

Position of strength

Jill Hruby rolls out simplified strategic plan pointing to a dynamic future

By Nancy Salem

Sandia is the healthiest it has been in a long time, and can build national security impact on a base of talent and delivery, says the Labs' new president and director.

Jill Hruby told more than 600 people at the 2015 Managers' Meeting Aug. 19 that a strong Nuclear Weapons program is driving that vitality. She reiterated the message at a similar meeting in California on Aug. 25. "When work in the Nuclear Weapons program is as robust as it is today, the Labs tends to be in a great place," she said. "We have a strong modernization program and are sustaining the stockpile."

She said other scientific and engineering programs as a whole are steady. "We turn over programs every day. We execute against tough dynamic conditions in national security," she said. "So when you put those programs together with the one in nuclear weapons, I really feel the Laboratory is in a

(Continued on page 4)

SANDIA PRESIDENT AND LABORATORIES DIRECTOR Jill Hruby, right, was joined at the 2015 Managers' Meeting by Labs VPs, from left, Rob Leland (1000), James Peery (5000), and Becky Krauss (11000), and deputy Laboratories directors and executive VPs Kim Sawyer (Mission Support) and Steve Rottler (National Security). The executives took questions from the audience and discussed the direction Sandia is headed.

(Photo by Randy Montoya)



Workhorse machine HERMES III



fires its 10,000th shot . . . pages 6-7

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'Together we deliver; that's the vision'



SPEAKING TO A PACKED HOUSE in the recently updated Steve Schiff Auditorium, Deputy Labs Director and Executive VP for Mission Support Kim Sawyer said, "Together we deliver; that's the vision. That's what we want to continue to focus on and have strength with." (Photo by Randy Montoya)

By Valerie Larkin

At the New Mexico Mission Support all-hands meeting on Aug. 20, the focus was on celebrating accomplishments and welcoming change.

The gathering, hosted by Kim Sawyer, Deputy Laboratories Director and Executive VP for Mission Support,

Mission Support all-hands meeting offers a time to reflect on recent successes and changes

opened with the personal stories of Mission Support employees who contributed to a successful B61-12 flight test at the Tonopah Test Range earlier this summer.

"We should all be so very proud right now. That was a very significant test. It demonstrated that together we can deliver, and also it demonstrated to our customer that we can do hard things, we work together as a team, and, most importantly, we can do it on schedule and on cost," Kim said to a standing-room-only audience.

Change as opportunity

The theme of change featured prominently at the meeting, with Kim discussing the shifts in leadership that have occurred at every level of the organization in FY15. From the appointment of a new Labs director and president, to the retirement and selection of several new vice presidents and center directors, FY15 brought many changes to the Labs.

"There are a lot of new folks on our leadership team, which is a great thing. Change is opportunity," Kim said.

(Continued on page 4)

Researchers see potential in wide bandgap, ultra-wide bandgap materials

By Sue Major Holmes

Sandia researchers are working on wide bandgap materials that someday could replace silicon as the backbone of the power semiconductor industry.

Wide bandgap (WBG) materials such as silicon carbide (SiC) and gallium nitride (GaN) could potentially vastly improve the performance of the electric power grid, solar photovoltaics, and electrical motors, and help meet the aviation and automotive industries' need to use less energy. GaN has already enabled a revolution in efficient lighting technology and serves as the heart of widely available bright light-emitting diodes. These semiconductor materials have bandgaps significantly wider than that of silicon, the material on which most power systems and modern computers are based.

Bandgap is a fundamental materials property. WBG and ultra-wide bandgap (UWBG) materials are attractive as transistors, or switches, because they can handle higher temperatures and voltages with less degradation.

UWBG materials have potential applications in nuclear weapons and defense systems as well as in future energy systems because of their potentially high radiation resistance and the prospect of enabling smaller and lighter power systems. However, the materials still require a lot of research, says Sandia Fellow Jerry Simmons (1000).

Sandia is researching SiC and GaN, but it's also working to leapfrog over these next-generation materials to the genera-

(Continued on page 5)



Nothing but water

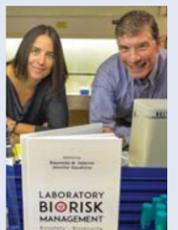
A new chapter in clean energy is starting in Hawaii. At Young Brothers Ltd.'s Port of Honolulu facility, Sandia is leading a project to test a hydrogen-fuel-cell-powered generator as an alternative to conventional diesel generators. See page 3.

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Book explores biorisk

Sandia senior managers Jennifer Gaudio and Ren Salerno have edited *Laboratory Biorisk Management*, a book that provides guidance to hospitals and bioscience facilities about mitigating biological hazards. See page 8.



That's that

Do you go to the State Fair? We've lived in New Mexico for more than 30 years and in all that time, I don't think I've ever missed it. I love the animals, especially the 4-H entries and the earnestness of the kids involved. I love the agricultural displays, the honky-tonk atmosphere of the midway, the rodeos, the concerts. All of it. I especially enjoy watching the pitch-men and -women in the commercial exhibit hall hawking their stuff: the absolutely positively last mop you'll ever buy; the latest chopping, dicing, and slicing gizmos guaranteed to practically make your salsa for you; the miracle towel that absorbs 40 times its own weight in spilled margaritas. I'm a bit ashamed to admit how many times, mesmerized by their polished delivery, I've succumbed to a well-honed pitch and bought yet another space-stealing contraption, like the one last year that spins when you push it up and down and whips up the best scrambled eggs you've ever tasted. (Full disclosure: I used the gizmo once. I think.)

Over the years, I've always been a looker and not a do-er. Every September I feel a bit inadequate that I haven't entered anything in one of the many competitions held during the fair. I'm not a painter, so that's out. I don't make a famous grilled Spam 'n cheese sandwich. I don't own an heirloom collection of whittled Revolutionary War figures. I've been known to grow tomatoes, but they aren't very big, nothing like the beach ball-sized things that win blue ribbons.

Bottom line, I don't make, cook, or grow anything worthy of entering in the State Fair. But at least I have some high-profile company. A colleague here who is friends with a well-known former state official passed along this individual's lament: "When are they gonna have a category for the biggest weed patch? I have a best-in-show collection this year!" I identify. In that category, I'd be a winner. As an aside, I wonder if at the Colorado State Fair they really will have a "weed" category this year?

* * *

It was an ordinary day. A day to get up, kiss the spouse and kids goodbye, and head to work. By all accounts, Sept. 11, 2001, was an unusually beautiful morning on the East Coast, with the kind of pre-industrial blue skies that are as cherished as they are rare. It has been 14 years now since the terror attacks that shattered the serene beauty of that day, our memory of those events less vivid with each passing year. But we should remember; We owe it to the dead. As then-British Prime Minister Tony Blair said in October 2001 in a speech before the Welsh Assembly, "It is important we never forget how we felt watching the planes fly into the twin towers. ... Never forget those answering machine messages. Never forget how we felt imagining how mothers told children they were about to die."

A few months after the 9/11 attacks, *The New York Times* published a series of first-hand accounts by surviving members of victims' families. Here are a few excerpts:

"The last thing he said was that he loved me and that he loved our little baby, Zoe. That's the last I spoke with him."

"The first thing he said to me, he said that I meant the world to him and he loved me. He said tell the girls he loved them very much. He said now, Liz, don't forget about the life insurance. Don't forget about these different programs he had with work. . . . And he went down an A to Z of his life, and what I needed to address."

"He said that he was on the 91st floor [trying to work his way to the top of the South Tower after the airplane hit.] He said 'I am fading, we can't go any more. Tell the kids I love them, and I love you, mom, and tell dad I love him.'"

"I really gotta call mom. In case I don't get out, I love you, brother.' He wasn't crying. I said, 'I love you, too.'"

On an answering machine: "A plane has hit the building, I don't have much . . . I just want to tell you I love you. No matter what, I'm going to be okay."

"He said, 'Mom, what was that explosion?' I said, 'The other tower just went down.' He said, 'Oh, my God. I love you.' The phone went dead."

"Kris, there's been an explosion. We're trapped in a room. There's smoke coming in. I don't know what's going to happen. I want you to know my life has been so much better and richer because you were in it.' He said he would do his best to get out. He said, 'I love you,' and he said goodbye. I think he had been crying, but he stayed strong for me."

At the very end, amid the pain and fear and confusion of those horrific minutes, when all hope was gone and death a looming certainty, one thing remained: love. That may be one of the key lessons of that day – and a final gift for us from those who died.

See you next time.

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

Sandian Bill Waugaman honored by Office of Secretary of Defense

By Rebecca Brock



MEDAL WINNER — Bill Waugaman accepts the Office of the Secretary of Defense Medal for Exceptional Public Service from Deborah J. Kelley, SES director for J8, NORAD, and USNORTHCOM.

(Photo by Mila V. Dimal, NORAD and USNORTHCOM J9 Interagency Directorate)

Bill Waugaman (5628) was awarded the Office of the Secretary of Defense (OSD) Medal for Exceptional Public Service at a ceremony in August. The medal is the second-highest award the OSD presents to individuals outside the Department of Defense (DoD).

It was awarded to Bill for his work as energy security lead and operational manager of the multi-agency project known as SPIDERS, Smart Power Infrastructure Demonstration for Energy Reliability and Security. According to the award citation, Bill was honored for his "tremendous leadership and innovation."

"It has been an honor to have been able to impact national security and homeland defense in a real way. I could not have accomplished this effort without the outstanding teammates we partnered with," Bill says.

Sandia was the lead laboratory on the technology development side of SPIDERS. The combined DOE/DoD project built smarter, more secure microgrids for the military that incorporated renewable energy and storage sources. "This is an award for the entire SPIDERS team," Bill says.

As noted in the award citation, Bill was responsible for the development of national-level capabilities that impacted proven technologies in electric energy microgrids into field-enabled versions for use at DoD facilities. His accomplishments include providing the nation's first responders and warfighters with revolutionary new proficiencies in energy resilience during prolonged utility system failures.

In addition to serving as the operational manager of SPIDERS, Bill is on assignment as the energy security program manager at North American Aerospace Defense Command (NORAD) and US Northern Command at Peterson Air Force Base. Before becoming a Sandian, Bill retired from the US Air Force as a command instructor pilot. His final tour was as deputy head of the department of electrical and computer engineering at the US Air Force Academy in Colorado.

A native of Detroit, Michigan, Bill holds a bachelor's degree from the US Air Force Academy, a master's degree in electrical engineering from the University of Texas at San Antonio, and a doctorate in electrical engineering from the University of Colorado.

Bill's manager, Jennifer Depoy (5620), says, "Bill is passionate about his work, and everyone who works with him is motivated by his high standards and his discipline. He has the highest levels of principles."

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Nothing but water

Hydrogen fuel cell unit to provide renewable power to Honolulu port

By Patti Koning

A new chapter in clean energy is starting in Hawaii. At Young Brothers Ltd.'s Port of Honolulu facility, Sandia is leading the Maritime Hydrogen Fuel Cell project to test a hydrogen-fuel-cell-powered generator as an alternative to conventional diesel generators.

The project kickoff was marked with a ribbon-cutting ceremony attended by US Sen. Brian Schatz, D-Hawaii, Young Brothers President Glenn Hong, and Div. 8000 VP Marianne Walck.

"Today, we take another big step in transforming our nation to a clean energy economy," said Schatz. "The fuel cell technology being deployed today will one day mean less carbon pollution in our ports and on the high seas. The great work from all the partners involved, especially Young Brothers, is helping lead the way to a cleaner, more energy-efficient future."

In June, Hawaii Gov. David Ige signed four energy bills, including one that strengthens Hawaii's commitment to clean energy by directing the state's utilities to generate 100 percent of their electricity sales from renewable resources by 2045. As the most oil-dependent state in the nation and one that could be most affected by rising sea levels, Hawaii has become an early adopter of emerging technologies and innovative energy solutions.

Hydrogen more efficient than diesel

Planning for the Maritime Hydrogen Fuel Cell project began in late 2012 with a study that determined that hydrogen fuel cells could replace diesel generators in providing auxiliary power on board and to ships at berth. DOE's Fuel Cell Technologies Office and the US Department of Transportation's Maritime Administration are funding the six-month deployment of the hydrogen-fuel-cell-powered generator.

"At the point of use, hydrogen fuel cells produce nothing but water — zero pollutant emissions and no greenhouse gases," says Joe Pratt (8366), Sandia's project lead. "This technology could enable major commercial ports and marine vessels to lessen their environmental impacts."

An analysis by Sandia and DOE showed that due to fluctuating loads in maritime auxiliary power applications, a hydrogen fuel cell, which only supplies power when it is needed, is more energy efficient than a diesel engine.

Hydrogenics Corp. designed and built the hydrogen fuel cell generator unit, comprised of four 30-kilowatt fuel cells, a hydrogen storage system, and power-conversion equip-

ment, all packaged in a 20-foot shipping container. With 75 kilograms of on-board hydrogen storage, the generator has enough energy to power 10 refrigerated containers for 20 continuous hours of operation.

Clean power in Honolulu

The unit already is providing power to refrigerated containers on shore. Soon it will begin powering the same refrigerated containers on Young Brothers' barges that distribute goods to Hawaii's other islands. Young Brothers is a subsidiary of Foss Maritime Co.

"Young Brothers will be testing and demonstrating this technology on our on-shore and ocean environments over the next six months," says Hong. "We are very pleased to have been selected to participate in this project with our many national and international partners in expanding this clean technology into new applications."

Hickam Air Force Base in Honolulu is supplying the hydrogen to power the fuel cell. The hydrogen is produced by electrolysis, the process of splitting water into hydrogen and oxygen, using electricity supplied by Hickam's solar-powered electrical grid.

Future deployment

Following the six-month test of the fuel cell unit, the project team will analyze the project's successes and challenges, including the operating and cost parameters needed to make a business case at other ports.

"The long-range goal is to develop a commercial-ready technology that can be widely used at other ports," says Joe.



"WE ARE PLEASED to help expand this clean energy technology to new applications," says Young Brothers, Ltd., President Glenn Hong. Young Brothers is hosting a project led by Sandia to test a hydrogen-fuel-cell-powered generator as an alternative to diesel in powering refrigerated containers. (Photo by David Murphey)



"The project team sees a strong market need and desire for a fuel cell solution, not only at maritime ports but also for users who aren't connected to a grid," adds Joe. "That could extend to developing countries and remote locations worldwide."

"The Maritime Administration continues to fund innovative projects that support the US maritime industry's shift toward cleaner and more-sustainable power sources," says Maritime Administrator Paul 'Chip' Jaenichen. "This hydrogen fuel cell deployment project has the potential to reduce not just emissions, but costs to shippers, all while preserving the precious maritime environment."

To learn more, visit Sandia's Maritime Hydrogen & SF-BREEZE website at <http://tinyurl.com/nv4gxhm>.

Acting NNSA DP chief Brig. Gen. Stephen Davis visits Sandia



Acting NNSA Defense Programs chief Brig. Gen. Stephen L. Davis visited Sandia in mid-August to learn more about the Labs' technologies and capabilities. After being welcomed by Sandia President and Labs Director Jill Hruby, Davis toured several Sandia facilities related to weapons work. In the photo at left, Davis is briefed on Sandia's Z machine capabilities by Pulsed Power Sciences Center 1600 Director Keith Matzen. During his half-day stop at Sandia, Davis also was briefed on the latest developments in the Labs' materials science research.

Davis was appointed to his current role to replace Don Cook, who retired from NNSA in July. Before accepting the position, Davis had been NNSA's principal assistant deputy administrator for military application. Previously, Davis served in a wide variety of increasingly responsible positions in the US Air Force. He was commissioned as a 2nd Lieutenant in 1989, where his first assignment after training was as a Minuteman III combat crew member. He attained his current rank of brigadier general in 2014.

(Photo by Randy Montoya)

Jill Hruby rolls out simplified strategic plan

(Continued from page 1)

sweet spot. We are working from a position of real strength. It doesn't mean we don't have to change going forward, but we think about what change is needed."

Jill said Sandians should have time to appreciate and enjoy the Labs' well-being — and get things done. "We have grown. We have hired many new people. We have lots of new leadership in position," she said. "We have real opportunities."

Multimission: A new way of thinking

Jill rolled out Sandia's FY16-FY20 Strategic Plan in her keynote address. She first outlined two key changes. One is a revised set of mission areas that defines Sandia as a multimission rather than a multiprogram laboratory. "It's a new way of thinking about the Labs," she said. "We know what our missions are, and we are multimission. National security, yes. Multimission, yes. Multiprogram, no. We are really focused on mission."

Jill said the leadership team is convinced that just as Sandia cannot deliver on its other missions without the nuclear weapons mission, it cannot execute the nuclear weapons mission without the others. "They are co-dependent," she said. "We need both. They are intertwined. It is very important we recognize that."

That interdependency also is reflected in the changes to the mission areas, which now number seven instead of eight:

- Global Nuclear Assurance and Security, which combines two of the former mission areas, "allows us to think about nuclear areas from threat to solution, the whole space," Jill said.
- National Security Space Innovations, formerly Leveraged Defense Innovations. "The name is clearer since we realized this is mostly about what we do in space," Jill said.
- Reduce Global, Chemical, and Biological Dangers
- Secure and Sustainable Energy Future
- Cyberspace
- Synergistic Defense Products
- Nuclear Weapons

Jill said her goal is to simplify the Laboratories' strategic

framework. "I believe we've made it too confusing," she said. "I get lots of questions about mission areas, PMUs, divisions, policy areas."

She said mission areas are not a management construct, PMUs and divisions are. "Those are management constructs because they are needed in order to manage the Labs in a responsible way," she says. "We can change them when we feel we need to."

Sandia does strategy through mission areas, she said. "They are a way we think about strategy. They are not how we manage the Labs," Jill said. "We need a way to think about strategy in mission space. If you do strategy in PMU space, you are too constrained by the customers and programs today. We really need to think about it more broadly."

Streamlined strategic objectives

Jill said mission areas currently are a piece of the strategic plan and will take on a more prominent, integrated role as they develop. In addition to mission areas, another important part of the strategic plan is strategic objectives. As with the number of mission areas, the number of strategic objectives has been reduced. There are now three objectives instead of the previous five:

- Amplify our national security impact
- Strengthen our Laboratories' foundation to maximize mission impact
- Advance an exceptional work environment that enables and inspires our people in service to our nation

The plan no longer has a stand-alone nuclear weapons objective. "We combined the nuclear weapons objective with other national security objectives," Jill said. The combined objective now represents all the mission impact Sandia has across the complete portfolio.

The objectives are interwoven with two crosscut areas: trusted partnerships and exceptional performance, both considered integral to the success of the plan, Jill said. "We

"I believe Sandia is at its strongest and we're going to keep it that way."

really have to consider fundamentally changing the way we think about partnerships — such as academic alliances, commercialization partners, community partners, and others," she said. "And we should be good at everything we do."

Each objective is followed by a set of milestones. The leadership team has a draft set but the lists are evolving. Jill said they are not everyday work goals. "We want to talk about milestones with conviction and depth," she said. "We have to talk about the things that really matter and things we want to integrate and use our time to do, and not use our time to status 50 or 60 milestones that, although important, the PMUs and divisions were going to do anyway."

Leadership development

Jill said the team made small changes to the Labs' values and added a new one: We live safe and healthy lives. "Given how much emphasis we place on safety and health, we needed to be more explicit about that as a value," she said.

Jill was joined at the meeting by Sandia's Laboratory Leadership Team. Some of the VPs fielded questions from managers during a panel discussion and were praised by Jill for their work on the strategic plan and dedication to Sandia and its mission. "This is a team of extraordinary leaders," Jill said.

She said the unprecedented turnover in Labs leadership the past year means Sandia must rebuild its leadership engine.

"People have stepped up, and many director and vice president positions have been filled from within. But we must make sure we have the proper leadership development," she said. "It's a trademark of Sandia that we grow leadership. It's a time of opportunity, a time to think about change, a time to think about how we can make the Laboratory better."

"I believe Sandia is at its strongest and we're going to keep it that way. We have a great base to build from, so much talent, so much good work to do, thanks to all your good efforts and to the efforts of your staff. It's a very positive time for the Laboratory. I'm pleased to have the opportunity to lead you during this time."

Kim Sawyer

(Continued from page 1)

Kim also noted leadership changes at NNSA, including new Sandia Field Office Manager Jeff Harrell and Deputy Manager Mike Duvall.

Change also will visit the Mission Support decision-making process, Kim said.

"We in Mission Support are going to have a broader area of responsibility in terms of making decisions,"

"Stop folks when they say, 'We've always done it this way.' We don't always have to do it that way."

she said, with some decisions previously occurring at the Laboratory Leadership Team level now occurring at the Mission Support Team level.

Kim shared an update on Sandia's management and operating contract, noting that it will expire April 30, 2017.

"The most important thing for all of you is not to worry, and to do the work and have excellent performance. We'll do the best we can to make sure there is no interruption in our performance," she said.

A new strategic plan

"Change isn't always hard or bad; sometimes it's very good, and I would say the same thing about our strategic plan," Kim said, announcing the recent publication of the FY16-20 Strategic Plan.

The plan reflects a streamlined set of strategic objectives, which have been reduced from five to three. "We're focusing on amplifying our national security, advancing our

foundation, and strengthening our work environment. Go take a look, and get familiar with it. It's pretty impactful," Kim said.

Mission Support focus

To support the newly streamlined strategic objectives, Kim said Mission Support organizations will focus on improving operating effectiveness and efficiency, simplifying the integrated management model, and enabling informed decisions.

Describing one change to improve business effectiveness, she said, "We're changing the way in which we release investment dollars. I've decided that holding back dollars until the middle or end of the year just doesn't work. You need to have that funding in advance so you can execute throughout the year. I think it's going to work very well."

Sandia is investing in projects to integrate and update its information systems, Kim said. For example, improvements to the Human Resources Management System are underway, and an upcoming update to the Corporate Policy System will simplify access to policy information.

Kim highlighted the maturation of the Analytics for Sandia Knowledge (ASK) platform, which she said is improving access to corporate human resources, safety, and financial data and enabling informed decisions for the leadership team. "That's progress," she said.

"We have a lot of change going on. You all have a lot of great ideas for improvements. I ask you to bring those forward. Let's make it better for ourselves and for the next generation. And stop folks when they say, 'We've always done it this way.' We don't always have to do it that way," she said.

The meeting featured a talk by guest speaker Debra Benton (see box at left) and closed with a question-and-answer session with Mission Support leaders, who responded to questions about staff augmentation, the ASK project, and increased demands on Mission Support resources.

A separate all-hands meeting was held Aug. 27 at Sandia/California. In addition to receiving Mission Support updates, attendees heard from the Mission Support vice presidents who participated in a panel discussion on "Bringing Your Whole Self to Work." They shared stories about how the experiences and people in their personal lives enable them to be more effective professional contributors. Videostreams of both meetings are available in the Corporate Streaming Library.

A healthy dose of Cheez Whiz

Attendees left the New Mexico Mission Support all-hands meeting with their shoulders pulled back, their heads held a little higher, and the words "Cheez Whiz" on their lips after hearing the talk by guest speaker and executive coach Debra Benton.

Benton, who has worked with Fortune 500 executives for more than 30 years and has authored 10 books, shared her insights into how to cultivate the behaviors and intangible qualities that improve individual effectiveness.

"I've spent 30-plus years studying, consulting to, coaching, and being mentored by very successful people in all walks of life. And I've tried to find out what makes them that way," she said.

Expecting and giving acceptance in all interactions is critical, Benton



DON'T DO THAT — "If you want to be viewed as more memorable, impressive, credible, genuine, trusted, comfortable, competent, and confident, the rule of thumb is to intelligently observe what most people do in any situation, and don't do that. That'll serve you pretty well," said Debra Benton, the guest speaker at the New Mexico Mission Support all-hands meeting.

(Photo by Randy Montoya)

said. "Leaders — successful, effective people — universally have this mindset where they expect acceptance. It doesn't mean they are owed anything, but they expect acceptance for who they are and what they bring to the table."

Gesturing to her face, Benton said, "If you want to show you 'expect acceptance,' it's in here." She demonstrated what she called the "game face" by saying the words "Cheez Whiz," making her lips part and the corners turn up slightly. The subtle facial expression one has when saying "Cheez Whiz" shows that he or she is alert, approachable, and nonjudgmental, Benton said.

"It's amazing the effect you have on others, and it's back to the most nuanced of behaviors," she said.

Sandia researchers see potential in wide bandgap, ultra wide bandgap materials

(Continued from page 1)

tion-after-next, UWBG materials such as aluminum nitride (AlN).

AlN and GaN are compatible enough to be mixed. That allows researchers to take small steps toward developing AlN by gradually increasing the amount of AlN versus GaN to study behavior and the effect of lattice mismatch between the semiconductor and the material it's grown on, says Bob Kaplar (1768), principal investigator for a Grand Challenge Laboratory Directed Research and Development (LDRD) project on UWBG materials.

Wide bandgap materials have performance advantages

Estimates predict SiC could perform 100 times better than silicon for power switching, GaN could be 1,000 times better than silicon, and AlN could be 10,000 times better than silicon. However, their potential can't be tapped until researchers better understand how the materials work, develop mature techniques to process them, and address reliability concerns, particularly for high-consequence uses.

Sandia researchers have conducted wide bandgap research for nearly two decades. Early work largely focused on solid-state lighting and ultraviolet light emitters, then research expanded into such areas as photodetectors and radio frequency transmitters.

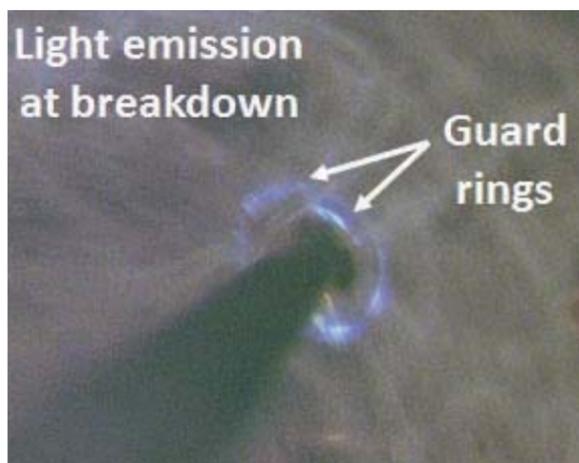
The UWBG grand challenge is the flagship project for Sandia's Power on Demand Research Challenge aimed at developing electrical power systems with the smallest size and weight, while handling the largest possible amount of energy. The research challenge tackles underlying fundamental science questions, engineering applications, and technical challenges for devices, materials growth, and power systems.

The grand challenge is a major investment and an opportunity to create a team with a single vision, says Manager Rick Schneider (1120), program lead for the grand challenge and part of the research challenge team. Technology from the grand challenge could advance the research challenge's effort in power electronics. Power on Demand's other two focus areas are advanced battery research and photovoltaic research.

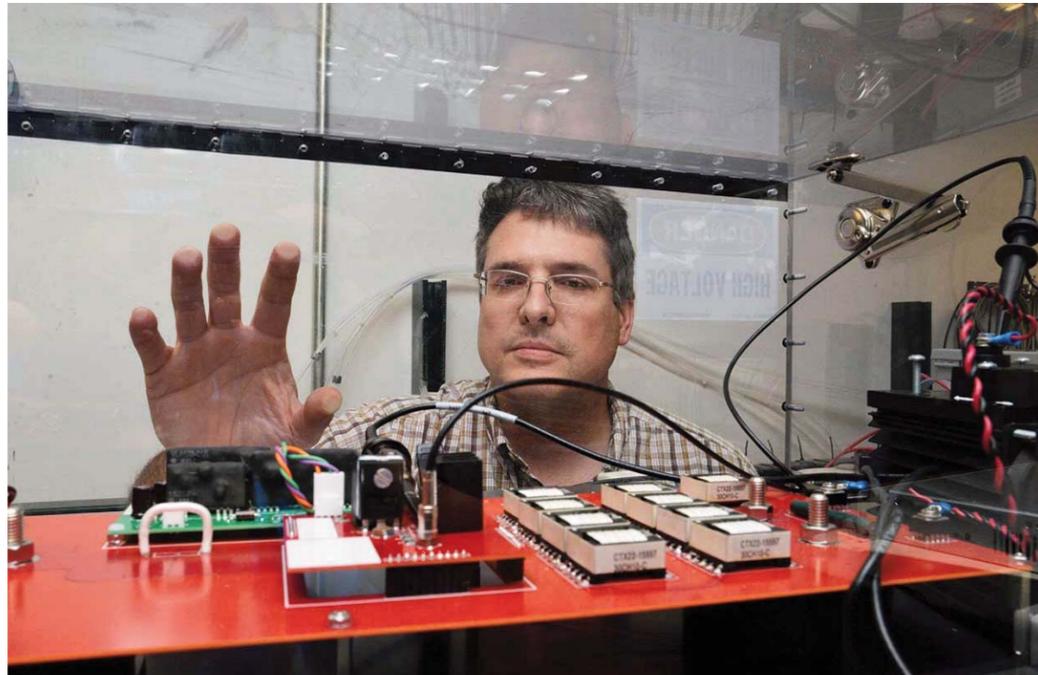
The grand challenge covers three areas: materials growth; device design, fabrication, and testing; and defects and radiation resistance. It explores ways to grow UWBG materials with fewer defects and different device designs to exploit the properties of materials other than silicon.

Among others leading teams or research focus areas, Andy Allerman (1126) works on growth of wide and ultra-wide bandgap materials; Andy Armstrong (1123) measures densities and energy levels of defects in these materials; Art Fischer (1123) and Albert Baca (1766) research device architectures and fabrication; and Jason Neely (1353) evaluates device performance.

"DOE already supports the wide bandgap manufacturing industry, so there's a national priority around this technology," Rick says. Sandia is unique in the DOE complex for its semiconductor capability — the Microsystems and Engineering Sciences Applications (MESA) complex; the Center for Innovative Nanotechnology it operates with Los Alamos National Laboratory; and Sandia's long history of innovative



GALLIUM NITRIDE EXPERIMENT — Sandia researchers studying wide and ultra-wide bandgap materials conduct numerous tests on the materials, such as the one pictured here with the tip of a probe on a gallium nitride diode. Operating near the device breakdown point, light emits from guard rings designed to spread the electric field away from the contact in order to increase device performance. (Image courtesy of Org. 1768)



BOB KAPLAR (1768) peers at a test circuit built under a Grand Challenge Laboratory Directed Research and Development project to evaluate the switching performance of wide bandgap and ultra-wide bandgap power semiconductor devices.

(Photo by Randy Montoya)

"With expertise spanning fundamental materials growth all the way through systems integration, Sandia is uniquely qualified to tackle the entire range of challenges in this emerging field and is well-positioned to be the leading laboratory in an area of increasing national importance."

— Sandia researcher Bob Kaplar (1768)

semiconductor devices and materials. "We come in with a lot of relevant experience and a rich base for power electronics," Rick says.

The largest support for the Wide Bandgap Grand Challenge within Sandia comes from nuclear weapons programs, and Defense Systems & Assessments is interested as well, he says. Nationally, the research has potential impact on the grid, transportation technology, and energy efficiency.

Once Sandia establishes a core ultra-wide bandgap capability, "We have the potential to create very unique radiation-hardened components. It may be a very good opportunity to think about a trusted manufacturing enterprise within Sandia in partnership with MESA. That's a 5- to 10-year vision for Sandia with the potential for external collaboration and industry outreach," Rick says.

Performance issues include defects, integration into larger systems

Although some devices using SiC and GaN are on the market, thorny problems remain, Bob says. Common performance issues include defects, incompatibility with the microelectronics substrates on which the materials are grown, and the impact of integrating a device into a larger system. Sandia researchers can evaluate those problems impartially, building on knowledge and capabilities gained in decades of nuclear weapons work.

Improvements in WBG or UWBG materials could cascade into improvements in an entire system.

For example, WBG materials could potentially reduce the estimated 10 percent energy loss that occurs between generating electricity and transmitting it to a home or business. A wide bandgap allows faster switching, which could reduce the size of bulky passive elements, Bob says. Thus, WBG devices could mean higher reliability, smaller size, and less expensive systems.

Likewise, if electric vehicles could tap the potential for WBG and UWBG power electronics to withstand higher temperatures, they might not need liquid cooling systems, resulting in smaller and lighter electronic systems. That could reduce the system's complexity and improve vehicle range because the car would weigh less.

But materials compatibility also can be a problem in part of the transistor called the gate, which turns the switch on and off. A critical part of that is the gate oxide, or insulating material. Researchers are exploring various substances as possible gate oxides.

For silicon and SiC, the gate oxide is silicon dioxide. While it's a match for silicon, silicon dioxide is a more complex interface for SiC because the presence of carbon results in more material defects that can affect the transistor's electrical behavior, Bob says. Oxide physics on GaN pose an extremely complicated materials science problem that will require atomic-level understanding before such devices will be practical, he says.

Researchers studying how to grow wide bandgap materials better

There also is no widely available, low-cost, large-area GaN substrate, the crystal on which semiconductor material is grown. That lack affects the type of transistor structure that can be made. Bob led an LDRD project to explore how to design, grow, and fabricate GaN devices on GaN substrates.

Silicon and SiC are grown on very pure single-crystal silicon or SiC wafers purchased commercially, meaning the starting material and grown layers are basically the same. However, without low-cost, large-area GaN wafers, GaN traditionally is grown on slices of sapphire, silicon, or SiC. Since the atomic spacing between the wafer and GaN isn't the same, GaN ends up with tiny defects, Jerry says. Defects limit the type of transistor structure that can be made.

That's why device performance doesn't live up to predictions, Jerry says. Defects also impair reliability, a critical issue for uses such as the electric grid and transportation.

Until researchers can figure out how to grow large-area bulk GaN substrates inexpensively, they use such tricks as etching minuscule fingers into the substrate so GaN grows on top of the fingers and merges, reducing the strain inside, Jerry says.

WBG and UWBG devices must be integrated into larger systems. A switch, for example, fits with other parts into a system that includes high-voltage switches and low-voltage sections such as microprocessors, with a buffer or driver in between. Everything in a highly integrated system must withstand high temperatures. While WBG materials are robust at such temperatures, the packaging or semiconductor chip casing is not as resilient, Bob says. Sandia is studying robust packaging approaches.

"With expertise spanning fundamental materials growth all the way through systems integration, Sandia is uniquely qualified to tackle the entire range of challenges in this emerging field and is well-positioned to be the leading laboratory in an area of increasing national importance," Bob says.

10,000th shot

Workhorse gamma ray generator HERMES III reaches significant milestone

By Neal Singer

Photos by Randy Montoya

The High-Energy Radiation Megavolt Electron Source, better known as HERMES III, fired its 10,000th shot on July 14. HERMES III is the world's most powerful gamma ray generator. It produces a highly energetic beam that tests the capability of electronics to survive a burst of radiation that approximates the output of a nuclear weapon. The machine can accommodate targets that range in size from a single transistor to large vehicles.

The machine does its work by generating an intense electron beam at energies approaching 20 mega-electron volts. The electron beam is then guided into a high atomic-number target, where it is slowed down and produces copious amounts of gamma rays. The thinness of the target permits the majority

of the beam's energy to pass through it; thus, the passage causes minimum damage. This enables HERMES to fire multiple shots at a time without breaking vacuum. "HERMES III has gone hundreds of shots without any damage to the tantalum Bremsstrahlung diode," says manager Ray Thomas (1342).

To achieve its high voltage, HERMES III uses 20 inductively isolated modules arranged in series. The machine resembles a short subway train in size and shape — 17 feet wide, 50 feet long, and 16.5 feet high. Each "car," or unit, adds 1 million volts in series, reaching a total of 20 million volts. Its linear, voltage-adding geometry is distinct from the wagon-wheel shaped architecture favored by Saturn and Z, which is useful for adding current.

Also, HERMES III places its targets at an end of the machine rather than its center.

"Our customers bring their own targets, place them at the front of the machine as we request, and then remove them after the shot," says technician Gary Tilley (1342), who's worked

on HERMES III for 20 years. The other two facilities have to clean up the remnants of exploded targets placed at the center of their energy flows.

Juan Diego Salazar (1342) is part of the team that watches to make sure each module receives the proper dose of power, at the right moment in time, to accelerate the beam.

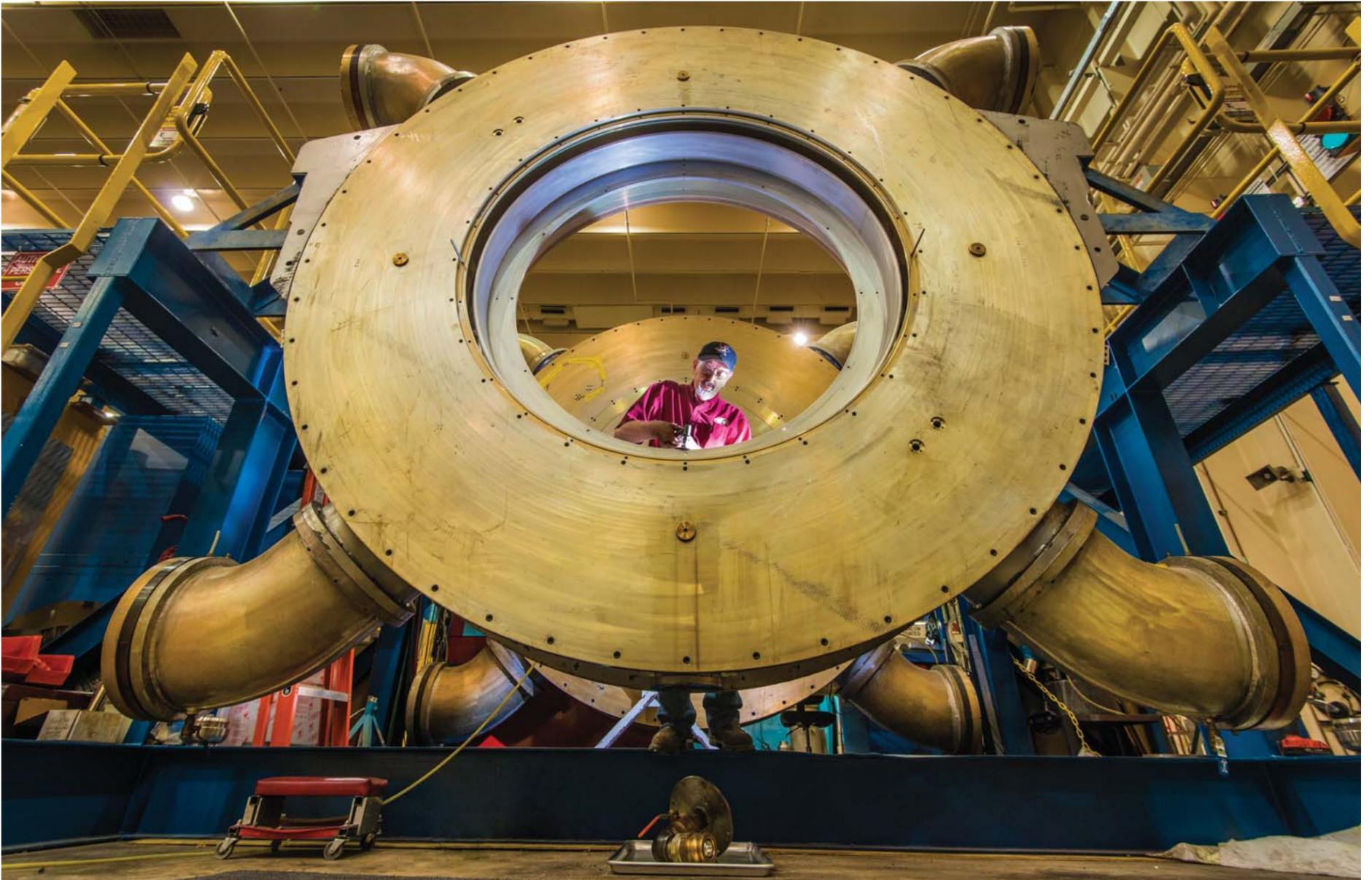
"Every firing is different," he says. "The targets always change." Continual reevaluation of the electrical power feeding the beam as it flows through its modules, and continual recalibration of the beam's line of sight to the target, are necessary because an unobserved power or alignment failure somewhere within the system could mistakenly show a target more radiation-resistant than it actually is.

Real-time adjustments would be too late: The achieved beam flashes for 20 billionths of a second, about the time it takes light to travel 20 feet.

"Accurate results are important," says Ray. "That's what we're about."



FORMER CONTRACTOR JJ Montoya (foreground) and Chris Kirtley (1342) work atop the HERMES III Accelerator, making final adjustments on a newly rebuilt cavity.



GARY TILLEY (1342) repairs a HERMES III cavity.



CHRIS KIRTLEY (right) and Aaron Bowers (both 1342) sand the inner vacuum surface of a HERMES III cavity.



PAT LAKE (1675) (left) and Ray Thomas (1342) examine the vacuum test fixture for the HERMES III insulator stack.



IN THIS PHOTO taken around 1989, Steve Neely (left) and Jimmy Flores service the machine.

'Laboratory Biorisk Management' details safety, security methods for biosciences sites

Sandia, international experts publish first biorisk management how-to book

By Heather Clark

Recent mishaps at laboratories that mishandled potentially dangerous biological substances and the transmission of the Ebola virus in a US hospital are symptoms at bioscience facilities that two Sandia researchers seek to prevent in a new book on biorisk management.

The 228-page "Laboratory Biorisk Management" published by CRC Press was edited by two senior managers, Ren Salerno of the Biological Sciences and Technologies Program (8630) and Jennifer Gaudioso of the International Biological and Chemical Threat Reduction Program (6820).

"This is the first full-length manuscript on the detailed implementation of biorisk management," Ren says. "Laboratory biorisk management is fundamentally a culture of rigorously assessing risks, deciding how to mitigate those risks deemed unacceptable, and establishing mechanisms to constantly evaluate the effectiveness of the control measures."

Salerno, Gaudioso, and the other authors advocate a cultural shift in how laboratories, hospitals, and other bioscience facilities approach safety and security. They say biorisk management should:

- prioritize an intellectually sound, evidence-based decision-making process using substantive risk assessments to evaluate a facility's risk based on the unique operating environment.
- require implementation of mitigation measures according to the risks of specific activities, experiments, or projects.
- constantly assess performance.
- emphasize more meaningful roles and responsibilities for all personnel within a facility.
- assign ultimate responsibility for safety or security performance to top management.
- be scalable from the smallest hospital or clinical lab to the largest research institution.

About a dozen other Sandia experts in the field paired up with their international counterparts to develop and advance a practical set of concepts relevant and able to be implemented by labs worldwide, Jen says.

Other Sandia authors include William Arndt, Susan Boggs, Ben Brodsky, contractor Mark Fitzgerald, Laura Jones, William Pinard, and Laurie Wallis (all 6824); Lisa Astuto Gribble, Susan Caskey, and Monear Makvandi (all 6825); and LouAnn Burnett, Lora Grainger, and Cecelia V. Williams (all 6826).

In addition to explaining biorisk management and providing a model, the book includes chapters on risk assessments, facility design and controls, training, operations and maintenance, how to evaluate biorisk management performance, communications issues, case studies, and future directions and challenges for biorisk management.

Authors say growth of biosciences necessitates need for change

The time to rethink the safety and security of biosciences facilities is now because of the expansion in scope, scale, and sophistication of the biosciences field over the last 15 years, Ren says. Examples of this expansion include the rapid advance of synthetic biology and, following the 2001 anthrax attacks on the White House and Congress, the deep integration of biosciences within national security research.

"The times are changing and what we have never done in the biosafety community is take a good hard look at why we do what we do and ask ourselves if the system needs to be radically reshaped in light of all the changes in biology," he says. "From our perspective, this is way overdue."

Today's biosafety guidelines were created in the early 1980s. The Centers for Disease Control



JENNIFER GAUDIOSO and Ren Salerno are editors of a new book, *Laboratory Biorisk Management*, that aims to aid hospitals and bioscience labs assess, mitigate, and manage biological risks. (Photo by Randy Montoya)

and Prevention partners with the National Institutes of Health to publish biosafety guidelines to protect workers and prevent exposures in biological laboratories, Ren says.

The current guidelines tier biological agents into four risk groups and designate work with those agents into one of four biosafety levels. Ren says use of the guidelines has become perfunctory and their nuances are not widely understood by many personnel at bioscience facilities. For example, he says, it has become common practice in the field to share risk assessments or material safety data sheets between facilities, so they no longer take into account the unique circumstances of each facility, including location, the type of work done there, and the expertise and training of its personnel.

"I believe the events of the last year in this field demonstrate exactly what we've argued: that the current system is broken. It's a systemic problem," Ren says. "We've created an administrative-based safety culture in biology that is way too simplistic for the level of complexity of today's science."

Global assistance in lab security brings issues to light

Sandia scientists became more aware of the issues through their work over the past 15 years with laboratories around the globe.

In 2008, the European Committee for Standardization hosted an international workshop that published an agreement among 24 countries, introducing an overview of biorisk management. The World Health Organization, which quickly adopted the biorisk management framework, asked Sandia and other technical advisers to create a two-week Biorisk Management Advanced Trainer Programme, which Sandia experts helped teach in 2010-2011.

"We were barely scratching the surface and everybody wanted more information, more detail, and wanted to understand how to implement the concept," Ren says. "That's when we began talking about the need for a manuscript."

In addition to the book, the Labs also curates the Global Biorisk Management Curriculum, which contains 47 separate courses developed by Sandia and others. It is being taught by 500 trainers worldwide, Jen says.

Book says focus on performance can prevent problems before they happen

Ren says the book promotes the idea that a good biorisk management system determines ahead of time the metrics that will show a project, experiment, or activity is being done safely and securely.

The risk assessment completed before an activity has begun sets

leading safety and security performance indicators. Then, regular monitoring and documentation will show whether the activity is achieving the safety and security goals, enabling scientists to identify things that are working fairly well, but perhaps not perfectly, while the activity is in progress, he says.

"In other words, by evaluating performance you can adjust your safety measures before something happens," Ren says. "You don't want a bad thing to happen to determine whether or not your system is working."

Some might view this as added paperwork, but Ren and Jen point out that experience in other high-consequence industries shows that when processes are more effective and efficient, a more effective safety system is the result, which in turn leads to decreased costs and improved productivity.

Jen explains that a lot of the risk assessment and mitigation work in the book should help institutions solidify good practices and fill in gaps in their procedures.

"The burden should be proportionate to the risk, so that you're not asking too much from people who are carrying out activities that don't present a lot of risk to themselves or the community," she says. "But for people whose activities carry more significant risk, then yes, they have to do a little bit more to make sure they are managing those risks appropriately. I don't think that's an unreasonable thing to ask."

Culture change in biosciences required

Ren recognizes the system outlined in the book won't work unless stakeholders in the biosciences community buy into the concepts.

"If someone takes this book, agrees that the performance chapter makes some good points, but then adds a large number of additional, perhaps arbitrary, requirements, the system will look like yet another administrative checklist. That would be counterproductive," he says.

In the final chapter, author Ben Brodsky (6824) and a co-author wrote that biorisk management is a relatively young approach that faces challenges to being implemented broadly.

More evidence is needed to show whether biorisk management works, so they call on more organizations to develop ways to measure the performance of biorisk management and to show how it benefits an organization.

"This will enable the biorisk management community to continue creating tangible benefits for the bioscience community, including keeping society and the environment safe while more efficiently facilitating the delivery of science," they wrote.

Physicist Marcus Knudson accepts first joint faculty appointment with Washington State University

By Neal Singer

Marcus Knudson (1646) is the first joint faculty appointee to serve both Sandia and Washington State University (WSU). Among the appointment's purposes is to enhance fundamental research into the compression of materials under extreme conditions. The work will utilize the unique capabilities of Sandia's Z Machine.

"The science of dynamic material compression is a core capability at Sandia," says Sandia Science and Technology Div. 1000 VP Rob Leland. "Washington State University also has a long tradition of excellence in both research and education in this area. This agreement for a joint position across both institutions will push forward the frontiers of high-energy-density science."

Says Daryll DeWald, dean of the College of Arts and Sciences at WSU, "Dr. Knudson's appointment will be a tremendous resource for WSU graduate students and will provide more research opportunities for them. This joint position will help pave the way for new and beneficial partnerships between national laboratories and research universities across the country."

Marcus, a Fellow of the American Physical Society, has subjected materials to extreme conditions at Z, a machine that uses massive pulses of electrical power to create huge magnetic fields or accelerate materials to extremely high velocities of about 50 kilometers a second — far faster than a rifle bullet. He has examined the response of materials at extremely high-energy densities. His results have helped reconcile conflicting estimates of the age of Saturn, altered scientific estimates of the amount of water on exoplanets, and generally furthered understanding of the behavior of materials under extreme conditions.

"Since the 1950s, Washington State has had a vibrant program in the areas of dynamic compression and shock physics. Their alumni already have made outstanding contributions. I expect to help lead new science there and develop joint, nationally recognized competencies," Marcus says.

He himself is a product of WSU's shock physics program. "Many of our past and present dynamic materials staff members at Sandia were educated at WSU," he says. "Ultimately I look forward to mentoring and advising graduate students



SANDIA PHYSICIST MARCUS KNUDSON at Sandia's Z machine has accepted a joint appointment with Washington State University. (Photo by Randy Montoya)

and postdoctoral researchers in projects utilizing the capabilities of pulsed power facilities at Sandia. I hope to create a pipeline of well-trained students capable of producing immediate impact in research."

In 2007, the American Physical Society recognized the long-term achievements of WSU's shock wave effort by renaming the biennial Shock Compression Science Award (the premier recognition in the field) the George E. Duvall Shock Compression Science Award. The late professor Duvall is credited with mentoring a generation of renowned research scientists.

"Many regard Duvall as a founder of shock compression science in the US," says Sandia Senior Manager Dawn Flicker (1640).

Since the award's inception, seven out of 15 Shock Compression Science Awards have gone to WSU graduates and/or faculty members.

A recipient of the 2001 award, professor Yogendra Gupta, has led the shock wave effort at WSU since the 1980s. With support from DOE Defense Programs, WSU established the internationally renowned Institute for Shock Physics in 1997, and continues to expand the national impact of dynamic compression research.

According to the terms of the joint appointment, Marcus will "assist both institutions [in developing] ... new, joint, nationally recognized competencies," and "nurture ... core competencies within each institution," with collaborations that "manifestly benefit the community, state, and nation."

Sandia's bots step it up at international expo

By Rebecca Brock

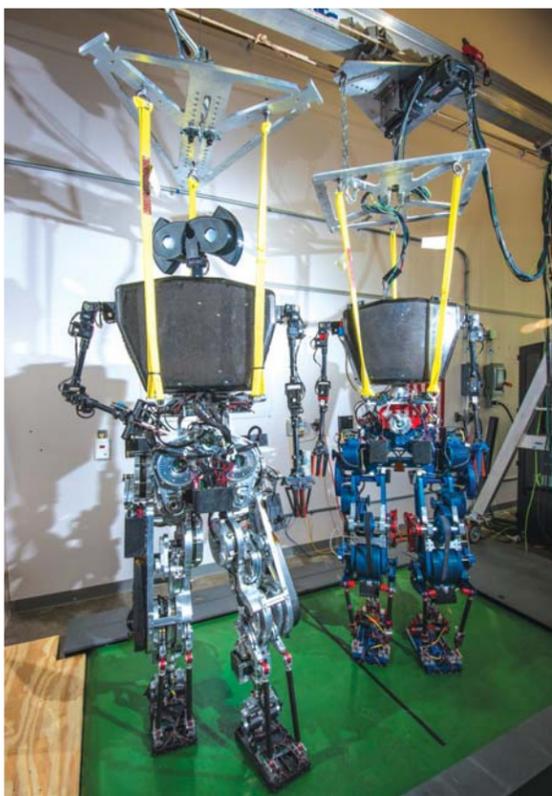
One of the biggest robotics competitions in the world, the DARPA Robotics Challenge Finals 2015, brought together a who's who in the field of robotics, including researchers from Sandia.

"The atmosphere had the 'wow' factor," says Senior Manager Philip Heermann (6530). "There was a sense of history in the making with people getting to see some of the first demonstrations of walking robots, looking through a window into the future of robotic technology."

The widely publicized event earlier this summer in Pomona, California, was funded by the US Defense Advanced Research Projects Agency (DARPA) to demonstrate the capabilities of robots for disaster and emergency response.

While Sandia was not in the disaster response competition, its roboticists participated in two booths inside the Technology Expo, a massive event that was open to the public, the international media, and a wide range of robot enthusiasts. In the DARPA Robot Endurance Test booth, a team of engineers led by Steve Buerger (6533) demonstrated the first large-scale legged robots built at Sandia.

Their technology originated from an intense two-year project supported by DARPA aimed at improving the energy



ADVANCED BOTS - Sandia's energy-efficient, bipedal robots STEPPR and WANDERER demonstrated their capabilities at the DARPA Robotics Challenge Finals 2015.

(Photo by Randy Montoya)

efficiency of legged robots for disaster response. Sandia revealed two energy-efficient, bipedal robots: STEPPR - Sandia Transmission Efficient Prototype Promoting Research, and WANDERER - Walking Anthropomorphic Novelty Driven Efficient Robot for Emergency Response.

Steve and the Sandia team presented WANDERER walking on a treadmill inside the Robot Endurance Test booth to see how long and how far it could go on a single battery charge. The results were impressive, Steve says.

"We demonstrated a system that operated for almost five and a half hours, and walked for more than four of those hours, covering almost 3 kilometers," he says. "Compare that to maybe 30 minutes or so for other state-of-the-art robots, and we have made a huge dent in the energy consumption problem."

Steve says that the success of Sandia's high-endurance robots resulted from a tremendous team effort. The Sandia engineers inside the DARPA Robot Endurance Test booth included Clint Hobart (6532), who led robot design and fabrication; lead technologist Mike Kuehl (6533); two postdocs, Ani Mazumdar (6533) and Steve Spencer (6533), who were focused on the underly-

ing research in efficient actuators; technologist Dennis Wilder (6532); engineer Tim Blada (6531); and two student interns, Greg Brunson (6533) and Nadia Coleman (6533).

"This team worked well because we were able to pair the new perspectives and solid research backgrounds of these students and freshly minted PhDs with the experience of the veteran Sandia team in making real, field-ready systems," says Steve.

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ROBOT WARRIORS - A team of Sandia robotics engineers led by Steve Buerger demonstrated the first large-scale legged robots built at Sandia in the DARPA Robot Endurance Test booth.

Sandia also had its own booth at the Technology Expo, providing researchers a rare opportunity to exhibit the wide range of robotics work being done at the Labs. Some of the technologies they demonstrated included the Sandia Hand, Urban Hopper, and Gemini-Scout. Philip says the event served as a platform to recruit new talent and get the word out that Sandia has a strong robotics capability.

"Having a presence at the DARPA Robotics Challenge Finals gave us an opportunity to present the national security mission of the Labs. Sandia is a place that is attentive to protecting you. We are focused on the long-term security of the nation. We strive to have technology ready when the nation needs it," he says.



JIM PASCH (6221), PRINCIPAL INVESTIGATOR of the S-CO₂ Brayton Cycle Research and Development Program, and Darryn Fleming (6221), principal investigator of the S-CO₂ Brayton Heat Exchange Program, investigate a turbine and compressor inside a Sandia test facility. (Photo by Randy Montoya)

Brayton breakthrough

New arena of power generation set in motion with MOU

By Rebecca Brock

Sandia and eight other companies and research organizations will collaborate to advance a distributed power system that can produce cleaner, more efficient electricity.

The memorandum of understanding focuses on the development of a fossil-fueled energy system based on supercritical carbon dioxide (S-CO₂) Brayton cycle technology.

Organizations signing the memorandum with Sandia are Peregrine Turbine Technologies and its subsidiary PTT Distributed Energy Systems of Wiscasset, Maine; Vacuum Process Engineering of Sacramento, California; Mid-South Engineering of Hot Springs, Arkansas; and four partners from Huntsville, Alabama: CFD Research Corp., the US Space & Rocket Center at NASA's Marshall Space Flight Center, Government Energy Solutions Inc., and the Energy Huntsville Initiative.

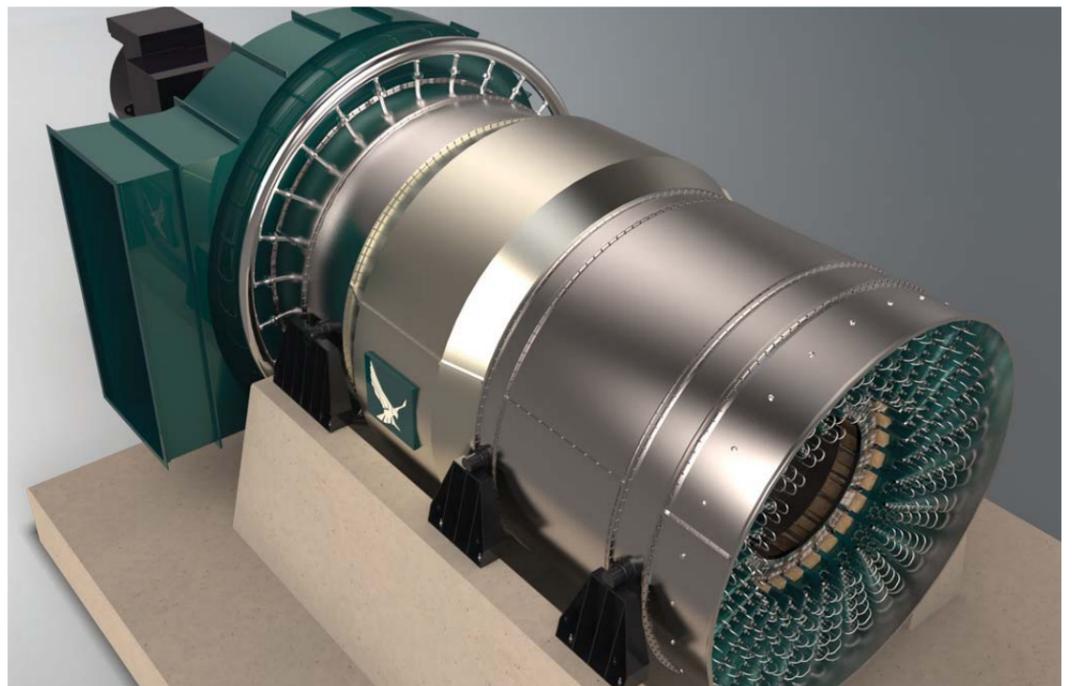
Sandia's Brayton Lab in Albuquerque is the only S-CO₂ research facility of its kind. The partners plan pilot testing there using a gas turbine engine based on a 6-megawatt energy-generating system developed by Peregrine Turbine Technologies. A second prototype engine would likely be tested at the US Space & Rocket Center.

"This is the first large collaboration to identify partnerships that will take the Department of Energy's lab-scale technology and accelerate its development to commercial industry deployment of a highly efficient, low carbon emission, electrical power generator," says Gary Rochau, manager of Sandia's Advanced Nuclear Concepts Dept. 6221.

The agreement allows the organizations to work easily together to accomplish similar goals: advancing the commercialization readiness of the supercritical carbon dioxide Brayton cycle technology, providing world-class testing and analysis, and encouraging the establishment of US-based, high-value technology and manufacturing jobs.

The term "supercritical" refers to the semi-liquid state of carbon dioxide when it is above its normal critical temperature and pressure, allowing S-CO₂-based systems to operate with high thermal efficiency.

Improving power generation technology is part of Sandia's mission to strengthen national energy security, Gary says. "The supercritical carbon dioxide Brayton cycle can replace steam systems in a smaller size with



This illustration depicts the 6-megawatt distributed energy generating system developed by Peregrine Turbine Technologies. (Image courtesy of Peregrine Turbine Technologies)

higher efficiency, lower cost, lower emissions and with distributed power generation, reducing the burden on the national power grid," says Gary.

He says supercritical carbon dioxide Brayton cycle technology could bring about large-scale improvements in production across most energy sectors, especially solar, nuclear and gas turbine. Potential economic and environmental benefits include

reduced fuel consumption and emissions and the ability to generate power from a variety of heat sources, he says.

Peregrine Turbine Technologies is developing a power generation turbine engine that uses supercritical carbon dioxide as a working fluid. Peregrine CEO David Stapp says it could be 30 percent to 60 percent more efficient than current technology.

SANDIA CLASSIFIED ADS

MISCELLANEOUS

CALLING ALL DOG LOVERS, Lap Dog Rescue special event Sept. 19. www.lapdogrescue.org. Hoffman, 280-0554.

BROWN SUEDE RECLINER, very good condition, \$100 OBO. McDonald, 505-554-2048.

FREE CRIB, converts to toddler bed, lovingly handcrafted by grandpa. You need to figure out assembly. Cox, 319-1714.

TWO NEW CHAIRS, brown, suede-like material, back 38" high, seat 18" wide by 20" deep, \$25 each. Walton, 897-0092.

STONEWARE, Pfaltzgraff Villa Flora, serves 12 (dinner and salad plates, bowls, mugs, serving bowl, creamer/sugar), \$500. Tribble, 604-1312.

KIDS' BIKES, TRIKE, SCOOTER, nice condition. Specialized Hotrock 20, \$125, Hotrock 16, \$85, Kettler trike, \$100, Taxi, \$25. Richards, 505-331-1542.

1932 LICENSE PLATES, set of new NM "Sunshine State" original cover, green and white, \$400 OBO. Lopez, 291-0010.

BRAD PAISLEY at Isleta Amphitheater, Sept. 17, three lawn tickets, \$35 each or three for \$100. Brown, 505-980-8660.

PROPANE DRYER, \$100. White, GE, purchased in 2008 for vacation home, excellent condition. Pictures at <http://albuquerque.craigslist.com>. Stein, 505-250-0185.

KENDON STANDUP TRAILER, for two motorcycles, excellent condition, used three times, paid \$2,700, asking \$1,500. Mead, 323-2253.

PA SYSTEM, Proaudio, PWMA 230, Pyle Pro, with cordless mike, \$50. Fenimore, 298-8052.

DELL WIRELESS KEYBOARD AND MOUSE, brand new, \$30. Hennessey, 505-269-6243.

QUEEN SIZE cherry wood sleigh bed frame, \$250. Cherry wood computer armoire desk from American Furniture, \$450. Bachmann, 505-379-0750.

BLACK LAQUER studio upright piano, Kohler & Campbell, very good condition, you haul, \$1,200 OBO. Davis, 268-0768.

FOUR FORD OEM 18 x 7 wheels, 5F93-1007-BD w/Firestone Winterforce 225/60R18 non-studded tires, fits Freestyle/Taurus X/Flex, \$200 OBO. Weber, 505-553-2118.

MICRO-SUEDE chaise lounge, like-new condition, mushroom-colored, \$100. Solid driftwood coffee table, \$100. <https://post.craigslist.org/manager/5140317176/a4z9t>. Burfeindt, 897-0179.

3 BARSTOOLS, solid wood, excellent condition, \$20 each. Round end table on pedestal, \$50. Drebing, 293-3335.

HAY, tall fescue, \$6 a bale, about 40 bales, benavides5@comcast.net. Benavides, 898-4373.

UPRIGHT PIANO, Centurion, beautiful burled oak, sounds good, needs tuning, \$200 OBO. Jennings, 505-610-1142.

WHITE COUCH, beige cushions, good shape, \$75. Provincial-style couch, good wood, needs an overhaul, \$40. Grenfell, 505-620-5745.

FURNITURE, curio cabinet, 73" x 24" x 11", \$100. Cherry bookcases, 36" x 32" x 11.5", \$100 each. Antique server, \$100. Hutch, sewing machine, \$80. Allman, 505-299-2438.

TRANSPORTATION

'06 CORVETTE COUPE, 3LT white, beige leather, six-speed auto, one owner, Edelbrock supercharger, 93K miles, \$27,000 OBO. Barreras, 505-898-4951.

How to submit classified ads

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

Submit by one of these methods:

- EMAIL: Michelle Fleming (classads@sandia.gov)
- FAX: 844-0645
- MAIL: MS 1468 (Dept. 3651)
- INTERNAL WEB: On internal web homepage, click on News Center, then on Lab News link, and then on the very top of Lab News homepage "Submit a Classified Ad." If you have questions, call Michelle at 844-4902.

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.

'12 2DR JEEP RUBICON, six speed, after-market clutch, lifted, 35's, bumper, winch, roof rack, K&N filter, \$30,000. Sahakian, 503-409-0699.

'08 TOYOTA PRIUS, silver, 47 mpg, 157K miles, always garaged, well-used/well-kept, service records, \$6,500. Holle, 505-281-7460.

'07 TOYOTA HIGHLANDER, gold, hybrid limited, AWD, one owner, never wrecked, clean, leather, 136K miles, \$12,199. Morales, 505-610-8300.

'06 TOYOTA SOLARA, convertible, SLE, red with tan top, leather upholstery, 175K miles, \$6,750. Hesch, 350-9903.

'92 HONDA ACCORD LX, 2-door, 5-speed manual, 188K miles, rosewood, plenty of life left, \$800. Buerger, 299-2608.

RECREATION

'06 CROSSROADS CRUISER, 26-foot 5th wheel, very good condition, \$18,900. Bethke, 505-463-6641.

PROFLEX, full suspension mountain bike, aluminum and carbon fiber, medium, \$350. Call or text, pictures. Hanks, 249-1931.

'02 HD ROAD KING, fuel injected, custom paint, cruise control, wind screen, travel bags, more, \$8,200. Wemple, 505-280-8744.

'95 DUTCHMAN 1203, pop-up camper, excellent condition, cover, many extras, \$3,000. Lebien, 505-459-4074.

'01 EXCEL 5th WHEEL, 35-foot, three slides, rear kitchen, entertainment center & TV, computer cabinet, lots of storage, well maintained, \$22,900. Schuster, 299-1072.

'87 ALPENLITE 5th WHEEL CAMPER, solar panels, 23-foot, two queen-size beds, new mattress, room for king, new tires, very good condition, \$4,500 OBO. Grady, 382-7978.

'97 JAYCO EAGLE 5th WHEEL, bunkhouse model w/slideout, exceptional condition, new awning & batteries, used little, \$8,500 OBO. Saladin, 505-881-2219.

REAL ESTATE

3-BDR. HOME, Rio Rancho near Intel, 1,891-sq. ft., RV parking, two-car garage, \$174,000. Cummings, 505-453-8101.

3-BDR. HOME, two baths, two-car garage, 1,898-sq. ft., northwest Albuquerque, MLS#845287, \$209,900. Montoya, 505-897-7258.

3-BDR. TOWNHOUSE, one-story, two bath, 1,850-sq. ft., near park, 10223 Admiral Halsey NE. Spray, 505-385-2442.

SUBLET IN 3-BDR. PENTHOUSE, three baths, 3,263 sq. ft. plus roof access, \$2,000 a month to share. Frank, 850-510-7276.

SANDIA PARK, two- and four-acre lots w/utilities, between Crest Rd. and Paa-Ko, \$105,000/\$160,000 w/\$10,000 down. Mihalik, 281-1306.

4-BDR. HOME, 1.75 baths, 2,174-sq. ft., Uptown area, updated, modern, corner lot, granite, backyard access, additional storage, \$230,000. Velasquez, 505-280-6866.

WANTED

UTILITY TERRAIN VEHICLE, good to excellent condition, great if has a snow plow fitting and/or snow plow. Bell, 239-8606.

SEWING MACHINE, gently used, and full-bed mattress set. Jennings, 505-610-1142

BABY SITTER, early mornings, take 2 children to school, Mondays through Thursdays. Text or call. Duran, 505-321-5725.



Employee death

Frank Eisele was 'one of the good ones'

Frank Eisele, who joined Sandia as a custodian in Custodial Services Dept. 4848 in January 2013, died August 16 at age 56.

"Frank was one of the good ones," says colleague Robert Naranjo. "His outlook on life was one of greatness. He loved his family and his grandchildren and spoke of them very proudly. His work here at Sandia will be missed. God bless always."



FRANK EISELE

Another friend describes Frank as "simply a shining ray of gentlemanly sunshine."

Dawn Thomas, who works in Bldg. 821 where Frank was custodian, says Frank touched the lives of everyone there.

"I had the honor of working with Frank," Dawn says. "He was always optimistic and had a contagious smile that showed the true sweetness of his soul. Frank was a genuinely nice person."

Critical Asset Protection and Security Center 6600 Director Billy J. Marshall Jr. also works in Bldg. 821, where he interacted often with Frank. "I must admit that I'm struggling to reconcile my feelings. I'll never see Frank again. He

did an excellent job of caring for our building and was always a friendly, encouraging person to be around. Each time Frank and I talked, which was two or three or times a week, we would share stories about our families, what he was doing with his grandkids, etc. It was clear to me he was a devoted family man who cared about people, and had an upbeat personality. I will miss him greatly."

A quiet game-changer

Frank's team supervisor, Chuck Crawley (4848-1), describes Frank as "a stellar employee."

"His superb work ethics and personal character modeled both integrity and trustworthiness in the highest form," Chuck says. "In fact, what set Frank apart was his unique ability to assimilate within the various organizations and admirably perform his work as a team player by building honest relationships within Sandia's diverse workforce community."

Chuck describes Frank as "a quiet game changer wherever he was assigned to work," adding that "Frank's love of his work and mankind was immeasurable. He was a jewel and will be greatly missed by our team members and Sandia as a whole."

According to those who knew him, Frank's cheerful nature made him a pleasure to

be around. Says colleague Belinda Christakis, "Frank, you were a pure delight to have on my team. The smile everyone talks about is so true of you. You've already been missed so much, but I know the influences you've passed on to fellow workers will live on forever. You'll always be a huge part of us. Rest in peace, my friend!"

Daniel Griego (4848) saw Frank as a friend, a voice of experience, and a fount of wisdom.

"I had the privilege of working with Frank at Sandia," he says. "We had some good times joking with each other about work and family and life in general. He loved all of his girls and grandchildren with all of his being. He often gave me advice on my daughter that I will never forget. He was a credit to the human race. I will miss him deeply."

Paul M. Smith (4879) recalls that Frank "was always cheerful and went out of his way to brighten the days of others. Sandia was a better place because of him and we miss him. My heart goes out to Frank's family because they've lost such a good man."

Before coming to Sandia, Frank had a long career as a grocer, working for Furr's, Railey's, and Albertsons.

Frank is survived by his wife of 36 years, Mary; three daughters, Alva, Sabrina, and Alyxandria; sons-in-law; five grandchildren; two brothers; and a sister.



FRANK EISELE (foreground) will be missed by his colleagues in Custodial Services. His easy-going and cheerful nature touched everyone who knew him.

Two extraordinary Sandians nominated for magazine award

By Rebecca Brock
Photos by Randy Montoya

Sebastian Rael was born without legs, but his parents raised him to believe that he was not disabled. He recalls that as a kid growing up in Albuquerque's North Valley, he was helping pull weeds in the yard when the neighbors noticed and called the cops to report what they saw as the abuse of a child in a wheelchair. "When the cops arrived, my dad said, 'My son has no legs, but he still needs to do chores.'" Sebastian (9515) explains he is the contented person he is today because "my parents raised me like any other kid. They did not raise me to feel different."



SEBASTIAN RAEL

Sebastian, along with Jimmie Wolf (9336), a network engineer who has overcome several chronic illnesses, is one of two outstanding Sandia employees with disabilities who were nominated as Employees of the Year for the national magazine, *Careers & the DISABLED*. The annual award recognizes the personal and professional achievements of individuals with disabilities.

Sebastian drives a full size 4WD pickup truck to work every day, and gets in and out of it as easily as anyone with legs. "The way I look at it is, if there is a way to do it, I will figure it out. I believe I can do anything that other people can do," he says.

His father's son

Sebastian was born without legs because his father, Henry Rael, served in the US Army in the Vietnam War and was exposed to Agent Orange, the herbicide that is now known to cause birth defects. His dad was his idol. "My dad came back with three Bronze Stars and a Purple Heart. That was the type of man he was," he says.

Sebastian's parents made sure he was able to attend public school, where he would have the same opportunities as other kids. He excelled at science and math, and once he began working with computers, he was hooked. He graduated from Valley High School and worked at Intel, Gateway Computers, T-Mobile, and Sprint before joining Sandia.

Slam dunk

Outside of work, Sebastian exercises four days a week. He plays sled hockey and tennis, and coaches two wheelchair basketball teams. He is known as "Spuds" by his friends and peers, a nickname he chose after basketball player Spud Webb, one of the shortest players in NBA history who could dunk the ball.

Sebastian helped form the junior wheelchair basketball team for children, which is part of the Carrie Tingley Hospital

Foundation. "Wheelchair basketball is about camaraderie. It's about feeling like part of a group, rather than an outsider," he says.

Problem solver

Sebastian began his career at Sandia as a contractor setting up mobile devices, where his knack for solving technical problems earned him the trust of customers. He now runs the service desk for the Sandia Enterprise Program Management Solutions department.

John Shaw (9515), Sebastian's manager, says, "Sebastian is one of the most inspiring people I have ever known. His gregarious personality, willingness to help people, and incredible technical competence in every software application and hardware system he encounters make him a great member of corporate IT."

Outside of work, Sebastian has a busy life as a husband and new dad. His wife Andrea is a local elementary school teacher, and they have a 1-year-old daughter, Zoey.

Meet Jimmie

Jimmie Wolf (9336) is an example of how a healthy attitude can change a life. Fifteen days after celebrating her wedding to fellow Sandia engineer Brad Altman (412), Jimmie's doctor diagnosed her with multiple sclerosis (MS), an autoimmune condition that attacks the central nervous system. Jimmie had endured chronic health problems, but she says the MS diagnosis came as a shock. "I told Brad, you did not sign up for this. I will give you a 'get out of jail free card,'" she says. Brad told her he would stay, for better or for worse. That was 10 years ago.

Meet Jimmie today, a vivacious network engineer who has been at Sandia for 16 years, and it's clear why she was nominated for the award with *Careers & the DISABLED* magazine. She motivates others who have MS and has taken control of a life-threatening disease with exercise and proper nutrition. "There was a time when I did not think I was going to live very long, so I try to live every day to the fullest," she says.

Top of her class

Jimmie was the first person in her family to go to college. "After I got my degree, my older sister finished hers, my dad got his, and then my brother. I kind of led the way to show them it was possible," she says.

Named after her father, who retired from the Army, Jimmie moved around a lot with her family before landing in Albuquerque, where she graduated from Manzano High School. At the University of New Mexico she was valedictorian of her undergraduate electrical engineering class, an impressive feat considering that throughout her life, she suffered from chronic migraines and painful muscle spasms that are now explained as symptoms of MS. Every few months she would get a debilitating attack, where for weeks she would need a cane to walk and help with basic functions like eating, doing laundry, and getting dressed.

An accomplished career

Despite roadblocks with her health, Jimmie persevered. She worked at Intel and NASA before beginning her engineering career at Sandia, where she has earned master's degrees in electrical engineering and engineering mechanics.

"Jimmie is technically very strong," says Joseph Brenkosh (9338), her mentor. "What is exceptional is that she has acquired a high degree of skill in the unrelated disciplines of electrical engineering, engineering mechanics, and now networking. Despite serious health issues, she does not shy away from difficult tasks."

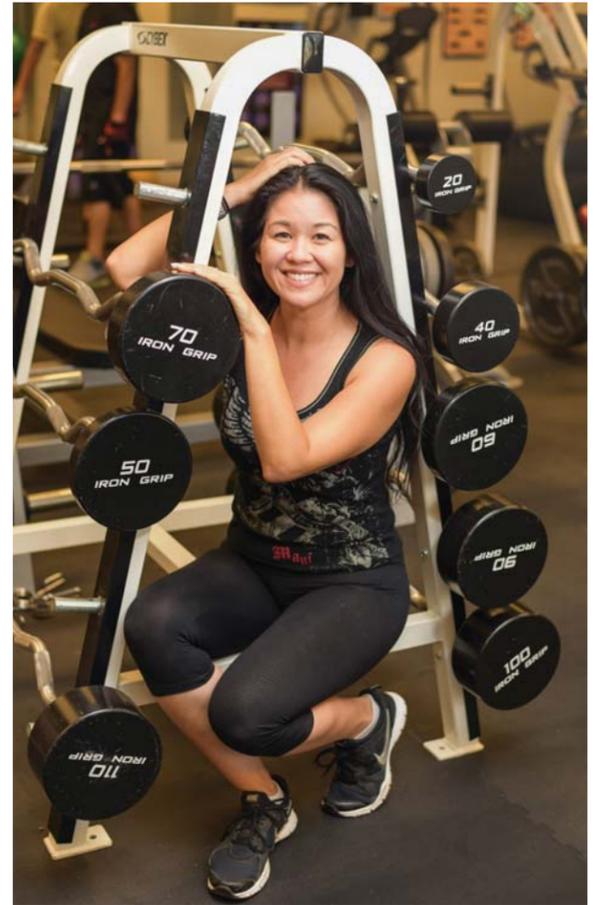
Her accomplishments include leading the Gigabit Passive Optical Networking (GPON) revitalization project. Her manager, Jeremy Banks (9336), says, "She completes an exceptional amount of critical work with a great attitude. This was a large multimillion dollar project with many team members and stakeholders."

A transformation

Jimmie battles the autoimmune diseases Lupus and Sjogren's syndrome in addition to MS. Three years ago she began focusing on nutrition and exercise with trainers at 3H Fitness, an Albuquerque gym that specializes in helping people with disabilities. She has shed 80 pounds, and has only had one MS attack in the last three years.

"My doctors say it is incredible. They knew nutrition and exercise could have an effect, but they did not realize it could be this dramatic," she says.

Jimmie says she has become a devoted fitness fan. She exercises five to six days a week and trains for fitness competitions. "I love the support I get from my coaches and the people on my team. It is something that keeps me motivated



JIMMIE WOLF

to stay on top of my health," she says.

"I went from being this really shy girl at 200 pounds to now feeling confident enough to get up on stage in front of hundreds of people. It makes me feel proud."

This November, Jimmie will compete in a national fitness competition, Fitness American Weekend 2015, in Las Vegas. She says her new hobby gives her a platform to tell her story and inspire others.

"By taking control of my health with exercise and good nutrition, it's almost like I have stopped my illness in its tracks. I tell people that the key to good health is the right attitude," she says.

Sandia strong

Both Jimmie and Sebastian have found reasonable accommodations at Sandia to make work accessible.

Div. 11000 VP Becky Krauss is the executive champion of the Disability Awareness Committee.

"At Sandia we are committed to fostering a work environment that enables our employees with disabilities. We have many great resources here to help co-workers and management understand how to support and include our capable and multi-talented employees," Becky says.

"My managers have always been really flexible with my work schedule," Jimmie says.

"I feel embraced and accepted here," Sebastian adds.

With their recent nominations for *Careers & the DISABLED* magazine, Sebastian and Jimmie serve as positive role models for all Sandians. Melonie Parker, Div. 3000 VP says, "Sandia is a place that values a diverse workforce, and that includes employees with disabilities who bring their own unique abilities to their jobs. I would like to extend my sincerest congratulations to Jimmie Wolf and Sebastian Rael, both of whom were honored by their peers for outstanding work."

Disability accommodation

Employees with a disability can request an accommodation by completing the Voluntary Self-Identification of Disability form through Sandia's HR Self Service website under Personal Information, Disability Status. Reasonable accommodations are determined on a case-by-case basis. For questions, employees can contact Sandia Medical (HBE) or EEO Job Accommodation Specialist Tammy Sanchez-Godin.

It is important to self-identify so that Sandia can provide accurate reporting to the federal government in compliance with federal regulations. Additionally, by working with employees to determine reasonable accommodations, Sandia can help foster a more inclusive work environment.