the difference between something that's got intelligence behind it and something that's just a random failure? How can you tell the difference?"

The challenge's researchers will look at how to design and model cybersystems that can adapt to an adversary "who is looking at our responses and changing their attack," Len says. They also will study programming models that promote predictable behavior

amid failures or attacks, good models for very large cybersystems, how resiliency scales up to large systems, and how to measure and test resiliency.

Finding answers will require Sandians from all backgrounds, Len told the information session. "A real goal for us is to have as broad a sweep as possible to bring in as much thought as possible in the lab to work on this problem," he says. "It's a very hard problem."

The basic question is whether trusted systems can be built from untrusted components. "If you take a look at examples from

biology, every single cell in our body is a relatively untrusted component, and yet we seem to go along and generate emails every day," Len jokes.

The information session was followed a week later by a workshop intended to help define research areas and generate ideas for proposals under the research challenge.

Active Shooter Resolution (ASR) Training in N.M. and Calif. When minutes matter, Sandia's Protective Force steps in



IN AN ACTIVE SHOOTER RESOLUTION TRAINING EXERCISE, Sandia Protective Force officer Joey Branch (4237-3) shields civilians from a potential shooter while ProForce officers Al Garcia (4237-3, behind Joey) and Ruben Padilla (4237-4) provide cover. The red tape around the barrels of the weapons indicate they are training props.

By Stephanie Hobby • Photos by Randy Montoya

A speaker stood at the front of the room, delivering bad news to a room of somber employees. Suddenly, one person stood up and started shouting. Seconds later, he pulled a gun and started firing, taking down the speaker. As people dove for the floor, the shooter walked up and down the aisles, firing at his coworkers. Victims could be heard trying to reason with the shooter, while others moaned for help and tried to comfort one another. Within minutes of the first gunshot, the door flung open and three members of Sandia's Protective Force team charged in. Seconds later, officers took down the assailant and began securing the room. Officers verified that the scene was safe and secure, giving the paramedics the go-ahead to assist the victims. Thankfully, the scenario was only a demonstration

that showcased the immediate and aggressive response of the Sandia Protective Force. Capt. Bob Brown (4237-6), training captain of Sandia's Protective Force and his training staff, which consists of Lt. Andres Tabios and Lt. Tommy Serna, says the team has been conducting formal Active Shooter Resolution (ASR) training on a regular basis since 2008. "Sandia's Protective Force team has been together for many years. We conduct standardized training, so we can ensure that every scenario will get the same response, no matter what. We're a very seasoned force."

Sandia employees are trained to get out, hide out or, as a last resort, confront the shooter should the unthinkable happen. On average, active shooter incidents are resolved within five to eight minutes. "We have to have a quick response. We train our officers to think on the move, engage a target that is stationary or on the move, and

react to any situation possible," says Lt. Tommy Serna (4237-6). "Every second can mean a life saved."

Sandia's Protective Force Training Dept. (4237-6), trains its officers throughout the year and has worked with the National Training Center (NTC) to become the benchmark for Active Shooter Response (ASR) training throughout the DOE complex. This training has sparked the interest of outside entities, which include Sandia/California and area schools. Active shooter events are more prevalent in the workplace, so as the Protective Force continues its ASR training, they ask that every member of Sandia's workforce remain vigilant.

The Protective Force training staff is always looking for people to volunteer for the scenarios, so if you or your organization are interested in being part of an exercise or demonstration, contact Tommy at (505) 844-6414 or (505) 284-9596.



CHRIS DURAN (4230-2), a security incident investigator in his day job, tries to convince the shooter to stand down. As a general principle, employees faced with a shooter situation are trained to get out, hide, or, as a last resort, confront the shooter.



PHIL SANDOVAL of Physical Security Dept. 4242 played totally against character by being the bad guy in the scenario.



PROFORCE OFFICER Al Garcia (4237-3) restrains the shooter, while officers Joey Branch and Ruben Padilla secure the area.



EMERGENCY PLANNER Diana de la Rosa (4236-2) applies convincing make-up to a victim to add an element of realism to the exercise.



EMERGENCY RESPONSE TEAM first responder Dale Lares (4236-1) attends to victim Naomi Baros (4237).

Calif. security operations shifts attention to active shooter incidents

By Mike Janes • Photos by Randy Wong

Sandy Hook in Newtown, Conn. LAX. A New Jersey shopping mall. Emcore Corp. in Albuquerque. The Washington Navy Yard. By now, we're all familiar with the names, places, and tragic events with which they're associated.

But no one at Sandia's California site is more focused on those shooting incidents than the security operations team. "We've been thinking about this sort of thing [an active shooter scenario] for at least the past year, probably longer," says Dennis Baker (8511), who manages the security operations team for Div. 8000.

Due to the rapid increase in shooting incidents — coupled with physical changes that have come about as a result of the site's development plan — the security group has spent significant time contemplating the implications of an active shooter incident at Sandia/California.

"We first started to focus on our Protective Force and asked ourselves hard questions about our state of preparedness," Dennis says. To that end, an active shooter scenario was played out during the most recent Emergency Management field exercise to drill the Protective Force on its response capability.

"One important thing we learned is that our Protective Force would undoubtedly be the first on the scene during any active shooter event," Dennis says. Although local law enforcement partners such as the Livermore Police Department and state Highway Patrol would be essential resources in any prolonged event, he says, it is unlikely they would be able to arrive at the site in time to effectively address an active shooter situation.

"Unfortunately, with an active shooter, we don't have time to wait," Dennis says. "This is not like a hostage situation. We would need to engage a shooter right away before they harm people." Dennis says statistics show that the average length of time for an active shooter incident is just 12 minutes.

Expanded open campus, GAA space create new challenges

"It can be argued that Sandia is not an attractive location for an active shooter since we have guards and gates to effectively act as a deterrent," says Dennis. But now, even though guards and gates are still present, he points out that the expansion of the site's Livermore Valley Open Campus and General Access Area space undermines that argument.

"We still have many deterrents in place, but we now have areas that are freely accessible to the broader public, and that increases the risks," he says. "Though the likelihood of an active shooter or similar event remains small



MEMBERS of the Sandia/California Protective Force play out their roles during the Emergency Management field exercise, which simulated an active shooter event on site.



SANDIA/CALIFORNIA Protective Force members debrief to discuss lessons learned following the Emergency Management field exercise, which simulated an active shooter event on site.

and the presence of guards and gates acts as a deterrent, the openness of the LVOC and GAA makes our job more challenging."

Using new tools to ward off shooters

As a result of those new vulnerabilities and the spike in active shooting incidents around the country, Dennis says more emphasis is being placed on training the Protective Force and equipping it with the right tools to neutralize a shooter. For instance, members of the Pro-



A VIDEO ENDORSED BY THE FBI titled "Run. Hide. Fight" is considered to be one of the best training videos on the topic of active shooter response, says Dennis Baker (8511). He encourages Sandia managers to show the video to members of workforce and to seek out additional instructional material.

ective Force are now being trained on duty rifles in addition to the traditional handguns they've carried.

In addition, the security team is promoting a video to the workforce that Dennis says can serve as a "survival guide" of sorts.

The video, titled "RUN. HIDE. FIGHT", was produced by the City of Houston Mayor's Office of Public Safety and Homeland Security. It's endorsed by the FBI.

"This piece is considered by security professionals to be one of the best training videos on the topic of active shooter response," he says. "Its messages are easy to assimilate, and it is applicable whether you're a regular citizen, an elementary school teacher, or a Sandian."

Dennis urges department managers to show the video at staff meetings and says members of the security operations team are available to attend for Q&A. He says his group is developing an instructional brochure on the topic, and he also encourages people to visit the FBI website on active shooter preparedness for further reading and material.

"We want members of the Sandia workforce to be safe and secure at all times, whether they're here on site or somewhere else," Dennis says. "Watch the video, show your family, read up on the topic, participate in drills, and do whatever you can to prepare. We're not out to scare anyone, but this could happen to us."

Computer power clicks with geochemistry

By Nancy Salem

Radioactive waste disposal can worry people. They want to know where contamination might end up and how it can be kept away from drinking water.

"Very little is known about the fundamental chemistry and whether contaminants will stay in soil or rock or be pulled off those materials and get into the water that flows to communities," says geoscientist Randy Cygan (6910).

Researchers have studied the geochemistry of contaminants such as radioactive materials or toxic heavy metals like lead, arsenic, and cadmium. But laboratory testing of soils is difficult. "The tricky thing about soils is that the constituent minerals are hard to characterize by traditional methods," Randy says. "In microscopy there are limits on how much information can be extracted."

Randy says soils are dominated by clay minerals with ultra-fine grains less than two microns in diameter. "That's pretty small," he says. "We can't slap these materials on a microscope or conventional spectrometer and see if contaminants are incorporated into them."

Randy and his colleagues are instead developing computer models of how contaminants interact with soil and sediments. "On a computer we can build conceptual models," he says. "Such molecular models provide a valuable way of testing viable mechanisms for how contaminants interact with the mineral surface."

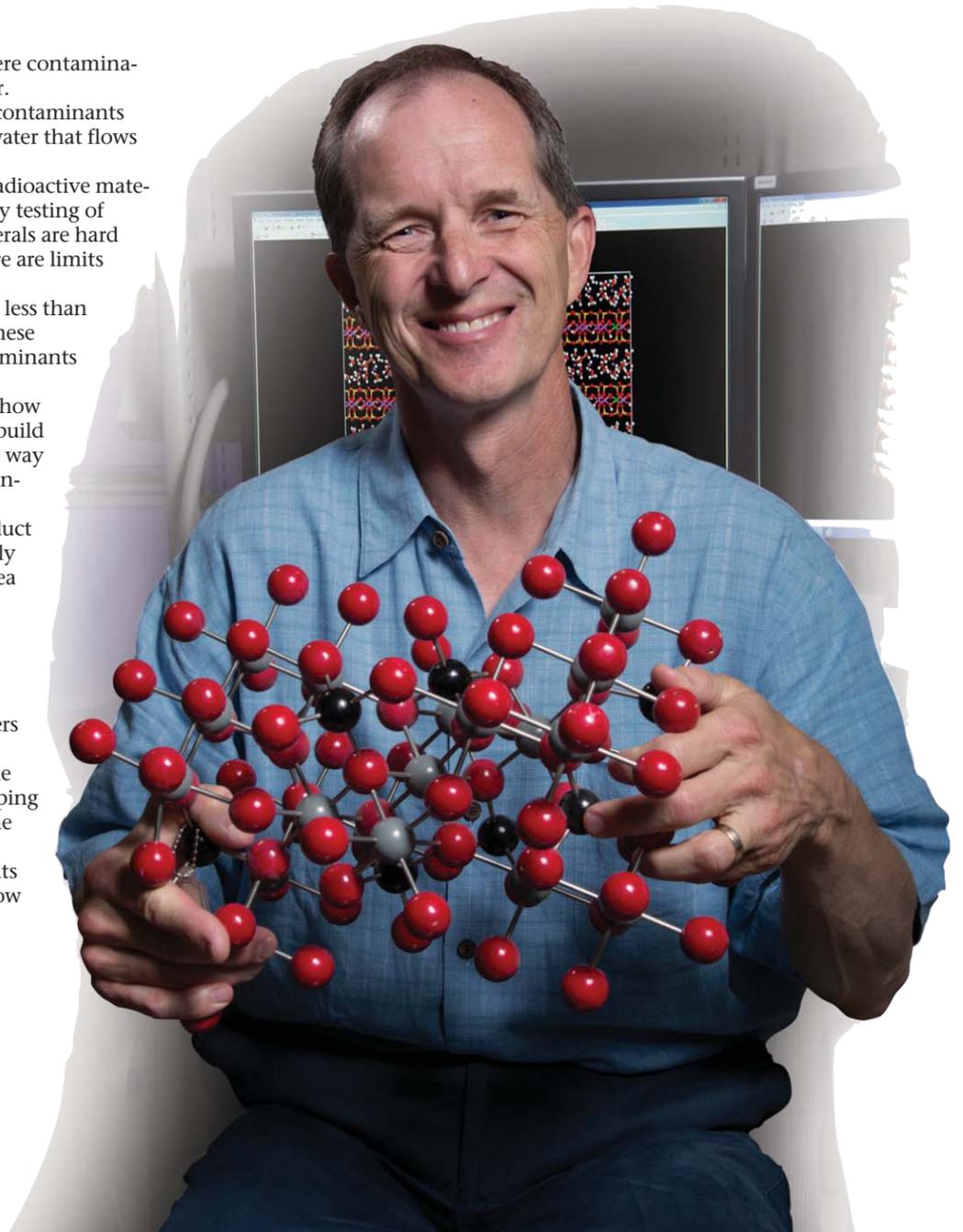
He describes clay minerals as the original nanomaterial, the final product of the weathering process of deep-seated rocks. "Rocks weather chemically and physically into clay minerals," he says. "They have a large surface area that can potentially adsorb many different types of contaminants."

Clay minerals are made up of aluminosilicate layers held together by electrostatic forces. Water and ions can seep between the layers, causing them to swell, pull apart, and adsorb contaminants. "That's an efficient way to sequester radionuclides or heavy metals from ground waters," Randy says. "It's very difficult to analyze what's going on in the interlayers at the molecular level through traditional experimental methods."

Molecular modeling describes the characteristics and interaction of the contaminants in and on the clay minerals. Sandia researchers are developing the simulation tools and the critical energy force field needed to make the tools as accurate and predictive as possible. "We've developed a foundational understanding of how the clay minerals interact with contaminants and their atomic components," Randy says. "That allows us to predict how much of a contaminant can be incorporated into the interlayer and onto external surfaces, and how strongly they bind to the clay."

The computer models quantify how well a waste repository might perform. "It allows us to develop performance assessment tools the Environmental Protection Agency and Nuclear Regulatory Commission need to technically and officially say, 'Yes, let's go ahead and put nuclear waste in these repositories.'"

Molecular modeling methods are also used by industry and government to determine the best types of waste treatment and mitigation. "We're providing the fundamental science to improve performance assessment models to be as accurate as possible in understanding the surface chemistry of natural materials," Randy says. "This work helps provide quantification of how strongly or weakly uranium, for example, may adsorb to a clay surface, and whether one type of clay over another may provide a better barrier to radionuclide transport from a waste repository. Our molecular models provide a direct way of making this assessment to better guide the design and engineering of the waste site. How cool is that?"



RANDY CYGAN (6910) says molecular modeling sheds light on how a waste repository might perform. "It allows us to develop performance assessment tools the Environmental Protection Agency and Nuclear Regulatory Commission need to technically and officially say, 'Yes, let's go ahead and put nuclear waste in these repositories.'"

(Photo by Lloyd Wilson)

Sandia makes holiday gift wishes come true for more than 300 foster children



Vanessa Petty's (99) children selected the bicycles the family donated for the holiday giving program, as they have for every year since she started working at the Labs. The annual holiday gift drive provides unwrapped Christmas gifts for children who may not otherwise receive a present at Christmas. The program, organized by Sandia's Community Involvement Dept. 3652, helped make the Christmas for Albuquerque's foster children a little brighter. This year, nearly 400 unwrapped gifts, most labeled with a foster child's name, were delivered to the New Mexico Children, Youth and Families Department's offices.

Money-saving ideas earn recognition

By Nancy Salem

Twenty-two Sandia teams were recognized for strategies they submitted to a website that collects information on who at the Labs is saving money, how, and how much. The Operational Innovation site identified and validated \$81.6 million in efficiencies in fiscal year 2013, including \$17.3 million in cost savings and \$62.3 million in cost avoidances.

Pam McKeever, senior manager of Operational Innovation Dept. 710, says website managers evaluate the effectiveness and efficiency of ideas and determine if they are candidates for Labs-wide implementation, funding, or if they need a policy, process, or procedure change.

Teams were recognized in the categories of Cost-Savings, Cost-Avoidances, Parent Company Reach Back, and Best Practice Integrations.

The teams and the amounts they saved in FY13 are:

Cost Savings

- Healthcare, \$14 million
- PBGC Savings, \$996,000
- WIP Production of Neutron Tube Parts, \$995,000
- Energy Savings Rate Reduction, \$984,000
- Asset Management Equipment Threshold, \$268,000
- Physical Security Resource Savings, \$158,000
- TSS Project Management Efficiency Savings, \$98,000
- Division 1000 Staffing Efficiencies, \$55,000
- Investment Management Duplicative Services Terminated, \$44,000
- Safeguards Control & Communication System Closeout, \$24,000

Cost Avoidances

- Joint Radar Shared Module, \$18.5 million
- Quality Cost Management for MC4682, \$2.1 million
- Enterprise IT Contract Redesign, \$1.4 million
- Executive Data Center Consolidation, \$1.1 million
- W88 Program Alternate Design, \$578,000
- B61 Contract Purchase Agreement Process, \$223,000
- Labs-Wide Downgrade of Q Clearances, \$161,000
- Security/Emergency Management Training Staff Reduction, \$88,000
- SIMP Data Loss Prevention Tool, \$74,000
- New Process to Destroy HSPD-12 Credentials, \$32,000

Parent Company Reach Back

- Executive Data Center Consolidation, \$1.1 million

Best Practice Integration

- Laboratory Space Management
- 6S event for Closed Area

The Operational Innovation website began collecting data earlier this year. "In FY13 we were able to get 95 percent of the year's realized efficiencies into the Operational Innovation database," Pam says. "Our goal is to achieve 100 percent capture in FY14."

Pam and her team created submission and evaluation processes, tapped organizations for data, and developed program, implementation, and training plans. Key collaborators have been the business and



THE EXECUTIVE DATA CENTER CONSOLIDATION team (back row) included, from left, Tom Klitsner (9320), Joe Kielytyka (9342), Tim Seigler (9324), Sam Jones (9342), and Tony Perea (9324). The Joint Radar Shared Module team members, from left in the front row, included Roman Martinez (5353), Denise Borrego (10653), Larissa Velasquez (10653), and John Williams (5353). Both teams were recognized for finding ways to save Sandia money.

finance groups, who often hear about cost-saving strategies. About 90 Sandia financial analysts were trained to use the system, entering and reviewing ideas and doing cost-savings estimates.

"This is truly an effort that everyone can participate in. We all know of ways to improve our operations; we just need to step out and take the time to do it."

— Pam McKeever, senior manager
Operational Innovation Dept. 710

"The Operational Innovation database is not only for capturing dollars saved or avoided," Pam says. "We are capturing any effort that results in a benefit to the Lab. We are capturing intangible benefits such as quality improvements, increased employee morale or corporate reputation, improved capability posture, or expanded intellectual capital."

She says efficiency ideas come from sources including benchmarking or comparison studies, causal analysis, lessons learned activities, Lean Six Sigma events, parent company contributions, value engineering studies, audits and assessments, or from individuals or departments.

"This year's Operating Excellence recognition event was an opportunity for us to thank the many people who participated in making the Labs more effective and efficient," Pam says. "Our winners came from all areas of the Labs — Direct and Indirect, Mission Technology and Mission Support, management, and staff. This is truly an effort that everyone can participate in. We all know of ways to improve our operations; we just need to step out and take the time to do it."

The larger Operational Innovation project, which improves the effectiveness and efficiency of operations, is integral to Sandia's Strategic Objective 3: Lead the Complex as a model 21st century government-owned contractor-operated national laboratory, says Kim Sawyer, deputy Laboratories director and executive vice president for Mission Support.

"The Operational Innovation initiative has played an important role in providing an integrated picture of how we achieve that objective," she says. "It also supports Strategic Objective 2: Amplify our national security impact, as we continue to strengthen our partnerships with key customers."

2013 Pulse Survey Results

About 40 percent of Sandia employees responded to the 2013 Sandia Pulse survey and responses to the 15 questions show little change from the 2012 LM Voice survey on which the Pulse survey was based. Average scores for each question were fairly evenly distributed across the Labs, with most questions showing a variance of 0.5 or less across all divisions. Participation was down significantly from the 61 percent response rate from the full 81-item 2012 LM Voice Survey. This is typical for off-year Pulse surveys.

The Pulse survey was designed to help assess progress on the Labs' commitments to employees and to focus on key areas identified in LM Voice results as needing improvement, including performance management and rewards.

In response to the LM Voice results, strategies were implemented to help leaders in their ability to conduct meaningful career and performance discussions,

which resulted in a slight increase in employee satisfaction ratings. Employees responded more positively about the extent of the performance recognition outcomes they received and that these recognitions were a reflection of contribution. While the average for both these items was 3.3 on a 1-5 scale, with 5 being the best response, the change is in a positive direction.

"We have made broad corporate-wide changes to address an area of concern and it takes time for those changes to be fully recognized and reflected in survey feedback such as this," says Pam Hansen Hargan, VP for Human Resources and Communications (3000). "Typically, it takes a couple of cycles before we can really see the impact of implemented changes."

Employees will have an opportunity to share their voice again in the 2014 LM Voice survey. This larger biannual survey is planned for deployment on June 2, 2014.



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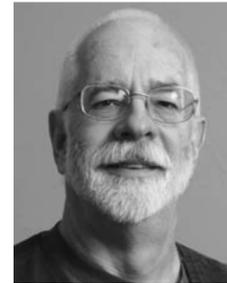
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30 5431



Mike Dvorack
30 435



Rebecca Darnell Horton
30 5640



Melvin Krein
30 5418



Scott Nicolaysen
30 2625



Mark Pilcher
30 5424



Steven Wagner
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Ephraim Arquitola
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Phil Sackinger
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Charline (Char) Wells
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Nancy Aldridge
20 4254



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David Betsill
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Susan Caffery
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Ken Chen
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Seung Choi
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Mike Eldred
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Brian Griego
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Deborah Kernan
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James Lucero
20 2718



Dominic V. Martinez
20 1733



Nicole Morgan
20 9343



Maria Walsh
20 421



Ronald J. Baker
15 99



Chuck Browder
15 6524



Mike Chandross
15 1814



Randy Clarin
15 8231



Jeremy Dencklau
15 9535



Linda Flores
15 5900

BEYA winner offers community kids a hand

By Nancy Salem

There's more to receiving a Black Engineer of the Year (BEYA) award than just being a winner, says Aaron Brundage (5431). "The intent of the award is to provide guidance to young people to pursue careers in science, technology, engineering, and math (STEM)," he says. "It gives them a role model."

Aaron was named a 2013 BEYA Minority in Research Science Emerald Honoree in the category of Most Promising Scientist – Government. "This recognition means so much to me," he says. "I'm honored to be part of something that is bigger than the award itself. At Sandia I have the privilege of doing world-class research, working with and being mentored by the best minds in the country, and using the best facilities in the world."

BEYA is a program of the national Career Communications Group, an advocate for corporate diversity, and part of its STEM achievement program. The awards recognize the nation's best and brightest engineers, scientists, and technology experts. Aaron will receive his award at the 28th BEYA conference Feb. 6 in Washington, D.C. The event precedes National Engineers Week.

Aaron works in modeling and simulation of energetic materials, penetration mechanics, thermodynamics, and combustion and shock physics. He first came to Sandia as an intern in 2002 while pursuing his PhD in mechanical engineering at Purdue University. He has bachelor's and master's degrees in mechanical engineering from Pennsylvania State University.

Aaron feels strongly about giving back to the com-



AARON BRUNDAGE (5431) became a budding engineer at age 3 when his mom gave him a LEGO 566 kit for Christmas. He spent the day building the house pictured on the box, spurring a lifelong interest in engineering and science. (Photo by Randy Montoya)

munity. He serves on the board of directors of Big Brothers Big Sisters of Central New Mexico. In 2011, he and his wife founded a nonprofit, Tools for Learning Outreach Services (TFLOS), that provides workshops in partnership with schools and community programs. The STEM education programs, intended to reach children who are underserved, at-risk, or underrepresented in STEM disciplines, provide hands-on activities and opportunities for learning through play.

The organization developed a LEGO robotics curriculum offered at five afterschool programs this year in partnership with the Rio Grande Educational Collaborative. TFLOS teamed with the Girl Scouts of New Mexico Trails in a United Way of Central New Mexico (UWCNM) grant titled "Generation STEM" to present its mobile technology educational program to underserved girls in the four-county region covered by UWCNM. Aaron also brought STEM to underrepresented youth in the 6th through 12th grades by volunteering for eight summers as an instructor for HMTech, Sandia's summer science and engineering program, and teaching ACT courses at the University of New Mexico.

Aaron was director and past chair of the New Mexico section of the American Society of Mechanical Engineers and is a member of the K-11 Technical Committee on Combustion.

Jeff Isaacson, VP of Defense Systems & Assessments Div. 5000, says Aaron "is the epitome of the type of researcher we require to deliver innovative solutions to some of our nation's toughest technical problems."

"There is more that makes Aaron an exceptional employee — the desire and ability to teach mathematical and scientific concepts to the next generation," Jeff says. "Aaron is active in our local community promoting STEM at the elementary through post-secondary levels."

Aaron says role models are most effective when they work directly with youth and offer hands-on experience. "As awardees, our job is to share our stories to inspire the next generation and help them understand what they can achieve," he says.

Dr. Martin Luther King Jr. opened doors and turned a dream into reality

By Ken Holley

Note: In recognition of Dr. Martin Luther King Jr. Day 2014, long-time Sandian Ken Holley (3555-3) wrote the essay here at the request of the Lab News.

Sometimes we forget where we have come from. It is easy to do. Life changes and we accept the change and keep moving with society. Taking a moment to

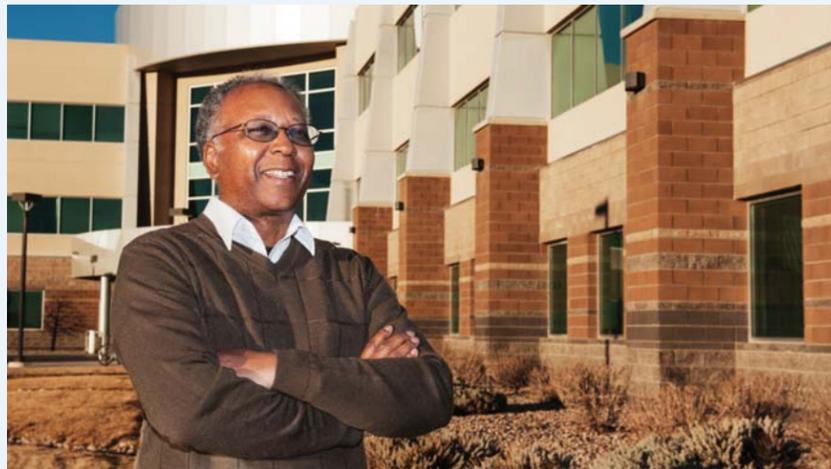


reminisce, I remember going to a segregated elementary school in rural North Carolina. Our bus would pass the other school every day. We didn't think anything of it at the time. That was the way things were back then. In the 1960s we began to question why things were so different. The separation of things was as plain as black and white. Gray areas did not exist and there was no room for compromise. President Kennedy inspired us to think out of our current circumstances. He inspired us as a nation to dream of a different kind of life. Then came Rev. Dr. Martin Luther King Jr. He gave reality and solidity to the dream. He expanded our minds and encouraged us to take a stance for equality and civil rights. He became the face of the civil rights movement in the US. It is interesting that he came out of the church. I wonder sometimes if his movement would have been as profound if he had come from society or the military or academia.

The changes that have happened to us as a nation have been nothing short of miraculous since this movement. Forty years after the civil rights movement we have a black president of the US. Some say this is a miracle of epic proportions, a real "Red Sea" experience for our country.

Back to me: My earliest aspirations were to get an education and work as a teacher or work a farm like my dad. Preachers were the top of the community. There were few role models or examples of being anything else. My brothers thought of the military because our father and grandfather had served our nation.

Thanks to the efforts of Dr. Martin Luther King Jr. and the civil rights movement, schools were integrated. Opportunities became available and we all benefited. I earned my BA from Winston Salem State University and my master's from Oral Robert University in Tulsa, Okla. I worked for several companies but spent most of my career here at Sandia, 29 years now. When I arrived in 1985, Sandia was taking some major steps in implementing affirmative action using guidance from the Department of Energy. Sandia became a leader in the HBCU (Historically Black Colleges and Universities) program, the DOE Science and Technology Alliance, the GEM (National Consortium for Grad-



KEN HOLLEY, a 29-year veteran of Sandia, credits the efforts of Dr. Martin Luther King and others who literally put their lives on the line during height of the Civil Rights era with opening doors that have changed his life and the lives of countless others. (Photo by Randy Montoya)

uate Degrees for Minorities in Engineering and Science) program, and the National Physical Sciences Consortium (NPSC) program.

Sandia created strong relationships with several outstanding black colleges, including Prairie View A&M, North Carolina A&T, Howard, and Tennessee State. These relationships supported recruiting and programmatic and institutional development.

I dare say that without the efforts of Dr. Martin Luther King Jr. and the civil rights movement, much of this would have never happened. I remain proud of Sandia for its efforts to increase the diversity of its workforce.

Having been born in another era, I know our nation has made great strides in the area of equal opportunity over the past several decades, but I know, too, that there is still much to do.

When asked about the benefits of Dr. Martin Luther King, Jr. and the civil rights movement I am caught up in a whirlwind of thoughts because life would have been too different to imagine. I would live in a second-class culture with no access to the OTHER culture and my dreams would be limited to those things that were possible within those societal limits. I never could have been employed by a national lab. The doors for opportunities would have been closed and aspirations would have been limited. The civil rights movement affected blacks, Hispanics, Asians, Native Americans, and women. Most of us cannot imagine how life would be if these laws had not passed and the US had not adjusted to today's cultures. As a nation and as a people we are blessed.

February is Black History Month

Black History month is celebrated annually in the United States during the month of February to remember and celebrate the achievements black Americans and the central role of African Americans in US history.

The story of Black History Month begins in 1915 when historian Carter G. Woodson and Minister Jesse E. Moorland founded the Association for the Study of Negro Life and History, which was dedicated to researching and promoting achievements by black Americans and other peoples of African descent. Now known as the Association for the Study of African American Life and History, the group sponsored a national Negro History week in 1926, choosing the second week of February to coincide with the birthdays of Abraham Lincoln and Frederick Douglass.

Mayors across the country began issuing yearly proclamations recognizing Negro History Week. In the late 1960s, due to the civil rights movement and a growing awareness of black identity, Negro History Week evolved into Black History Month. President Gerald Ford officially recognized Black History Month in 1976, calling upon the public to "seize the opportunity to honor the too-often neglected accomplishments of black Americans in every area of endeavor throughout our history."

Each American president since then has designated February as Black History Month and endorsed a theme. The 2014 theme is "Civil Rights in America" to mark the 50th anniversary of the 1964 Civil Rights Act and encourage exploration of the history of equal rights for all.