‘Excellent’ used to describe Sandia’s mission work in annual performance evaluation

“The rating in all our mission delivery areas is ‘excellent,’ and it could not have been achieved without outstanding mission support. The results are consistent with the direction for the Labs’ mission performance set in the FY12–FY16 Strategic Plan. They also validate our progress in operations and reflect the need for further improvements. We appreciate our partnership with the NNSA, which resulted in a strategic and holistic approach to evaluating our performance this year. . . . I thank all our employees for their hard work and dedication to the Labs’ important mission.”

Sandia President and Labs Director Paul Hommert

By Heather Clark

NNSA rated Sandia’s mission work as “excellent” in FY13, noting that many scientific and technological breakthroughs and milestones were reached during a period that the Labs was working through budget uncertainties and constraints.

The Performance Evaluation Report (PER) is the NNSA assessment of how well Sandia met the objectives agreed upon in the annual Strategic Performance Evaluation Plan. Sandia’s performance is evaluated through peer reviews, external reviews, achievement of milestones, customer feedback, program reviews, and through Sandia’s self-assessment.

Sandia received a rating of “excellent” for its mission-related work and ratings of “very good” in institutional management and contractor leadership. The mission and institutional management ratings showed improvement over the previous fiscal year.

“I’m pleased with this year’s results on the PER,” said President and Labs Director Paul Hommert. “The rating in all our mission delivery areas is ‘excellent,’ and it could not have been achieved without outstanding mission support. The results are consistent with the direc-

(Continued on page 4)

DISCOVER ENGINEERS WEEK
FEBRUARY 16-22, 2014

Sandia marks 2014 National Engineers Week

Personal reflections on the practice of engineering from VPs Bruce Walker and Steve Rottler. See **page 7.**

Events planned to celebrate engineering

Inside

and . . .

LDRD
LABORATORY DIRECTED RESEARCH & DEVELOPMENT

Sandia LabNews

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Sandia National Laboratories

Clearing up cloudy understanding on solar power plant output

MATT LAVE (6112) uses pyranometers like these to measure the amount of irradiance, or available sunlight. There are four round pyranometers, capped by small glass domes, on this device. The work by Matt and Josh Stein (6112) shows that the variability of a point sensor is larger than the variability of a PV power plant. (Photo by Dino Vournas)

By Stephanie Hobby

The sun’s abundant energy presents a clean, affordable, and renewable way to keep the power on. Systems are relatively easy to install and begin working immediately. They are virtually maintenance-free and can run unassisted for decades.

But clouds are dimming industry growth: What happens when they cover part of a solar photovoltaic (PV) array and cause a dip in output, how big is the dip, and how can a utility company compensate for it?

Matt Lave (6112) has been working to understand that drawback and determine just how much clouds can affect solar power plant output.

Typically, sunlight is measured using a single irradiance point sensor, which correlates nicely to a single PV panel. But that doesn’t translate to a large PV power plant.

“If a cloud passes over, it might cover one panel, but other panels aren’t affected,” Matt says. “So if you use the single point sensor to represent the variability of the whole power plant, you will significantly overestimate the variability.”

To get a more accurate picture of how clouds affect PV power plants, Matt developed a Wavelet Variability Model, or WVM, to use data from a point sensor and scale it up to accurately represent the

(Continued on page 5)

That's that

First it was the Elvis face on Mars. Then the pyramids. And now we have the Mystery of the Jelly Donut. The Mars conspiracy crowd pricked up its ears a couple of weeks back with the discovery by the Mars rover *Opportunity* of a rock that seemed to have appeared out of nowhere. The widely publicized "jelly donut" rock (so-called for its resemblance to that donut-Friday health food staple) abruptly appeared in the frame of a photo where a few days before, it wasn't in a photo of the same spot.

Opportunity program scientists were immediately intrigued; this was exactly the kind of unexplained development that keeps their work interesting and exciting. The rover team admitted up front at being startled by the development, but that's a not-uncommon experience when you're exploring at the very boundaries of knowledge.

After putting their heads together and applying some logic and old-fashioned common sense they came up with a best guess: The rock had been flipped into the photo frame by one of the rover's wheels during a tricky maneuver. Or maybe, and less likely, it was a piece of ejecta from a nearby meteor impact. They pretty much ruled out one possibility. William Shatner — yes, *that* William Shatner, Capt. James T. Kirk — tweeted a question to *Opportunity* principal investigator Steve Squyers: "Have you ruled out Martian rock throwers?" "I think Martian rock throwers are unlikely, although we'll keep our eyes open for those," Squyers said. (An aside: Squyers is a remarkable communicator; I mean, really, really good. Check out this video where he discusses the jelly donut: http://tinyurl.com/m8tjuyv.)

* * *

But back to the conspiratorialists: Far from being startled, they were delighted, but not surprised. Oh, no! Much as NASA tries to deny it, these folks *know* the Martians are building monuments to Elvis and living in pyramids, so the appearance of things where they hadn't been before is just one more "proof" that the Martians move stones around. Maybe the native denizens, merry Martian pranksters, are merely pulling NASA's chain.

Then there's the school that says the jelly donut "proves" that the entire "mission" is being done in a studio somewhere in Pasadena and the jelly donut represents just a lapse in continuity, like where you're making a movie and forget that in one shot the star is wearing lipstick and in the next she's not. (Another aside: Apollo 11 astronaut Buzz Aldrin once punched out a guy at a bar who said the entire moon landing was faked. Good for Buzz!)

It goes without saying that there's a self-styled activist who's suing NASA over this issue, accusing the agency of covering up the fact that there is incontrovertible evidence of life on our neighboring planet. The jelly donut, he asserts, is a Martian form of a lichen also found on Earth. The "rock," he says, literally grew up out of the soil in the interim between the two photos.

He could be right; this universe is full of mysteries and we certainly don't know everything. But my question to the litigant would be, Why would NASA cover up evidence of life when one of the main drivers for this mission — and for every other Mars mission we've undertaken over the past several decades — has been to seek out life? It doesn't make sense.

Maybe this guy thinks our leaders are afraid of the societal disruption that would follow from the revelation that we are not, after all, alone.

I've heard that argument before, but I don't buy it. Not a bit of it. A century ago, millions of people happily accepted that there were canals on Mars, that the canals showed seasonal variations, that the regularity of the features suggested an intelligent agent behind the canals. People were convinced of this, and yet life on Earth went on like it always does, with wars, famines, and drought, abundance and scarcity, kindnesses and cruelties. Love and hate. It wasn't until the early *Mariner* missions that the canal theory was pretty much put to bed; the "canals" were some sort of optical artifact combined with the human inclination to impose order where there is none.

A revelation that there is life on Mars, exciting and interesting as that would be, won't really change much here at home. I'd bet a jelly donut on that.

See you next time.

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

Partners in science

Agreement lets Sandia, UNM staff work side-by-side

By Nancy Salem

JULIA PHILLIPS, Sandia Acting Div. 7000 VP and chief technology officer, and UNM Provost Chaouki Abdallah shake hands after signing the Inter-Institutional Visitors Agreement allowing closer research collaboration. (Photo by Randy Montoya)

Sandia has launched a new kind of collaboration designed to strengthen research bonds between the Labs and the University of New Mexico.

"This is another sign of the close and deepening partnership between two of the pre-eminent research institutions in the state," Acting Div. 7000 VP and Chief Technology Officer Julia Phillips said at the Jan. 17 signing of the Inter-Institutional Visitor Agreement (IVA). "It enables Sandia to provide access to unique capabilities we have to further the research agenda of UNM. And Sandia has the opportunity to engage with the fine researchers at the university — professors and students. I am delighted."

Julia signed the agreement with UNM Provost Chaouki Abdallah, who said it will further the missions of the university and Sandia through strategic partnership. "We will leverage our respective strengths and maximize our respective resources," he said. "New Mexico and the nation will be well served by UNM and Sandia sharing facilities, equipment, and talent. UNM appreciates the significance of this pact and Sandia's support of our faculty and students."

An IVA allows Sandia to work collaboratively with academic and research institutions without having to put in place a Cooperative Research & Development Agreement (CRADA), which typically requires a private industrial partner to commercialize the work, says Vic Weiss (10679), who helped negotiate the agreement. "Sometimes we just want to do research with a university, to push the frontiers of science and make discoveries," he says. "An IVA is an instrument that lets that happen."

The IVA signed in January will allow UNM staff to irradiate material samples at the Annular Core Research Reactor and the Gamma Irradiation Facility in Tech Area 5. The university researchers want to predict sample response to experimental conditions like those at the Large Hadron Collider in Geneva, Switzerland, which is being upgraded.

Matt Burger, senior manager in Nuclear Facilities and Applied Technology Dept. 1380, says UNM and Sandia will benefit from the collaborative research. "We have a large contingent of staff in Division 1000 looking at radiation effects on materials and electronics," says Matt, who worked on the agreement with Paul Raglin (1210). "We will share data back and forth. I'm very excited about this collaboration."

Vic says a condition of an IVA is that the research should closely align with Sandia's mission. "We have to be trying to solve some engineering or scientific research issue that aligns with our mission and the university's," he says. "We want to be able to work with academic and research institutions to leverage our knowledge and expertise in trying to solve some of these more challenging scientific and engineering issues."

Matt says the agreement will give UNM students access to facilities with capabilities beyond what is available on campus. "It provides a platform for collaborative investigation into radiation effects sciences, which is important to the organization I work for," he says.

UNM Vice President for Research Mike Dougher said the agreement is a "big step forward because, bottom line, it is the scientist-to-scientist collaborations that are critical to our long-term collaborative success."

"Previously when UNM and Sandia researchers wanted to collaborate, UNM had to use a project-specific contract to have Sandia staff run the experiments," he said at the signing. "With this agreement, Sandia technical staff can collaborate directly with UNM researchers and run the experiments together."

Julia said the IVA will be a model for potential further collaboration between Sandia and UNM. "This could be the first of many with UNM and other institutions," she said. "It opens the door for academic research institutions to work with Sandia and push the frontiers of science."

Sandia LabNews

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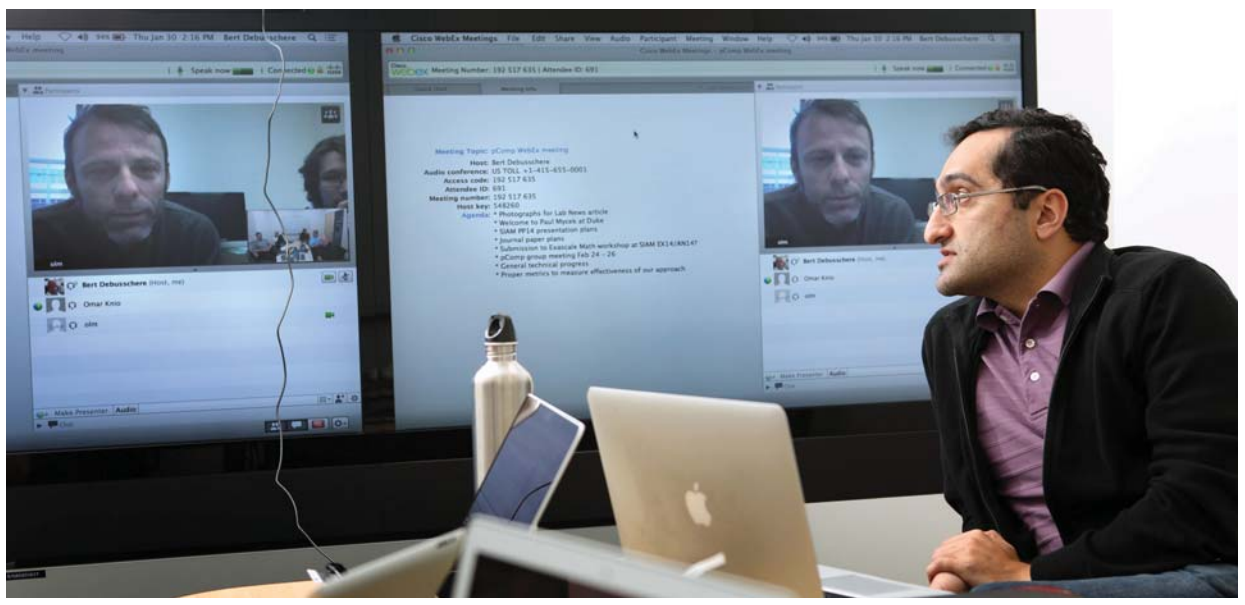
Sandia's exascale computing effort expected to curtail effects of system faults

By Mike Janes



VIDEOCONFERENCE — Khachik Sargsyan (8351) speaks to Olivier Le Maître (French visiting professor at Duke University) and Paul Mycek (postdoc at Duke University, off to the side in the videolink). Omar Knio (professor at Duke University) joined by voice only. (Photo by Dino Vournas)

Computing power today is more potent than ever before. Or is it? In many applications, yes, but when it comes to sophisticated, detailed modeling of the Earth's climate and other pressing global challenges, an apt analogy to describe our computational resources might be the use of an abacus to track the national debt.

That might be an exaggeration, but to hear Bert Debusschere (8351) explain the situation, the comparison is not too far off base.

"To accurately predict the Earth's climate over the next 200-300 years, one needs to simulate the atmosphere, the oceans, and the Earth's land, and one would need to do it all at the same time," Bert says. Current supercomputers, as powerful as they may be, would take several years to spit out accurate predictions — and that's only if they could be dedicated for that sole purpose.

"Each component of climate modeling and simulation [atmosphere, oceans, and land] is, by itself, challenging the most powerful computing resources known today," Bert says. "The problem is, to make sound predictions about the future, we need to have the computers run simulation programs, not just once, but hundreds of times for slightly different conditions, for each model or component. Predictive power requires that kind of computational muscle and capacity."

To put the problem even more succinctly, DOE's Office of Advanced Scientific Computing Research (ASCR) predicts that the DOE's mission — to include not only climate modeling, but also genomics, high-energy physics, light sources, and other program areas — will necessitate 1,000 times the capabilities of today's computers, but with a similar size and power footprint. That will require major advances in computing technology — "exascale computing," to be precise.

Flops, petas, and quintillions

The vision for exascale computing is to achieve at least one "exaflop," or a thousandfold increase over the first petascale computer that came into operation in 2008. An exaflop represents a thousand petaflops, or a quintillion floating point operations per second (a "flop"), or about 4,000 times the computing power of Sandia's Red Sky machine. That level of computing power would be considered a significant achievement in computer science, as it would approach the processing power of the human brain. Even more important, Bert says, is that climate research and other important applications simply can't be done effectively without exascale computing capabilities.

These needs motivate DOE's ASCR program, which funds the deployment of advanced computational facilities such as the Leadership Computing Facilities at Oak Ridge and Argonne national laboratories and the National Energy Research Scientific Computing Center (NERSC) at Lawrence Berkeley National Laboratory, as well as research to develop the algorithms, codes, and software to make effective use of those facilities.

Advancing these efforts is complex, but doing so is important since these centers house many of the world's top supercomputers and provide the most robust computing resources available to researchers. Sandia computer scientists are working on ways to expand and improve upon those capabilities.

In one of the many exascale-related research efforts at Sandia, Bert's group is focusing on fault tolerance.

"We're looking at fundamental mathematical and algorithmic aspects of keeping calculations meaningful, which is particularly important when you're dealing with the need for extreme scalability and the soft and hard errors that are inevitable with massive, powerful machines," Bert says.

In computational terms, a "soft" error has occurred when a number has been stored digitally but — unbeknownst to anyone — is retrieved later as a vastly different number, resulting in a mistake in computation. "Hard" errors occur when machines go down or crash and stop whatever programs are running.

While both kinds of errors are important, Bert says, the traditional solution to hard errors — looking at "checkpoints" and restarting the full machine — will soon become obsolete as computing moves towards exascale since it will actually take longer to perform checkpoint/restart than the machines will remain up. With soft errors, today's workarounds (such as error-correcting RAM chips) may not work in five to 10 years due to their extra cost in power consumption or execution-time.

Bert says the work Sandia is doing, if successful, will lead to software that programmers can use to solve these problems and allow exascale computing to positively impact climate research and other important applications.

As accurate as it needs to be

Traditionally, Bert says, computer scientists have looked at calculations as being deterministic: That is, there is a mathematical problem to solve, numbers are crunched, the machine spits back an answer, and there is confidence that the answer back from the computer will remain the same no matter how many attempts are made to replicate the calculation.

However, predictions like those needed for climate research are, in practice, never deterministic, he says. Even if there is a deterministic equation that's been accepted, there is always going to be uncertainty in input parameters, which can lead to an incorrect prediction.

"So we're accepting that there will be uncertainty in the predictions and are looking at the effects of soft and hard faults on the system as simply an additional source of uncertainty," Bert says. "We are treating it as just another factor that affects how much we can trust computer results."

Instead of seeking a deterministic number, he says, the approach is to treat uncertainty as an instrument, much like a thermometer offers a close estimate of temperature but is understood as possibly being up to a degree off. "We look at the computer as something that gives us a noisy measurement of the problem we want to solve," Bert says.

Using a tool known as "probability density function," Bert says the team captures the full body of knowledge about the computational problem and uses computer simulations to refine things to arrive at a set of descriptive data that's as accurate as possible. The idea, he says, is to come up with formulations that quantify the uncertainty that exists, then do more work until there is confidence that the predictions are close enough for the application's needs.

"This doesn't necessarily solve all of the problems, but it gives us more handles to pull on," Bert explains. "At least by quantifying the uncertainty, we can start to understand it and work with it instead of against it."

Reducing uncertainties with computational equations, Bert says, is a matter of splitting things into smaller "sub-domains." This "domain decomposition," a common technique in numerical simulation, essentially means that Bert and his team can assess all uncertainty through the solutions found at the sub-domain level, leading to algorithms that allow many tasks to execute in parallel. Relying on Bayesian methods, which provide a way to update a prior belief with information contained in noisy data, the results of all of these tasks are used to refine the knowledge about the problem solution.

If you have a "noisy" instrument, Bert says — in this case, a computer with faults — you can take the noisy data from the computer to provide information on your prediction. That reduces overall uncertainty.

Work requires diverse teams

Bert says Sandia brings a variety of disciplines to the table for tackling exascale computing challenges. There are mechanical engineers, applied mathematicians, computer scientists, software engineers, and others with expertise in application codes, operating systems, and uncertainty quantification. These experts conduct research and development at Sandia across a wide range of technologies to help enable exascale computing.

Bert's project includes a collaboration with Duke University that began its 3-year project last summer following a year-long pilot study funded by ASCR.

Bert's team will deliver several presentations on its new approach this year, including one at the upcoming Society for Industrial and Applied Mathematics (SIAM) Conference on Parallel Processing for Scientific Computing. This conference also includes presentations from more than a dozen other Sandia researchers working to push the frontiers of computing to the exascale.

THE EXASCALE COMPUTING TEAM at Sandia/California meets every two weeks and is typically joined via videoconference by collaborators at Duke University. Here, the group discusses its latest technical progress and coordinates upcoming activities. The team, clockwise from Cosmin Safta (8354) with back to camera, Bert Debusschere (8351), Khachik Sargsyan (8351), Francesco Rizzi (8351), Habib Najm (partially blocked), and Karla Morris (8351). (Photo by Dino Vournas)

Sandia CaliforniaNews

Excellent!

(Continued from page 1)

tion for the Labs' mission performance set in the FY12–FY16 Strategic Plan. They also validate our progress in operations and reflect the need for further improvements. We appreciate our partnership with the NNSA, which resulted in a strategic and holistic approach to evaluating our performance this year. And, as I wrote in my note before the winter break, I thank all our employees for their hard work and dedication to the Labs' important mission."

Throughout the PER, it is noted that Sandia met its performance objectives in a variety of areas despite sequestration, a continuing resolution, and other budget constraints.

The ratings are as follows:

- Nuclear Weapons Mission: Excellent.
- Broader National Security Mission: Excellent.
- Science, Technology & Engineering Mission: Excellent.
- Security, Infrastructure, Environmental Stewardship & Institutional Management: Very good.
- Contractor Leadership: Very good.

In its nuclear weapons work, the PER states, Sandia effectively managed directed stockpile work, Campaigns, and Readiness in Technical Basis and Facilities programs, and executed the Science and Inertial Confinement Fusion programs, while upgrading key capabilities of Z Machine.

The report also noted that Sandia successfully completed all milestones in the FY13 Nuclear Weapon Quality Improvement Plan.

According to the PER's executive summary, "Sandia met programmatic outcomes and was able to successfully execute all programs, exceeding expectations on almost all milestones."

In the Labs' broader national security mission, "Sandia continued to excel in executing [its] nonnuclear weapons missions, delivering quality research results and technology deployments to DOE/NNSA, other government agencies, and non-federal entities."

Sandia exceeded expectations sustaining and further strengthening the science, technology, and engineering base of the laboratory through strategic investments in multidisciplinary research foundations, development of capabilities roadmap, discretionary research and technology development, and effective technology transfer of licensed technologies. The PER states, "This multidisciplinary approach to solving complex scientific and technical problems has built strong technical capabilities and competencies that enable mission success across a broad spectrum of mission areas."

In Sandia's Security, Infrastructure, Environmental Stewardship & Institutional Management work, "Sandia exceeded many of the significant performance expectations, and effectively and efficiently managed operations over the past fiscal year," the PER states. Sandia delivered "responsive management systems" that ensured members of the workforce, facilities, capabilities, and resources were available to meet the DOE/NNSA mission under fiscal constraints.

Finally, Sandia demonstrated leadership across the National Security Enterprise in its support of the DOE/NNSA mission. The Labs led teams and councils, collaborated on solutions to critical issues, and implemented best practices and industry standards where applicable.

Despite addressing federal budget issues during FY13, Sandia ensured budgetary matters had minimal impact on the mission.

"Underpinning all operations, Sandia maintained effective safety and security programs and exceeded site-specific expectations," the summary states.

The summary acknowledges that Work Planning & Control and Engineered Safety are maturing, but says safety-related events and indicators continue to be observed. Such indicators relate to operational limits, prompt notifications and the organizational response to incidents outside normal operations.

In its Engineered Safety program, "Sandia devoted management attention and resources toward improving the safety culture and trending analysis, which has led to improved efforts to review safety-related data and events for learning opportunities," the report states.

The PER recognized Sandia for self-identifying a potentially serious issue in which line-led construction contracts lacked effective flow-down of safety requirements, which could have led to unauthorized work being performed. "Sandia's self-recognition of this issue and the associated corporate corrective actions demonstrate management attention toward improving safety culture," the report states.

Deputy Laboratories Director and EVP for Mission Support Kim Sawyer concludes that "The PER results are a welcome validation that our mission support team and our management and operations processes and procedures are enabling mission success every day. The report recognizes our enterprisewide leadership. I'm also encouraged that the report takes note of the progress we are making in our ongoing safety journey. We still have room for improvement in that area, and we need the engagement of our entire workforce."

LDRD

LDRD Program avoids budget cut

By Chris Miller

Although the budget for Sandia's Laboratory Directed Research and Development (LDRD) program has fallen over the past year because of reduced Lab cost projections, it does not appear the rate drop in the FY14 federal omnibus appropriation will affect it.

That's good news for technical staff currently working on more than 387 projects around the Labs. "LDRD projects," says Acting Div. 7000 VP and Chief Technology Officer Julia Phillips, "are vital to carrying out the Labs' research strategy to enable mission delivery now and in the future and advance the frontiers of science and engineering."

In January, Congress approved an FY14 omnibus appropriation that reduced the maximum LDRD rate to 6 percent, down from an 8 percent rate that had been in place from FY07 to FY13. The rate applies to the percentage of total Labs costs of about $2.5 billion.

However, Sandia had been applying a rate hovering around 6.5 percent over the past few years. Based on the new federal 6 percent rate, Sandia was looking to lower the LDRD program rate to about 5.9 percent.

Very conservative projections

Sandia set the rate for its FY14 LDRD program at 6.35 percent, which provided a budget of $155.5 million. Based on the new federal 6 percent rate, Sandia was looking to lower the LDRD program rate to 5.9 percent to allow for a small cushion. That rate applied to earlier Lab cost projections would have reduced the budget by an estimated $7.5 million during the remainder of FY14 and for FY15.

LDRD program manager Sheri Martinez said the program was exploring options to achieve the savings.

Julia presented the options to the Laboratories Leadership Team (LLT) on January 20. "During the discussion, it emerged that several strategic management units expect to see significantly higher costing than is reflected in the very conservative projections on which the FY14 LDRD program size was based," Julia said. "As a result, we do not currently believe that we will need to reduce the size of the program in order to stay below the mandated 6 percent cap."

Julia cautioned, however, that the LLT will review updated Labs cost projections over the next few weeks, which will either solidify the LDRD budget at $155.5 million, or force some tweaks.

"We will have to monitor both Labs costing and LDRD spending very carefully to make sure that we stay below the 6 percent limit," Julia says.

Sandia's LDRD program budget had been steadily rising over the past few years. In FY10, the program budget equaled this year's $155.5 million program budget, and then grew to $163 million in FY11, $165.2 million in FY12, and $168 million in FY13. During 2013 the LDRD program budget was sized lower for FY14 because of reduced Labs cost projections and concerns about a potential LDRD rate reduction, leading to reductions in some strategic investments such as the Research Challenges. The LDRD program budget grows or declines each year in response to the Labs' overall costs.

Why LDRD is so important to Sandia

Ask any Sandia scientist or engineer about the benefits of LDRD and chances are you will get an up close and personal perspective. In FY13, for instance, nearly 1,700 staff participated in LDRD projects. Over the course of their Sandia careers, many Sandians have direct experience working on LDRD projects, whether in the two-year Early Career LDRD program, or in the regular LDRD program.

"The LDRD program enables our technical staff to pursue creative, high-risk, and potentially high-impact research and development . . ."

— Acting Div. 7000 VP & Chief Technology Officer Julia Phillips

Sandia's LDRD program gives staff the opportunity to pursue leading-edge research ideas, hone their technical skills, develop leadership skills, and advance the state of the art in science, technology, and engineering. It also helps attract many of the nation's best and brightest young technical staff to work at Sandia.

LDRD experience was a common theme among three of the four young Sandia researchers who received the 2013 Presidential Early Career Award for Scientists and Engineers (PECASE), the highest honor bestowed by the US government on outstanding scientists and engineers who are beginning their independent careers. LDRD also helped lift the careers of three of the four current Sandia Fellows, a designation reserved for technical staff members who are truly pioneers in their fields.

LDRD research has benefited Sandia's work in all of its mission areas. Breakthroughs have occurred in areas as diverse as new sensor technologies, quantum science and technology, nanotechnology, metamaterials, computational modeling and simulation, molecular biology, energy, and cognitive science.

Many technologies that receive R&D 100 Awards begin in LDRD projects. The Sandia Cooler is a recent example. The Sandia Cooler provides a radically new approach to cooling heat-generating hardware within tight spaces of a computer. The technology has potential applications in a host of electronic devices, from laptop computers and high-performance gaming PCs to home video game boxes.

Much of the foundation of Sandia's Microsystems and Engineering Sciences Applications (MESA) facility, which conducts research and prototyping of custom integrated microsystem products, had its origins in LDRD projects. LDRD led to the creation of many Sandia computing and simulation codes. And the Sandia technology that was used to remove radioactive material from several million gallons of contaminated wastewater at Japan's damaged Fukushima Daiichi nuclear power plant was developed in an LDRD project about 20 years ago.

"The LDRD program enables our technical staff to pursue creative, high-risk, and potentially high-impact research and development, often in collaboration with scientists and engineers in academia, industry, and other DOE laboratories," says acting Div. 7000 VP and Chief Technology Officer Julia Phillips. "LDRD-funded research leads to the development of next-generation technical capabilities, which are needed to address both established and emerging mission challenges."

LDRD research helps Sandia fulfill its national security missions and provides direct and indirect benefit to both current and future DOE and NNSA missions and research priorities. The research, Julia says, is essential to maintaining the vitality of Sandia's mission-critical science, technology, and engineering disciplines.

To receive funding, LDRD proposals must have exceptional technical quality, differentiating and programmatic value to Sandia, and relevance to the missions of DOE/NNSA and other federal agencies. LDRD proposals undergo a robust peer review, resulting in the selection of projects that are of the highest technical quality and well-aligned with Sandia's national security missions.

GBD III group latest at Sandia to receive AS9100 C quality management system certification

By Heather Clark

Manager Mike Rightley (5761) initially was not a fan of the AS9100 C quality management system, but after he helped the Global Burst Detector III program obtain it, he became a "passionate adherent."

"It's been a huge value for my department," says Mike, who along with Bridget McKenney (5718), manager of the Flight System Engineering group, and retired Sandia manager Veronica Chavez-Soto, led the effort to obtain AS9100 C certification for the GBD III program, the latest group to receive the certification at Sandia. The GBD III program includes Project Management, System Engineering, Sub-System Product Realization, System Integration Testing, and Delivery.

The Energetic Components Center 2500, the Integrated Correlation And Display System (ICADS), and Ground Nuclear Detonation detection system Terminals (GNTs) have also received the certification since last August.

Getting AS9100 C, a widely adopted and standardized quality management system for the aerospace industry, started with Defense Systems & Assessments VP Jeff Isaacson's mission assurance initiative, which was introduced in 2011.

The certification, which the team received with a perfect score in all six categories, provides a framework over project management, quality management, and system engineering to allow innovation and design to occur in a way that assures reliability and protects intellectual property from workforce variations, Mike says.

"The AS 9100 C standard is a very robust, very particular standard that makes sure that we've considered all the things that could go wrong. It forces us to write a quality management system for our product that includes all those items," he says.

The standard ensures that nothing is left undone, that all the bases are covered, and that an organization has a written set of procedures and processes that are updated regularly and monitored daily, he says.

Bridget says the new certification helped as her group was setting up a new infrastructure to apply a more robust systems engineering lifecycle to the GBD program. The AS9100 C certification validated that her group was doing the right thing, provided additional guidance on the details to be included in the new infrastructure to align it to standards, and increased employee acceptance of the new lifecycle structure, she says.

"We have moved from what was a very deep expert-based organization to a process-based organization," Bridget says. "That means if a person left, we also lost their knowledge of past decisions or their understanding of a test or production process. Now, work is based on processes and records that are maintained in the configuration management system so that institutional knowledge remains intact."

The certification also drove a higher level of collaboration between teams due to a new nonconformance process that requires identifying and involving other stakeholders earlier in the process.

"You get a richer approach to a solution earlier than you would have previously," Bridget says.

Wavelet variability

(Continued from page 1)

entire power plant. The WVM uses measurements from an irradiance point sensor, the power plant footprint — or the arrangement and number of PV modules in the plant — and the daily local cloud speed to estimate the output of a power plant.

In many cases, output measurements from the power plant aren't available, but point sensor data is, so the WVM is useful for estimating how much energy must be stored to make up for cloud-caused fluctuations.

The variability is a concern for grid operators as unanticipated changes in PV plant output can strain the electric grid. At short timescales, measured in seconds, sharp changes in power output from a PV power plant can cause local voltage to flicker. At longer timescales, measured in minutes, producing less PV power than expected produces balancing and frequency issues, where load can exceed generation. Backup systems (such as battery storage) to mitigate the variability can substantially add to the cost of a PV power plant.

He points to Puerto Rico, where changes in power output are required to be less than 10 percent per minute. "With this tool, you can estimate how often you'll exceed that limit, and determine how to mitigate those effects."

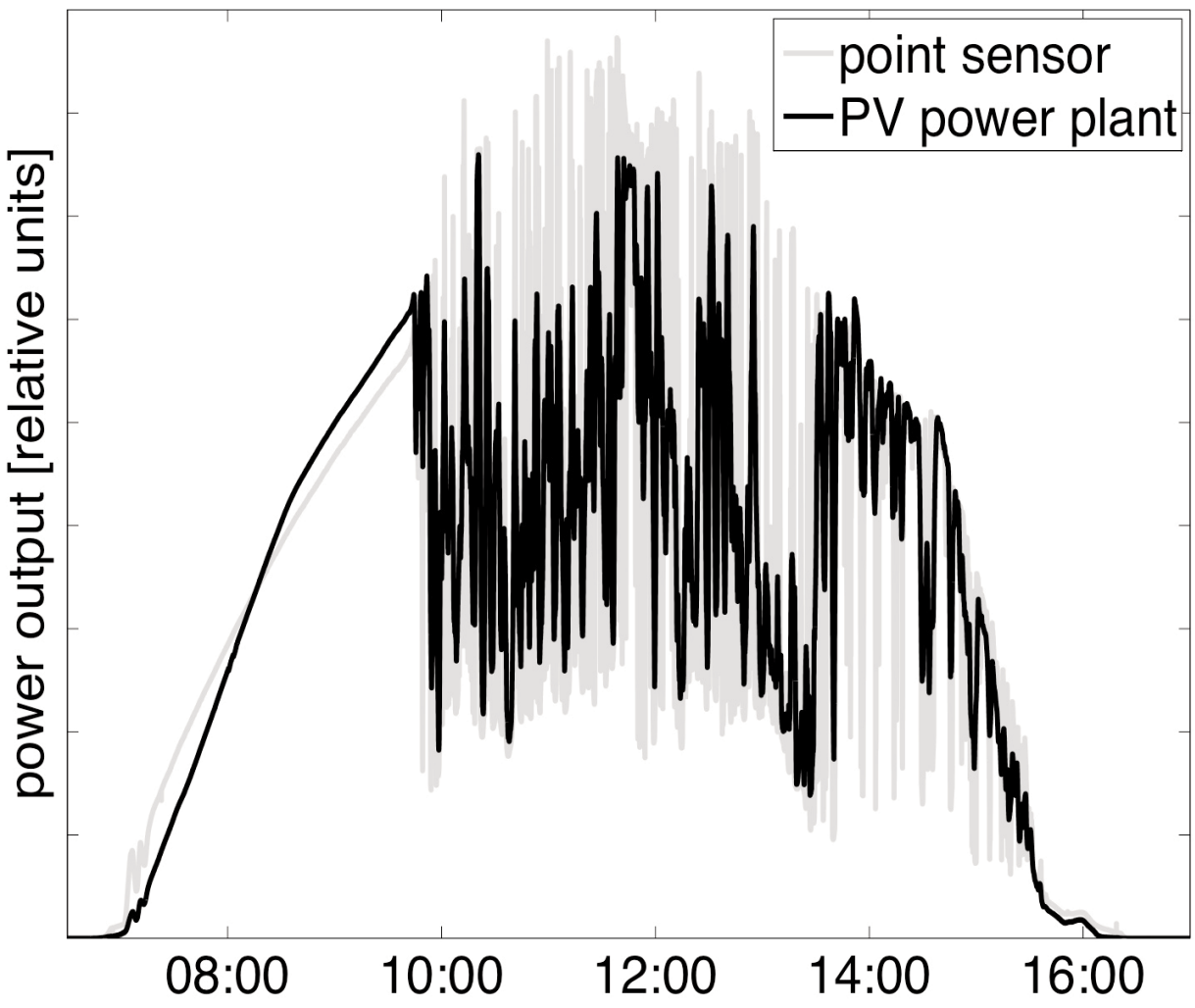
Matt and Josh Stein (6112) teamed with researchers from University of California at San Diego, where Matt did graduate work, and recently published a book chapter in Solar Energy Forecasting and Resource Assessment. The chapter, "Quantifying and Simulating Solar-Plant Variability using Irradiance Data," offers metrics to characterize and simulate the variability of solar power plant output.

This work supports the DOE SunShot vision of reducing solar costs and greatly increasing how much solar energy goes to the electric grid. By helping grid operators solve variable short-term power generation problems, Matt says utilities will be more likely to increase their solar energy portfolios.

"Essentially, there has been something of a problem in the industry with people assuming that the point sensor's variability represents their whole plant's variability, and significantly overestimating the problems that would be caused by connecting PV to the electric grid. That's something I hope to help people understand. It's not going to be as big of a problem as it would seem from an irradiance point sensor," Matt says.

"Essentially, there has been something of a problem in the industry with people assuming that the point sensor's variability represents their whole plant's variability, and significantly overestimating the problems that would be caused by connecting PV to the electric grid. That's something I hope to help people understand."

— Sandia researcher Matt Lave (6112)



A COMPARISON OF THE RELATIVE POWER OUTPUT of a point sensor (light grey) to a 48MW PV power plant (dark black), showing that the power plant output is significantly less variable than the point sensor. Put simply, this is because it only takes a very small cloud to cover the sensor of the pyranometer, which is less than one square inch. That same small cloud would only cover a small fraction of a large PV power plant, which can cover a square mile, and would not significantly reduce the power output.

Low budget workshop for PI's plays to packed house

By Neal Singer

Principal investigators (PIs) tend to be wary when the latest jargon purporting to help them more effectively manage people comes clanging for notice. But the recent all-day workshop called "How to Be an Effective PI" was particular to Sandia problems, featured ideas enhanced by personal experience, came with splashes of humor, and played to a full house in a large conference room in 858EL.

Explaining the strong interest by technical staff for the day's talks, workshop co-organizer Blythe Clark (1111) said, "Being a PI is a daunting task that everyone is expected to do and no one is given any formal training for." (See "The story behind the workshop" at right.)

The full day's speakers were selected by Blythe and co-organizers Laura Biedermann (1816), Amber Young (1728), and Rachel Colbert (2615), who worked long hours to make the workshop happen.

The event, introduced by acting Div. 1000 VP Duane Dimos, had only 100 attendee slots available, and these "sold out [so to speak]in a single day," said Blythe. "We could see how thirsty Sandians are for this kind of knowledge, how much they want to have a better feel for what's expected of them and to have the most impact in PI roles. We tried to structure the workshop to address that.

"It was a lot more work than we originally thought, but we got a lot of payoff: We learned as much from the talks as the attendees."

Says Rick Schneider (1123), whose presentation is summarized below, "Blythe and her co-coordinators did a terrific job of organizing this workshop as a bottoms-up, grass-roots initiative. I hope that the very strong response by researchers will help to further the dialogue about the nature of leadership and teams at the Labs, and the nature of the training behind it."

The *Lab News*, due to time and space limitations, covered only a portion of the workshop.

AMBER YOUNG (far right) moderates workshop Panel 1: "Planning for Success." Participating are, from left to right, Troy Olsson (1719), Chris Apblett (2546), Sita Mani (5771), and Jeff Nelson (1131).

Two presentations

Staff member Vipin Gupta (6124), a project co-lead for Sandia's former Solar Tiger team and current microsolar effort, played an unusual video that demonstrated one process to gain followers for a new idea.

Borrowed from a TEDS presentation by entrepreneur Derek Sivers, the video shows a young man, sitting among dozens of people on a hillside, spontaneously standing and dancing by making unusual flapping movements with his arms — in effect, presenting a new idea. People in the crowd laugh, shake their heads, or ignore him.

But a second person who sees something interesting in the leader's motion gets up, dances in imitation, and encourages several friends to join him.

Other onlookers who have a nose for the Next New Thing now hurry to start dancing before they miss out.

After a while, more people are dancing than are sitting. Low risk-takers, who prefer the security of siding with the majority, find themselves more odd-man-out by sitting than dancing. Soon, almost everyone is up and doing the leader's dance.

Analyzing the PI's job in this context, Vipin said, "If you want to start a movement, the number two person is of utmost importance. He never should be treated by the number one person as anything less."

Why does a Sandia team fail? Manager Rick Schneider (1123), who brought years of additional experience working at an industry mainstay (Hewlett Packard) and at a start-up to his talk, worked from the book "The Five Dysfunctions of a Team" by Patrick Lencioni to model five universally recognized dysfunctions to which Sandia teams could be vulnerable.

"A key flaw," he said, "is the so-called myth of infallibility — the idea that 'we don't make mistakes.' That's a denial of flaws. The perceived need for invulnerability can lead to guardedness." Team-building exercises can mitigate this problem, but the question for a PI to ask him- or herself, as Rick put it, was surprisingly introspective: "'Who am I, really? What is this team?' Self-awareness will lead to humility and candor."

As for fear of conflict, he said, "There are deep cultural biases at Sandia to move away from conflict, which may have origins in the myth of infallibility. [But] artificial harmony does not move a team forward. The team senses inauthenticity. There needs to be creative tension and emotional authenticity built into the structure of the team." Later, he qualified that one has to be able to have conflict "without risk of burning bridges."

A lack of commitment leads to ambiguity in direction and priorities, he said. There needs to be "candid discourse, everyone needs to be heard." In addition, simple project management skills will help to foster the commitment necessary to succeed. The flaws here, he said, may involve a cultural bias toward skepticism (second-guessing and over-analysis) and cynicism toward management.

The avoidance of accountability follows the tendency to avoid conflict and leads to low standards and expectations.

Finally, inattention to team results arises when a team member places individual ego and status before team achievement. "That leads to missed opportunities for greater impact through a 'whole is greater than the sum of its parts' experience," Rick said. He considered this problem a splash-over from academia, which praises individual rather than team achievement.

He concluded that, in addition to a compelling vision, synergy and interdependency have to be built into the structure of the team.

Vipin, who titled his talk "Leading and Developing Your Team as Principal Investigator," said that key team ingredients should include a poetic vision (such as the US Army's 1970s mantra, "Own the night"), a defined mission, and a way to reach the goal.

He mentioned "the leadership gumption cycle," like the community team that brought Intel to Rio Rancho. "You need to have a belief in something without knowing it's true," he said, lightly tweaking the widely held belief in scientific neutrality. For example, his team had no evidence that microscale solar — using tiny pieces of photovoltaic material fabricated like computer chips — would work, "but we thought long and hard on exactly how this can possibly be done.

"You need to believe, think, care, plan, commit, and achieve," he said, "but first you have to believe."

Bringing the same attention to teammates that PIs usually focus solely on their technical targets, PIs can help themselves and group members become aware of and navigate between excitement and boredom, flow and apathy, control and worry, and relaxation and anxiety.

Vipin used a chart that showed the great variety of personality types that could help a project at different phases, including the "flakes, loose cannons, and nut cases" (known more complimentarily as "creative, fearless, and fast-paced") who "make the impossible possible" by being "ahead of their time." These are followed by the "carpetbaggers, empire builders, and ambulance chasers" (otherwise known as "selective, organized, and growth-oriented") who are "in the right place at the right time" to "make the possible probable," and then by the "sharks, automatons, and control freaks" (otherwise known as "prudent, disciplined, and methodical") who "thrive in the present" to "make the probable certain."

What matters most, "in those brief moments in time when the stakes are high, are the small things. Make sure those individuals who are most attentive to detail are actively in play at those moments." (Emphasizing his point, he showed the classic cartoon by Regan of two dinosaurs sitting on a flooding island as they watch a large wooden ark filled with animals sail away; one dinosaur says, "Oh crap, was that today?")

Things that don't work, he said, are debates that get personal ("unending squabbles"), following rules instead of achieving results ("rules are constantly and carefully changed"), job titles in a defined hierarchy, rewarding individual behavior instead of group achievement, and assigning people according to capabilities rather than their interests or passions ("because you're treating people as tools, rather than giving them a chance to delve into a new arena").

He advocated leading big teams that do big things with big machines as the key ingredients at Sandia for achieving social and technical breakthroughs. "Three- or four-people teams is university-size," he said. "If that becomes our main R&D, we'd get known as the most expensive university in the world."

The day's program built on the success of a similar workshop held last March at Sandia/California. Co-organizers of that event, Tammy Kolda (8256), Jon Zimmerman (8966), Craig Smith (8539), and Melissa betz (8539), shared key lessons learned from their workshop and provided valuable feedback throughout the Sandia/New Mexico workshop planning.

The program was supported by the Division 1000 Workplace Enhancement Council, the Advanced Strategic Training Program, Division 1000, and ANGLE (Sandia's early career professional organization). Speakers included Jeff Nelson (1131), Chris Apblett (2546), Sita Mani (5771), Troy Olsson (1719), Dave Sandison (110), Rick Muller (1425) Kathy Simonson (5511), Rob Sorensen (1818), Susan Pickering (6230), Jamey Bond (2614), and Mimi Watson (TRACOM). Administrative help was provided by Carley Parriott (1111).

The story behind the workshop

By Amber Young, PI conference co-organizer

There are a lot of staff scientists excited about this kind of professional development opportunity and we hope to continue to build on that. I've tried to give more information about this effort in the following few paragraphs:

To be a successful Principal Investigator (PI) requires honing skills in developing customer relationships, finding funding, writing proposals, developing a sales pitch around new ideas, building teams, juggling milestones, unexpected hurdles, and budgets. These can be daunting to even the most successful staff members with formal training in the sciences and engineering, but who have often never received formal training in the skills critical to leading successful projects. Building on a workshop first launched at Sandia/California, Life of (a) PI: Create Winning Proposals and Run Effective Projects! staff members at Sandia/New Mexico recently organized a similar full-day workshop, How to be an Effective PI: Plan for Success and Run Effective Projects!

The workshop was designed to be by staff members for staff members. The co-organizers, Blythe Clark (1111), Amber Young (1728), Laura Biedermann (1816), and Rachel Colbert (2615), recognized a need at Sandia, and motivated by the desire to become more effective PIs themselves, volunteered their time to organize the event. The goal was to focus on a few of the key skills required to run effective projects and draw on the experience and accomplishments of seasoned staff to offer more in-depth advice than a typical brown bag lunch seminar and to provide concrete tools that can immediately be applied.

The organizing team reached out to a broad network of mentors and widely recognized PIs from across all divisions at Sandia in an intentional effort to provide representation from across technical fields and experiences and to learn from those widely acknowledged by their peers as successful PIs. In the process, the team encountered an outpouring of support from various business offices, the AST program, Div. 1000, and the CTO office offering encouragement, advice, and resources for the event. The event was met with great enthusiasm by potential participants, the 100 available slots filled up in less than a day. Numerous organizations and divisions have expressed interest in hosting similar events targeted at specific divisions and follow-up workshops to build on the energy the event inspired.

The team is working on developing an online PI Resource Guide, an unofficial guide to things you need to know or wish you knew, intended to be a central location to gather information about resources available to support PIs from across Sandia and to serve as central forum for PIs to ask questions and support one another. The hope is that this resource and workshops like these will encourage PIs to work together to support one another, creating opportunities to learn from one another's experiences and to create professional development opportunities to help ourselves fulfill the non-science side of our roles to the best of our abilities.

Sandia has an incredibly talented workforce composed of ambitious staff who strive for continuous improvement. The active development of skills that aid in developing and running more successful projects will contribute to our scientific accomplishments and build on Sandia's strategic foundation composed of our people, research, and capabilities.

More information about the PI workshop and presenter is available at http://tiny.sandia.gov/v74g6. Presenter's slides, videos of the day's presentations, and the interactive PI Resource Guide will be posted soon.

DISCOVER ENGINEERS WEEK
FEBRUARY 16-22, 2014

Sandia marks Engineers Week with tech talks, panels

What engineering means to me

By Steve Rottler, Div. 8000 VP and former Sandia chief engineer


STEVE ROTTLER

An engineer's work touches every aspect of our lives — the buildings where we work and live, the lights we read by, the cars we drive, even the diapers our babies wear. As an engineer, I am proud to be part of a profession that solves important problems and delivers innovative products that serve mankind.

I didn't set out to become an engineer. Throughout most of high school, my goal was to become a chemist; I wasn't even sure what engineering was. Ironically, it was my chemistry teacher, Zella Harton, who first suggested that I consider engineering as a career. Ms. Harton had noticed I enjoyed using math and science to solve problems and was very outcome-oriented — all markings of someone who might make a good engineer.

Engineering quickly captured my interest because I like to solve problems. More specifically, I am fascinated by complex systems. I love exploring how they behave; how to predict their behavior; and, as I've moved into management, how to manage them because organizations often exhibit the characteristics of a complex system.

When I joined Sandia, I envisioned staying a short time and then moving to academia because I enjoy teaching. But, like many of you, I became "addicted" to Sandia — the people, our capabilities, and especially our national security mission. I love knowing that my work has impact. This mission-driven sense of purpose has propelled me throughout my career and feeds my excitement "appetite" every day.

Engineering is a noble profession. When engineers achieve something truly remarkable, such as putting a man on the moon or inventing some new transformative technology, you win awards, your accomplishments are celebrated, and you might even realize significant financial gain. But the reverse is also true. Engineering mistakes are highly visible, they destroy relationships and reputations, and, most importantly, the consequences can be truly catastrophic — massive loss of life and money, even the undermining of our country's economy and national security.

In my first years at Sandia, I worked on a large strategic defense initiative program and, as a result, participated in two underground nuclear tests. My theoretical and computational work supported the design of experiments fielded on those tests. I had the opportunity to repeatedly visit the test site and participate first-hand in field test engineering. It was a transformative experience, providing me with my first exposure to "engineering on a grand scale."

I was struck by the realization that a thousand or more people from different organizations had spent years planning and preparing for an amazing event that would begin and end faster than the blink of an eye — setting off a nuclear device underground. To control and contain the energy released and conduct the many associated experiments, everything had to come together perfectly; there was no margin for error.

It is obvious that preventing errors is imperative on a project like an underground nuclear test. But error prevention is equally critical in all other aspects of engineering, even the most mundane tasks. In the words of Albert Einstein, "Concern for man himself and his fate must always form the chief interest for all technical endeavors in order that the creations of our mind shall be a blessing and not a curse to mankind."

I believe engineers have an ethical responsibility to master and incorporate into their work habits and approaches techniques that will prevent errors, or unwanted outcomes. While most engineers share this mindset, those new to the profession may not know how to translate that attitude into behaviors to make it a reality.

Preventing errors can often be accomplished through simple, common sense approaches, like using peer review and planning — tools that are known to every engineer but can be difficult to implement.

I have never met a Sandia engineer who would initiate a project without having a plan. However, I've also rarely met a Sandia engineer who relished the mechanics of planning. Yet, the act of planning is crucial because it enables engineers to understand and thus control, among other things, a project's interfaces and interdependencies, which are precisely where errors in complex systems are most likely to occur.

But we need to go further. Engineers also have an ethical responsibility to think critically at all times about the design and operation of a system or activity. You can't have excellence in engineering without determining how things can fail — and preventing those failures assuredly — in all aspects of our work.

These ideas regarding excellence in engineering are not solely my own, nor are they modern in any way. More than 2,000 years ago, Aristotle expressed this concept of excellence quite eloquently:

"Excellence is an art won by training and habituation. We do not act rightly because we have virtue or excellence, but we rather have those because we have acted rightly. We are what we repeatedly do. Excellence, then, is not an act but a habit."

My journey as an engineer

By Bruce Walker, Div. 2000 VP and Sandia chief engineer


BRUCE WALKER

When I was asked to tell the story of my journey in engineering, a number of ideas ran through my head. While there are many ideas I would like to discuss, one area that has been on my mind recently is when I learned about making and meeting commitments, and how important that is to how we execute engineering at Sandia.

While growing up, my first experiences with engineering came from indulging in numerous science hobbies. Like many of you, I survived chemistry set experiments, built model rockets and radios, took apart everything mechanical around the house, and spent hours looking at the stars. In the process, I also learned a few things about safety, fortunately without too many consequences.

However, one of the most important learnings that has impacted my work in engineering was not in a field of science, but in watching my dad manage a small construction business. I can remember seeing him work to complete construction jobs within budget and on schedule while often dealing with the impacts of delays due to subcontractors and foul weather. I saw personal sacrifices made to meet commitments, occasionally while losing money. As a youngster, this seemed flawed to me. Why would someone continue working while losing money? At that age, I naively thought I could do better. What I learned was that a commitment was a commitment, or as I like to say, a deal is a deal. A person's word was golden and would be kept, and sometimes this came at personal sacrifice.

This concept may seem difficult for us to apply to our work at Sandia. We cannot lose money. Inventions cannot be scheduled. Much of our work is R&D, has never been done before, and therefore it is difficult to predict cost and schedule with accuracy. However, we can start with the commitments we make to each other. We use words like "I hope to get this done by . . ." or "I will try my best to meet . . ." These are not words of accountability, and I suggest would not be acceptable in our private lives. Yet sometimes we let these words enter our business lives. For example, if my friends asked me if I could meet them at a certain time and I said "I hope to make it" or "I will try my best," these would not be acceptable answers. No commitment would have been made, and they would not rely on me to show up. I would have effectively put off a commitment to a future time, and would appear to be unreliable. Hope is not a plan and trying one's best is admirable, but not a commitment. These are not acceptable responses in our private lives or our business lives.

Now, none of us is perfect. I can unfortunately recount instances where I have forgotten, misunderstood, or in some way missed a commitment. While my intent may have been good, that is not sufficient. My grandmother used to say "The road to hell is paved with good intentions." So, we must make our commitments carefully, with prudence and critical thought, and meet those commitments.

There are many ways we can improve in how we make or manage our commitments at work. One way is to understand the margin or contingency we have in meeting commitments. Having no margin is unacceptable. Zero margin is infinite risk. If we truly have zero margin in performance, cost, or schedule, as soon as we exceed an estimate, we miss the commitment. We need to manage cost and schedule to the same rigor that we manage performance requirements. We cannot imagine delivering a product without sufficient margin in performance, yet we may not understand our margins in cost and schedule as well. To be successful in meeting commitments in project execution, we must understand our margins and manage those margins throughout the project.

Another way we can improve our success in meeting commitments is ensuring we have the requirements correct up front, at the beginning of any commitment. Clear communications are critical. If it is not written down, it does not exist. The onus of ensuring requirements are written and correct is on the individual responsible for meeting the commitment. Ensuring requirements are correct — clearly stated, with definable metrics, and free of defects — may be the single biggest factor in successfully meeting commitments.

Many modern tools and processes can aid us in understanding and managing margins and requirements. Processes like HALT, or highly accelerated life testing, can be used to understand the performance margin in products. Fagan inspections are a method of defect prevention in requirements reviews. I encourage you to learn the modern methods that apply to your domain.

You might know of Edwards Deming, a well-known leader in quality and developer of the "plan-do-check-act" cycle. He is considered a hero in Japan for his work in product quality. At a panel discussion, still active in his 90s, when asked a specific question on quality, his surprising answer was "I don't know; I am still learning." That is the way I feel about engineering. I am still learning. I am thankful to work for an institution that provides the opportunity to continue to learn, and pass on some of these learnings to help you in your own journeys as Sandia engineers.

For more on Sandia's activities celebrating National Engineers Week, see the next two pages

Artwork courtesy of www.discovere.org

Stories by Sue Major Holmes

Sandia Fellows offer engineering Tech Talks

Sandia's four Fellows — Jerry Simmons (7000), Ed Cole (1000), John Rowe (5000), and Jeff Brinker (1000)— will talk about their research in a special National Engineers Week forum, "Advancing the Frontiers of Science and Engineering," from 1:30-3:15 p.m. Feb. 19 at Steve Schiff Auditorium.

Jerry, Ed, and John were named Sandia Fellows last year. Jeff was named in 2003. The status is reserved for nationally or internationally recognized pioneers in their fields. Fellows are expected to bring the best science and engineering to the Labs and the nation, shape the future of Sandia's science and engineering enterprise, expand the breadth of their influence, mentor others, and maintain extensive professional networks.

Jeff has spent decades working on molecular nanoscience, starting with studies of fractal silica gels and aerogels. From 1997-2004, he developed evaporation-induced self-assembly as a means to create highly ordered porous films and nanoparticles resulting in a series of seven highly cited *Nature* and *Science* papers. Self-assembled porous nanoparticles became the basis in 2009 of the protocell nanoparticle drug-delivery concept and in 2010, targeted protocells, which have been demonstrated to improve the efficacy of chemotherapy drugs, antibiotics, and vaccines.

Ed is internationally recognized for his widely used work in failure analysis and reliability physics. His pioneering work and leadership in applying failure analysis techniques to the most challenging national security problems has led to novel methods for finding hidden defects.

John's expertise and technical leadership in remote sensing systems have helped shape US capabilities and are widely recognized in national security fields. His deep technical understanding of national sensing and detection systems makes him a highly regarded and sought-after expert by multiple government agencies.

Jerry made notable discoveries in the physics that examines electron tunneling — how an electron can turn up where by rights it shouldn't be. He is well-known for linking fundamental scientific understanding with engineering impact and has demonstrated leadership in helping to advance solid-state lighting, terahertz sources and detectors, and quantum qubits.


JEFF BRINKER

Jeff Brinker will speak on "Self-Assembly of Functional Nanostructures." His work is inspired by natural systems that have evolved over billions of years to solve difficult engineering problems such as water purification, energy harvesting, and selective cellular delivery. From a materials science perspective, nature's solutions often involve disparate materials combined in 3-D hierarchical architectures that result in synergistic, optimized properties and property combinations. Emulating proven natural designs in robust engineering materials using efficient, manufacturable processing approaches represents a grand challenge in materials science and engineering. Over the past two decades Jeff's research team has developed self-assembly as a robust and efficient means to create porous and composite thin film and particulate nanostructures with optimized properties and/or complex functionalities. Recent work has focused on mesoporous silica nanoparticles whose huge internal surface area and variable surface chemistry enables loading with diverse cargoes and whose external surfaces can be engineered to avoid or enhance binding with specific cell and tissue targets. Targeted nanoparticle delivery has emerging applications in human health and chem/bio defense.


ED COLE

Ed Cole's talk will be on "Microelectronics Defects: Challenges and Opportunities." Microelectronics plays a critical role to virtually all national security systems and in society in general. Localizing defects in microelectronics components is critical to ensuring process viability, device reliability, and functional performance. The complexity of modern devices, with their tens of millions of transistors and hundreds of millions of interconnections, can make finding defects extremely challenging. Sandia continues to develop capabilities, driven by mission needs, to detect and locate the "unfindable." Ed's presentation will describe challenges in microelectronics defect localization of interest to Sandia and how they are being solved through discovery and physical understanding. The tools for locating failures also apply to understanding how microelectronics function. This understanding is being used to enhance system performance and national security efforts in vulnerability assessment, trusted systems, and counterfeit detection.


JOHN ROWE

John Rowe's talk will focus on "Persistent Sensing," a proven technique that enables continuous monitoring of an area or an activity to help address US national security missions such as treaty monitoring. He will highlight selected research and development activities in Sandia's Defense Systems and Assessments SMU that focus on increasing sensor system performance/persistence to better address continuing and emerging national security challenges. Recent technical advances, particularly significant increases in achievable focal plane array (FPA) density, can lead to improvements in the performance of space-based optical sensors and provide expanded options for different classes of remote sensing systems. However, FPAs alone are not sufficient, and several interrelated technical challenges must be addressed to realize an end-to-end sensing system.


JERRY SIMMONS

Jerry Simmons will speak on "Novel Semiconductor Materials." The continuous development of such materials and devices has played center stage in Sandia's research, affecting multiple missions. Jerry will highlight some of Sandia's pioneering work and identify some topics for the future. For example, quantum electronic devices have advanced enough that single electrons can be individually controlled, with potential applications to information processing. Advances in semiconductor growth have enabled the quantum cascade laser, a novel laser architecture opening up new spectral regions. In the past decade new wide- bandgap semiconductor materials have enabled high-efficiency LEDs operating at previously unattainable wavelengths. This made possible advances in solid-state lighting technology that could save the nation tens of billions of dollars in energy costs every year. In the future, these same wide-bandgap materials will produce new power electronics, increasing the efficiency of electric motors, solar photovoltaics, the electrical grid, and electric cars.

Why I became an engineer

Early career Sandians reflect on their passion for engineering


ALICE MUNA

I became an engineer because math was always my favorite subject in school and I was encouraged to pursue engineering from my father. My father was an engineer and he took me and my brother to Take Your Daughters and Sons to Work Day.

My brother and I changed a few of his computer settings and he couldn't figure out how to change them back, which we thought was hilarious. While in college I found electrical engineering to combine my love of math and my desire to contribute to society. I currently enjoy all the different opportunities available to engineers and am glad I decided to make engineering my profession.

Alice Muna (4879)

I remember when I was in middle school, I stayed up late solving extra math problems with multiple approaches. I started attending programming classes offered at universities when I was 12 years old. In my native country we choose a major in high school. When it was time to select my high school major, the principal and my math teachers contacted my dad and told him that I should choose math as my major.

When I graduated from high school, my love for math and physics had grown so much that I knew there was only one option for me and that was engineering. This might be because I was born in a family full of engineers (My father, uncles, and cousins.). I love solving challenging problems as a way of giving back to my community.

Pania Newell (1555)


PANIA NEWELL

Sandia's National Engineers Week Events

Speaker	Title	Date	Time (MST)	NM Location	CA Location
Charles Elachi, director, Jet Propulsion Lab	The Engineering Challenges & Excitement of Robotic Space Exploration	Feb. 18	10:30 a.m.-noon	Steve Schiff Auditorium	Bldg. 904 Auditorium (Videoconferencing)
STEM Info Fair	STEM Info Fair (Includes booths and a display of UNM's Formula SAE Car)	Feb. 18	3- 3:30 p.m.	Steve Schiff Auditorium	N/A
Catalin Roman, UNM Dean of Engineering	UNM Engineering: Solid and Improving	Feb. 18	3:30-4:30 p.m.	Steve Schiff Auditorium	Bldg. 904 Auditorium (Videoconferencing)
Sandia Fellows Talk (Ed Cole, John Rowe, Jerry Simmons, and Jeff Brinker)	Advancing the frontiers of science and engineering — A tech talk by Sandia's Fellows	Feb. 19	1:30-3:15 p.m.	Steve Schiff Auditorium	Bldg. 904 Auditorium (Videoconferencing)

New Faces of Engineering: Greg White

Sandian Greg White has been chosen as one of the 2014 New Faces of Engineering to highlight the work of engineers ages 30 and younger. The recognition program is sponsored by the National Engineers Week Foundation, now DiscoverE, a coalition of engineering societies, major corporations, and government agencies.

Greg (2128) calls the recognition humbling.

"I very much appreciate the national recognition and hope that the stories of the New Faces of Engineering — which really puts a face to who engineers are — is motivation to young people that you don't have to be a musician or athlete to be successful," he says. "Working hard and not giving up, working with positive people who go above and beyond to give you a 'reality check' every now and then, can help you achieve."

The National Action Council for Minorities in Engineering (NACME) nominated Greg for the award. Member organizations of DiscoverE's Diversity Council each year nominate individuals who exemplify the ideals of the New Faces effort.

NACME Vice President Aileen Walter says her organization invites universities with which it has partnerships aimed at increasing graduation rates of underrepresented minorities to identify former minority students who are advancing the engineering profession. Greg, a NACME Scholar as an undergraduate at Virginia Tech, exemplified what Engineering Week is about, she says.

Greg credits his mentor, Virginia Tech engineering professor Bevlee Watford, with putting him on the road to academic and professional success. Watford once called him to her office to discuss the balance between his classroom performance and his heavy extracurricular involvement in National Society of Black Engineers and similar professional organizations. "Our reality check discussion helped put things in perspective," he says.

Greg, who earned a doctorate in chemical engineering from Clemson, joined Sandia as a postdoc in May 2011 and became a member of the staff in August 2012.

He currently works on the B61-12 Life Extension Program. "Supporting and contributing to a program that plays a critical role in our national security alongside countless bright, talented, kind folks is very important to me," he says.

The New Faces program, which began in 2003, personalizes what sometimes has been called "the stealth profession" by highlighting young, diverse, and talented engineers who demonstrate that engineering is exciting and open to everyone and has an impact on society.

DISCOVER ENGINEERS WEEK
FEBRUARY 16-22, 2014

JPL director speaks at Sandia for National Engineers Week

CHARLES ELACHI

Jet Propulsion Laboratory (JPL) Director Charles Elachi will help Sandia highlight National Engineers Week with a Feb. 18 talk on "The Engineering Challenges and Excitement of Robotic Space Exploration."

The landing of the car-size rover *Curiosity* on Mars was considered one of the great achievements of American ingenuity, boldness, and engineering.

Elachi will describe the engineering challenges faced in the quest for space exploration, the engineering ingenuity that led to various achievements, and discoveries made about the wonders of the solar system — from dry channels on Mars and subsurface oceans on Europa to hydrocarbon lakes on Titan and geysers on Enceladus.

His talk, slated for 10:30-11:30 a.m. MST at Steve Schiff Auditorium and video-linked to California Bldg. 904 auditorium, will be followed by a half-hour panel discussion with Sandia Div. 8000 VP Steve Rottler, acting Div. 7000 VP and Chief Technology Officer Julia Phillips, and Div. 2000 VP Bruce Walker.

Elachi joined JPL in 1970 and has been its director since May 2001. He is also vice president of the California Institute of Technology, which manages JPL for NASA.

As director for Space and Earth Science Programs at JPL from 1982 to 2000, he was responsible for developing numerous flight missions and instruments for Earth observation, planetary exploration, and astrophysics.

This year marks important anniversaries for some Jet Propulsion Laboratory missions. As of January, the Mars Exploration Rover *Opportunity* has ranged across the Red Planet for 10 years.

June will be the 10th anniversary of the *Cassini* spacecraft's arrival at Saturn, and 2014 is the 50th anniversary of the Deep Space Network, a three-continent system of ground stations that communicate with spacecraft throughout the solar system.

UNM engineering dean highlighting Sandia, school collaboration

CATALIN ROMAN

Catalin Roman, dean of the University of New Mexico School of Engineering, will speak at Sandia on Feb. 18 on "UNM Engineering: Solid and Improving," highlighting the collaborative effort between Sandia and the school and how students there are challenged to think creatively through engineering research.

The 3:30 p.m. MST talk at Steve Schiff Auditorium (video-linked to California Bldg. 904 auditorium) is one of a series of events recognizing National Engineers Week.

A 3 p.m. STEM (science, technology, engineering and math) Information Fair in the auditorium's lobby also is part of the celebration, and will include booths and UNM's award-winning Formula SAE car, which Sandia played a role in developing.

Roman, born in Bucharest, Romania, studied general engineering topics for two years at the Polytechnic Institute of Bucharest. He received a Fulbright Scholarship and became part of the first computer science freshman class at the University of Pennsylvania in 1971. He earned his bachelor's, master's, and doctorate in computer science from that school, then began his academic career as an assistant professor at Washington University in St. Louis. He became department head in 1997 and was named the Harold B. and Adelaide G. Welge Professor of Computer Science at Washington University in 2004. He headed the university's department of computer science and engineering from 2008 to 2011, when he joined UNM as engineering dean and professor of computer science.

According to UNM's website, Roman sees the school as being uniquely positioned to enable scientific advances, technology transfer, and workforce development in the state, national, and international arenas in ways that respond both to environmental and societal needs and build on the region's rich history, culture, and intellectual assets. His vision is to make collaborative education and research the norm at the university.

The last mile

Sandia helps bring life-saving vaccines to far reaches of the world

By Nancy Salem

Like people, vaccines don't do well when it's too hot or too cold. The life-saving biopharmaceuticals can perish if their temperature shifts a few degrees.

That fragility presents a challenge when the people who need vaccines live off the beaten path. "The vast majority of the world's population lives in areas where electricity and refrigeration are not reliable," says Bruce McCormick, president of SAVSU Technologies of Santa Fe. "It is difficult to get vaccines to these areas. We're talking several billion people."

McCormick, an inventor, knew of the obstacles in vaccine distribution in developing countries. Vaccines and other biologic materials such as blood, tissue, genes, stem cells, and proteins are made of living organisms that degrade at warmer temperatures until no longer effective. A bigger danger is freezing. "Seventeen to 39 percent of all vaccines are exposed to freezing temperatures through improper storage, and it kills them," he says.

With technical help from Sandia through the New Mexico Small Business Assistance Program (NMSBA), McCormick has developed a solar thermal icemaker to provide cooling for high-performance shipping containers that safely transport and store temperature-sensitive vaccines and biopharmaceuticals. Thousands of the systems are being used throughout the world, and McCormick has signed a distribution agreement for an expanded line of products.

"We are committed to extending the reach of life-saving materials for research and treatment to humans around the world," he says.

PHYSICAL CHEMIST Eric Coker (1815), left, looks over shipping containers developed by Santa Fe businessman Bruce McCormick, right, that safely transport and store temperature-sensitive vaccines and biopharmaceuticals. Eric helped McCormick create a solar thermal icemaker to provide cooling for the containers. They worked together through the New Mexico Small Business Assistance Program. (Photo by Randy Montoya)

Good intentions

Vaccines are often transported to remote places in coolers not powered by electricity or fuel, but using some form of ice. For most vaccines, the temperature must stay between 2 and 8 degrees Celsius (36 and 46 Fahrenheit).

"Inadvertent freezing is the result of good intentions," McCormick says. "The vaccines are in a cooler going from point A to point B. Ice is the primary means of thermal storage, and the feeling is that more is better. The vaccines end up freezing."

Transportation is hard to manage, and the range of vaccine distribution is limited by how long a cooler can maintain the proper temperature. "If you have a cooler that can keep the vaccine alive for 24 hours, that's how long you have to load, bring it to the village, community, or health care center, and administer," McCormick says. "As a result there are complicated logistics in moving the vaccines from, for example, a national distribution facility where they have reliable electricity to a remote clinic. But they have to get there. It's referred to as the last mile."

About five years ago, the Program for Applied Technology in Health (PATH), a Seattle-based non-governmental organization (NGO) that promotes new technology in the world health community, issued a challenge to industry to improve vaccine transport. McCormick had experience building insulated products and working with nanoporous materials.

He formed SAVSU (State of the Art Vaccine Storage Unit), teamed with a company that does industrial coatings, put together a prototype — and won the challenge.

"With that I needed to start working to commercialize it," McCormick says.

A failsafe system

His first container, the NanoQ, is a box that holds separate cases for ice and the payload, designed with super-insulating materials that allow low levels of heat transfer. It stores vaccines in hot environments for up to 10 days. A thermal buffer keeps the contents from inadvertently freezing.

The system uses ice because it goes to places where there are no special resources and water is common. "It's simple to operate. People don't need to be trained," McCormick says. "We don't want to limit the reach of the technology."

PATH asked if the box could store medicines longer than 10 days if the ice was swapped out. Replacing the ice would require refrigeration in areas where electricity is unreliable. "Even in big cities there are power outages," McCormick says. "The power went out for a weekend in a city in Mexico and all the vaccines in refrigerators in a district health center were destroyed. This is a fairly common occurrence around the world. You have to have power running 24/7 with no interruption when you use standard refrigeration systems."

McCormick turned to NMSBA, which pairs entrepreneurs with scientists at Sandia and Los Alamos national laboratories. The state-funded program was established in 2000 by the New Mexico Legislature to help small businesses get technical support from the labs. It has provided $39 million in assistance to 2,195 companies in 33 counties. The help is free of charge to the business.

The challenge was to make the NanoQ a long-term storage device instead of just a transportation container. Ice would have to be made in the field. "I found information about a large solar icemaker made at Sandia in the 1980s using a refrigeration technology called adsorption," McCormick says. "I wanted to find one of the original engineers who worked on the project."

They had retired and the project was defunct, but through NMSBA McCormick was paired in 2011 with Sandia engineer Brian Iverson, who found an old version of the solar icemaker at the Labs. Brian took it apart, studied the design and the notes of the original team, and set about making a better one using new technology.

"Bruce needed a passively driven refrigeration system," says Brian, now a professor at Brigham Young University. "I started digging into who had worked on the project, what the system's components were made of, and the process by which ice is made using solar energy."

Physical chemist Eric Coker (1815) joined the project. "Brian did the engineering and I took his recommendations and applied chemical knowledge to fill in the design gaps," Eric says. "I researched what would be a good adsorbent and adsorbate to make it work at the scale Bruce needed. It had to be portable and completely off grid with the only inputs being sunlight and water."

Eric and Brian delivered a workable design. The icemaker has a one-meter-square solar collection area, a condenser, and evaporator. Thermal energy is collected, and the heat drives a fluid, in this case methanol, out of a porous carbon material.

The fluid moves by gravity to the condenser where it liquefies. At night, when heat is no longer driving fluid off the carbon, the condensed liquid evaporates and the gas is absorbed back into the carbon, drawing heat from the environment. That reaction has a cooling effect that freezes water in a trough, creating from 2 to 12 pounds of ice a day.

"It needs no electricity or photovoltaic cells. It's a refrigeration cycle," Brian says. "Bruce did not want expensive components such as a PV cell."

McCormick says the icemaker is key to SAVSU's ability to offer the NanoQ to international agencies as a permanent replacement for expensive and impractical refrigeration systems. "They go together," he says.

'A good feeling'

McCormick says the collaboration with Eric and Brian was a high point of the SAVSU journey. "It was great," he says. "On a personal level, it's fun to brainstorm with people who have more knowledge than I do in the field of solar thermal energy, to be able to really explore possibilities and new ideas. You don't always know where you're going to land but you can create a project in a way that you're open to exploring what seem to be interesting channels. We have the best design possible."

McCormick has developed two other products, the CryoQ, for materials that need to be shipped at deep-frozen temperatures, and the PHD, for small-volume shipments. SAVSU products transport and store all kinds of biomaterials and other regenerative products used to treat disease.

The World Health Organization (WHO) Performance, Quality and Safety (PQS) system recently created a new specification for a 10-day storage container such as the NanoQ. Organizations such as UNICEF and the Gates Foundation that fund vaccination programs require the products to be approved by the WHO PQS.

In addition to producing the NanoQ for global health needs, SAVSU recently entered into an agreement with BioLife Solutions for distribution of the PHD and CryoQ products into the stem cell and regenerative medicine markets.

Eric, who has been at Sandia 13 years, says it was exciting to work on a project that so clearly saves lives around the world. "It's a really good feeling," he says. "It's very gratifying to think the work I did could help people in Third World countries receive vaccines that are still in good shape."

The NanoQ is being used at community health centers in Asia, Africa, and Latin America. "We've seen it work," says McCormick, whose collaboration with Sandia won an NMSBA Innovation Award in 2011. "The purpose of the boxes is to assure that vaccines are available at the community level when outbreaks occur. The NanoQ coupled with the solar thermal icemaker is a game changer in how vaccines are stored and distributed in developing countries."

Four Sandia researchers named Fellows of the American Physical Society

By Neal Singer

Four Sandia researchers have been named Fellows of the American Physical Society. Election for this honor indicates recognition by scientific peers of exceptional contributions to physics. No more than one half of 1 percent of APS membership can be elected in a given year.

The Sandia electees are:

Charles Barbour (1100 director), for outstanding contributions to the science and engineering of ion-solid interactions and thin-film materials, for leadership in professional societies, and for visionary development and guidance of programs and organizations in energy and national-security science.

CHARLES BARBOUR

Charles is one of the world's leading experts in ion beam analysis, specifically in the use and development of elastic recoil detection. He has published landmark work in the areas of amorphous alloy formation, ECR plasma synthesis of hard materials, electronic and optical materials, and ion implantation for the synthesis of novel high-strength aluminum alloys, all with important implications for energy technologies. He was co-editor and co-author of the 1st edition of the *Handbook of Modern Ion Beam Materials Analysis* (1995) which now has more than 750 citations, and of the *Tenth International Conference on Ion Beam Modification of Materials* (1996).

As an undergraduate he helped start the Colorado School of Mines Society of Physics Students (1979). He has been particularly active in the Materials Research Society, serving as general co-chair for its Spring 2006 meeting, serving for a time on its board of directors, and most recently chairing its Medal Selection Committee.

At Sandia, he helped establish a vision and served as first leader for the nanomechanics thrust in the Center for Integrated Nanotechnologies (CINT), one of DOE's five Nanoscale Science Research Centers. He spearheaded QASPR (Qualification Alternatives to the Sandia Pulsed Reactor), one of Sandia's flagship "deep physics" national security programs.

Marcus Knudson (1646), for pioneering experiments to understand matter at extreme dynamic compressions and having a broad impact on multiple areas of physics through exemplary equation of state results at high pressure.

Marcus led the effort to develop a hypervelocity experimental platform on Sandia's Z machine that performed shock-wave experiments at extreme pressures. This platform accelerated tiny objects to velocities of 40 km/sec (far exceeding that of a rifle bullet), and created pressures upon impact of more than 20 million atmospheres (Mbars). Prior to this development, impact experiments were limited to gas gun facilities that were capable of launching projectiles to 8 km/s, and reaching impact pressures of a few Mbars.

With this significant extension in the plate-impact technique, Marcus' Sandia team has been able to produce highly accurate equation of state (EOS) data to provide better understanding of matter at extreme conditions. The technique was used to resolve a controversy about the characteristics of the high-pressure response of hydrogen, a resolution that has had significant impact in the fields of basic theoretical physics, inertial confinement fusion, and planetary science. More recently these techniques were used to study the high-pressure response of water and demonstrated that the various EOSs used for water in planetary modeling overestimated the compression of water by 30 percent in the few-Mbar regime. These results are directly relevant to the conditions of interest for the planetary modeling of Neptune, Uranus, and presumably water-rich exoplanets such as the hot Neptune GJ436b, and should improve human understanding of these types of planets.

MARCUS KNUDSON

Steve Plimpton (1444), for creating the Large-scale Atomic/Molecular Massively Parallel Simulator (LAMMPS) molecular dynamics package. This open-source materials modeling software has become widely used by physicists and materials scientists worldwide (see http://lammps.sandia.gov).

The program is used at Sandia and elsewhere for modeling materials at the atomistic or coarse-grained scale for both solid-state and soft matter (polymers, fluids, biomolecules). After Steve originated it, LAMMPS became a team effort involving many Sandians in several centers, as well as collaborators outside the Labs, with more than 100 researchers contributing code to the package. Continued support has come from a variety of funding sources that include LDRD, ASC, DOE offices, and CRADAs.

STEVE PLIMPTON

Says Steve, "I think the chief reasons LAMMPS has become popular are that it's open-source, it can model a wide variety of materials, we do our best to support it, and we've tried to design the code so it's easy for users to modify and extend for their own modeling problems."

Kevin McCarty (retired), for pioneering experimental explorations of the dynamics of ceramic and metal surfaces.

In his 27-year career at Sandia, Kevin contributed much to the basic understanding of ceramic and metal surface structures. He began by developing characterization methods and synthesis routes for novel materials such as cubic boron nitride, diamond thin films and high T_c superconductors. This interest evolved to his studies of the basic mechanisms of crystal growth, using low-energy electron microscopy to make a remarkable series of discoveries of processes that govern the morphology of surfaces at high temperature.

These fundamental discoveries include the importance of bulk thermal vacancy creation on surface morphology, the mechanism by which metal thin films usually de-wet their substrate, the role of cooperative mechanisms of surface diffusion in multicomponent surfaces, and stoichiometry-induced phase transitions on oxide surfaces. Recently he also generated some of the most precise measurements of the mechanisms of graphene growth.

What distinguishes these efforts is not only do they allow observation of basic ubiquitous processes, but the experiments were designed to reveal the underlying simple physics. Rather than merely generating images or movies and letting others unravel the many processes responsible for what he observed, Kevin mastered ways to isolate individual processes in complex systems. In doing so, he expanded the state-of-the-art in quantitative electron microscopy.

He has been a mentor to many postdocs and international collaborators.

The American Physical Society

From the aps.org website:

The American Physical Society strives to:

• Be the leading voice for physics and an authoritative source of physics information for the advancement of physics and the benefit of humanity;

• Provide effective programs in support of the physics community and the conduct of physics;

• Collaborate with national scientific societies for the advancement of science, science education and the science community;

• Cooperate with international physics societies to promote physics, to support physicists worldwide and to foster international collaboration;

• Promote an active, engaged and diverse membership, and support the activities of its units and members.

Chanukah and Thanksgiving on the same day again — in the year 79811

By Neal Singer

Sandians who learned last November that the first day of Chanukah — the Jewish Festival of Lights —and Thanksgiving were to be celebrated on the same day might have been perplexed to learn from assorted news media that "a Sandia quantum physicist" had figured out that the next time the unusual coincidence would occur would be in the year 79811.

One might ask what quantum physics has to do with computing this far-flung date, and why a Sandia physicist was computing it?

The simple answer, says the physicist — post-doc Jonathan Mizrahi (1725) — is that the solution had nothing to do with quantum physics, and he figured it out after his workday was over. Curious when the holiday conjunction would happen next, Jonathan wrote a small program in the widely used program Mathematica to compute the next convergence. "I was surprised to see the coincidence would not happen again for the foreseeable future," he said.

JONATHAN MIZRAHI

That is because the overlap had occurred when the latest possible date for Thanksgiving on the Gregorian, solar-based calendar coincided with the earliest possible date for Chanukah on the hybrid lunar-solar Jewish calendar. Since the Jewish calendar is drifting forward (at the rate of four days per thousand years) relative to the Gregorian, the next time this convergence could recur is after a complete recycle, many eons in the future.

However, Jonathan points out, the overlap is actually more confusing than that. A Jewish calendar day starts at sunset and thus overlaps two days, not one, on the Gregorian calendar. On this basis, he computed, there will be two more overlaps — in 2070 and again in 2165 — before the void begins.

Jonathan's work gained him unsought fame when he posted his calculations on his Facebook page. Media outlets that scooped up his information ranged from *National Geographic* to the *Jerusalem Post*, and from ABCnews.com to hundreds of other news providers. "I never expected more than a handful of people to see it," he says.

Employee death

Remembering Susan Brozik

A spirit too big to be contained by words

"To explain Susan Brozik would take a lifetime." That is the assessment of friends and colleagues Phil Miller, DeAnna Lopez, and Jake Haworth (all 1714). Susan, a biologist in Sandia's Biosensors and Nanomaterials Dept. 1714, died unexpectedly last week at age 46.

In a collectively written memorial tribute, Phil, DeAnna, and Jake said of Susan: "She was so many things to so many people. She was everything to everyone. She was not just my boss, she was my mentor, my big sister, and my friend. No matter what was going on with life, be it a work project gone awry or a personal family matter, she always took the time to listen. No matter how long it took, she was there."

Susan made an indelible mark with her notable contributions to Sandia's mission. Recalls manager Steve Casalnuovo, "When Susan was hired 15 years ago, she was the first biologist to join Sandia's biological microsensor program. I think she found working with the physical scientists already on the team both challenging and amusing." When she came to the Labs as a PhD researcher, Steve says, "Her first priority was to recruit and train other bioscientists in order to bring a biological perspective to sensor development . . . Susan was highly sought after as a project leader and scientific collaborator."

Susan also had a vital quality that served her and Sandia well. Explains Steve: "Susan was adept at communicating the impact of her work to Sandia's national security sponsors, most of whom did not have much understanding of biology."

A researcher of consequence and accomplishment, Susan also was a dedicated runner, actively involved in the Albuquerque ultra marathon community. In that part of her life, Susan competed successfully (as a winner and high finisher many times) in races of from 50 to 100 miles in length, races that test the last full measure of an individual's strength, endurance, conditioning, and, most significantly, character.

"Susan was the foundation of our laboratory and a pillar at Sandia. She was our mentor, our sister, and our friend. She will be irreplaceable."

'A rare jewel'

It was that character that shone through for her friends. For Susan, what counted was what you did, how you treated people. Recalls colleague Lisa Garcia (1714), "In our last deep discussion, Susan told me she didn't care how many letters were after a person's name. She didn't care what position they had, what school they went to, or where they were from. She said what mattered most to her was what type of person they were, how they cared for people, and what they were doing to make a difference in life. She was a rare jewel."

Colleague Dulce Hayes (1714), who has worked as a technologist in Susan's lab for the past nine years, says, "Susan was our team leader, but above all she was my friend and my mentor. Her optimism and enthusiasm were her personality traits that made it a pleasure working with her. I'm deeply saddened that we have lost her but Sus will forever live in my memory."

When talking about Susan, when learning about her life, about what mattered to her, the word "mentor" comes frequently to the forefront. Steve says mentoring staff, technologists, and students was a passion for Susan. Fellow researcher Ronen Polsky (1714) says "Susan was the foundation of our laboratory and a pillar at Sandia. She was our mentor, our sister, and our friend. She will be irreplaceable." Adds Wahid Hermina (1710), "Susan was a luminary in the areas of biosensors and bio-inspired materials. She was a mentor to many and will be sorely missed as a friend and as a brilliant technical contributor and leader."

SUSAN BROZIK congratulates a friend at a recent wedding.

K.E. Achyuthan (1714) collaborated with her on several projects and said the interactions were unfailingly marked by team spirit, professionalism, and courtesy. These productive collaborations resulted in several joint publications in well-respected, peer-reviewed journals. "I will miss Susan and I respectfully offer my deepest sympathies to her family," K.E. says.

A light in the lives of friends

Amy Allen (1819) expresses a sentiment shared by many when she says, "As for words, I'm still at a loss of where to even begin. Susan was someone who saw the best in people and helped make them even better. Her dedication to her work and her colleagues showed in the caliber of the work we did. She was a light in the lives of her friends and the community here at Sandia."

Susan grew up in West Point, Neb., just up the road from Omaha. She attended Catholic schools in the area and then attended Mount Marty College in Yankton, S.D., perched on the bluffs above the Missouri River and not far from her home town. After receiving her doctorate from Washington State University, Susan worked for a time at Los Alamos National Laboratory before coming to Sandia in 1998. Susan was buried on Feb. 1 in West Point. She is survived by her father, a brother, four sisters, and nieces and nephews. Her mother passed away in 1994.

Colleagues Phil, DeAnna, and Jake remember Susan as someone of open mind and open heart. "She was never judgmental," they write. "She gave without needing or wanting anything in return. She saw past the flaws and saw potential in everyone, always teaching us how to reach our full potential. She could enter any room and instantly light it up with her contagious smile and personality. We loved her like she was our own family and she has forever left her beautiful mark in our hearts." — *Bill Murphy*

ON A TRIP to South Padre Island with friends.

KNOWLEDGE

You and Sandia = Total Health

POWER

What is Your UnitedHealthcare Provider's Rating?

Looking for a new doctor, or want to see how your current one compares? Take advantage of UnitedHealthcare's (UHC) updated UnitedHealth Premium Designation Program to identify high-quality and cost efficient in-network providers.

The program recognizes doctors who meet standards determined from evidence-based medicine and national industry guidelines. Providers are rated on the care they provide to patients throughout the entire treatment process, including diagnostic testing, prescribed medications, procedures, and follow-up care.

The UHC Premium Designation program is one of the longest running physician quality and cost efficiency designation programs in the industry, and was expanded in 2014 to include new specialties (such as ENT, general surgeons, ophthalmologists, orthopedists, and urologists) and improved standards to identify the most cost-efficient care.

How It Works

When you're looking for a doctor, consider using the Premium Designation Program to compare treatment options. UnitedHealth Premium Tier 1 is the highest-rated category within the Premium Designation Program. Tier 1 physicians have received the designation for Quality & Cost Efficiency OR Cost Efficiency & Not Enough Data to Assess Quality. You can check the UnitedHealth Premium Tier level of your doctor by visiting myuhc.com. Providers who have achieved Tier 1 status will be designated as shown below in the red box.

Updated Display

Doctors who have met the criteria for quality and/or cost efficiency could have one of these four UnitedHealth Premium designations. These are shown on **myuhc.com**.

- Quality & Cost Efficiency
- Cost Efficiency & Not Enough Data to Assess Quality
- Quality & Not Enough Data to Assess Cost Efficiency
- Quality & Did Not Meet Cost Efficiency

Other possible designations include:

- Not Enough Data to Assess Quality & Did Not Meet Cost Efficiency
- Not Enough Data to Assess
- Not Evaluated
- Did Not Meet Quality & Cost Efficiency

Physician designations are subject to change. For more information on the Premium program, visit **UnitedHealthPremium.com.**

UnitedHealth Premium specialties

New specialties added in 2014 are in bold.

Allergy
Cardiology
Cardiology – Electrophysiology
Cardiology – Interventional
Ear, Nose and Throat (ENT)
Endocrinology
Family Practice
General Surgery
General Surgery – Colon/Rectal
Internal Medicine
Nephrology
Neurology
Neurosurgery – Spine
OB-GYN
Ophthalmology
Orthopaedics – General
Orthopaedics – Foot/Ankle
Orthopaedics – Hand
Orthopaedics – Hip/Knee
Orthopaedics – Shoulder/Elbow
Orthopaedics – Spine
Orthopaedics – Sports Medicine
Pediatrics
Pulmonology
Rheumatology
Urology

Answers to Health Benefits Quiz

HBE thanks you for your participation in the Knowledge = Power quiz, which was intended to help you learn more about your benefits. By gaining knowledge and taking action, you can live a healthier life and potentially lower your medical costs. The results of the quiz have been calculated and you did exceptionally well! The quiz was taken 7,200 times total and over 2,200 scored over a 91%. Even more impressive, 725 individuals scored a perfect score of 100%! The average score of the 23 question quiz was 78%, up from 60% from the previous quiz in summer 2013.

According to the results, the two most widely missed questions are below:

1. If I have family medical coverage through Sandia, how much will Sandia contribute to my Health Reimbursement Account (HRA) if my spouse and I both complete the health assessment and the maximum Virgin Pulse activities possible?
   a. $750
   b. $500
   c. $1250
   d. It depends on the results of my health assessment
2. Which pays first?
   a. Health Reimbursement Account then Flexible Spending Account
   b. Flexible Spending Account then Health Savings Account
   c. Health Reimbursement Account then Health Savings Account
   d. Flexible Spending Account then Health Reimbursement Account

Remember, your Flexible Spending Account (FSA) always pays before your Health Reimbursement Account (HRA) because the FSA is your money (from salary contributions) and is 'use it or lose it' with no rollover. The HRA, however, has the ability to be rolled over to a maximum amount.

Also, a family enrolled in Sandia Total Health can earn up to $1,250 in their HRA by:

- Completion of health assessment by both member and spouse ($250 each)
- Child(ren) automatically funded $250 (health assessment not applicable)
- Maximum participation in VHM program by both member and spouse ($250 each)

For the individuals who participated in the Knowledge = Power quiz and earned 70 percent or higher, you can expect your 1,000 VHMs to be credited to your account by Feb. 3, 2014.

Look for our next quiz on consumerism in the spring of 2014. Again, thank you for your participation and please stay tuned for more chances to earn VHM for your 2015 HRA.

Sandia's Kauai Facility impresses visitors

SANDIA PRESIDENT AND LABS DIRECTOR Paul Hommert saw a successful intercept of an Aegis Readiness Assessment Vehicle (ARAV) ballistic missile target, part of the Missile Defense Agency's (MDA) Flight Test-Standard Missile-21 mission (top photo), during a recent week-long visit to Sandia's Kauai Test Facility (KTF) in Hawaii. In the second photo, Paul was accompanied by, from left to right, Integrated Military Systems Director David Keese (5400), site manager Reuben Martinez (5419), manager Steve Lautenschleger (5419), Deputy Director Vincent Salazar (5410), and government affairs officer Danny Milo (166). During the trip, Paul met with key customers, sponsors, and partners within the Pacific region, including representatives from US Pacific Command, the Navy's Pacific Missile Range Facility, the University of Hawaii, and the MDA. He also learned about KTF's test and evaluation support on Super Strypi, the Advanced Hypersonic Weapon, ARAV, and energy surety. Paul says: "Sandia's operations at KTF support some of our most critical national security missions, including our nation's ballistic missile defense system and developing next generation hypersonic capabilities. I am deeply impressed by the commitment of our KTF staff to this important work. KTF is integral to Sandia's mission as a national security laboratory."

Sandia Classified Ads

MISCELLANEOUS

ARMOIRE, custom, wood, 41-1/2"W x 69-3/4"T, 30-1/4"D, photos available, $200. Benavidez, 505-270-4577.

WOOD, 4 ea., 1 x 12 x 8' & 2 x 4 x 93", plus 16 shelf brackets. Moreno, 266-8498.

ELECTRIC STOVE, dishwasher, Frigidaire, white, never used, $250 ea. Provoost, 639-9965.

BICHON/MALTESE PUPPIES, 10 wks. old, located in Bernalillo Co., 2 females, 1 male. Romero, 505-306-8815.

BEDFRAME, Hudson queen, Pottery Barn, 2 yrs. old, some scratches from move, great condition, $850 OBO. Churchwell, 385-3585.

JUNIORS WOMEN'S CLOTHING, sizes XS-M, Bebe, Guess, etc., heel/pumps, size 6 & 6-1/2, new. Valasquez, 610-3672.

ADDAMS FAMILY TICKETS, 2, Popejoy, 1 p.m., Saturday, March 23, balcony aisle, $20 ea. Witt, 991-1878.

LCD FLAT PANEL TV, 55-in., Toshiba, excellent condition, paid $1,000, asking $450. Low, 379-0441.

STATIONARY RECUMBENT BIKE, ProForm 955R, good condition, $100; terrarium, 10-gal., $20; misc. stereo speakers, $5-$15. Ghanbari, 883-3819.

CROSS COUNTRY SKIS, w/boots, $25; Alpina 160 w/boots, $100. Cain, 281-2395.

ENTERTAINMENT CENTER, oak, very good condition, $125 or make me a deal. Griffin, 453-7996.

HAND-MADE ITEMS: baby blankets, scarves, hats, variety of colors & styles, $30 and up. Lambert, 505-307-0916.

MATCHING CONVERTIBLE CRIB & DRESSER, Babi Italia, dark wood, brand new in box, must sell ASAP, $650. Davis, 505-918-6469.

SKI/BOARDING EQUIPMENT: 2 skis 153/120, board 150, boots 9/11/14, men's & women's, helmets XS, S, adolescent pants. Davis, 710-5807.

ELLIPTICAL, Sole E55, excellent condition, text request for photos, $500 OBO. MacBain, 710-2530.

QUEEN MATTRESS, w/box spring, Sealy Posturepedic, rarely used, $400. Hennessey, 915-241-8634.

COFFEE TABLE, 2 pc., configured square or rectangle, $85; desk on rollers, bottom pullout shelf, $100. Skarda, 505-331-2852.

SKI RACKS FOR SUV, w/roof rails, 2 pairs, $50/pair; cross bar for Lexus roof rails, $50. Gough, 822-0090.

COUCH SET: off-white, microfiber, full length & loveseat, like new, $500; leather couch, tan, reclines, full length, like new, $500; photos available. Kappelman, 440-4877.

SOFA BED, full size, beige, 76-in. wide, photos available on request, $195 OBO. Brooks, 797-7703, ask for Carlton.

ETHERNET & Wi-Fi ROUTERS/EXTENDERS, misc. cables & hardware, cheap, will email list; old Acer laptop, $95. Cocain, 281-2282.

PDP JR DRUM SET, black, 5-pc., w/throne, $185; new Pearl 10-in. silver drum w/roller case, $180. Pena, 271-5222.

LOUDSPEAKERS, Klipsch Forte, oiled oak finish, excellent condition, $475/pair OBO. Stubblefield, 263-3468.

ELECTRIC HEATERS, 2, $12 ea.; stadium folding seats, 2, hardly used, $20 ea. or $35/pair; BBQ grill, small, portable, $25; other RV items. Garcia, 554-2690.

FLATWARE, Nambé, service for 8 (43-pcs.), contemporary design, excellent condition, used very little, $140. Langwell, 350-1313.

BABY/PET PLAY YARD, North States Superyard, metal, 6 panels w/gate, $50 OBO. Verley, 410-9885.

WASHER, top-load, Whirlpool, used 4 mos., $300; dryer, Whirlpool, $250; upright piano, $500. Reneau, 850-7180.

HOME GYM, Olympic Smith Machine, & adjustable dumbbells. de la Fe, 903-0717.

MIRRORED MEDICINE CABINET, 15" x 25", Broan, satin nickel, surface mount brand, new, $125 OBO. Wagner, 918-8936.

TWO FOUR-DRAWER FILE CABINETS, 15" x 18" x 52", 15" x 24" x 52", $20. Stevens, 298-7688.

TRANSPORTATION

'07 DODGE BIG HORN RAM 2500 SLT, quad cab, 4x4, 5.9 Cummins turbo diesel, $25,000 OBO. Molina, 505-6477.

'67 FORD MUSTANG CONVERTIBLE, red, beautiful classic car, daily driver, many upgrades, <book, $15,000 OBO. Varro, 505-228-7292.

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.

'01 BMW 325i, 4-dr. sedan, 1 owner, loaded, 112K miles, $5,200. Franklin, 235-7060.

'09 BUICK LUCERNE, pearl white, leather seats, 54.5K miles, evenings/weekend viewings, $15,997. Wiseman, 299-7089.

'88 PORSCHE 944, 2.5L, 5-spd., red, original owner, always garaged/maintained, 106K miles, great condition, $7,500. Danzilio, 505-908-5867.

'89 DODGE DAKOTA PICKUP, w/shell, V6, very good condition, call for more info, $2,500 firm. Garcia, 505-699-6844.

'71 MERCURY COUGAR XR7, good condition, runs great, needs some work, great for collector, $8,000 OBO. Davison, 323-9961.

'03 PONTIAC SUNFIRE, yellow, sun roof, 1 owner, low miles, 58K miles, 80K Michelins, excellent condition, $4,000. Graham, 275-2083.

'02 LEXUS ES300, V6, AT, loaded, sunroof, heated leather seats, voice navigation, tan, 67K miles, excellent condition, $11,400 OBO. Chandler, 505-610-3852.

'93 TOYOTA T100, 5-spd., V6, gold, 226K miles, recent tune-up, new parts, need around-town truck, $1,900. Wolfgang, 505-414-1483.

RECREATION

ARCTIC FOX TRAVEL TRAILER, 27-ft., sleeps 6, excellent condition, financing available, $15,995. Cox, 505-292-5568, ask for Andy or 505-321-0393, ask for Bill.

'12 FLAGSTAFF V-LITE TRAVEL TRAILER, 2 slide outs, sleeps 6, excellent condition, $28,500. Sandoval, 792-7883.

'99 KAWASAKI KX100, lime green, bell helmet & eye-wear included, Edgewood area, photos available, $750 OBO. Sanchez, 505-908-5981.

FISHING BOAT, aluminum, 14-ft., w/trailer & 9.9 Merc motor, $1,200. Fenimore, 298-8052.

'06 NOMAD RV, 25-ft., slide out, extras, few miles, excellent condition, $10,900. Linebarger, 505-298-1893.

BOY'S OR GIRL'S BICYCLE, for ages 8-13, good condition, originally paid, $150, asking $45 OBO. Ludwig, 856-5111.

MOUNTAIN BIKE, women's 26x1.96 GT Aggressor, brand new, never used, proof of purchase & all paperwork, tires slimed, $250. Romero, 917-7066.

'13 WINNEBAGO ITASCA 26QP, class C, all options, Ford, 9K miles, like new, $67,500. Campbell, 294-6000.

REAL ESTATE

3-BDR. HOME, 2-1/2 baths, 1,410-sq. ft., north of Manzano Community Center, FSBO, $178,500. Wright, 332-0773.

3-BDR. HOME, 2 baths, 1,720-sq. ft., metal roof, gated 1.25 acres, water rights, fruit/nut trees, Edgewood, $200,000. McCord, 252-2248.

3-BDR. HOME, 3 baths, 1,611-sq. ft., newer, gorgeous, 12419 Fountain Hill Lane, near Tramway/Comanche, low down, real estate contract, easy terms, $209,000. Mihalik, 281-1306.

4-BDR. HOME, 2-3/4 baths, large living areas, well maintained, Sandia High district, owner will consider financing, $228,000. Mozley, 884-3453.

4-BDR. HOME, 2 baths, 1,917-sq. ft., 2-car garage, 2 living areas, swimming pool, NE Foothills, 7 mins. to KAFB, $275,000. Garley, 505-453-6785.

4-BDR. HOME, 4 baths, 3,200-sq. ft., 3 living areas, pool, Four Hills, beautifully updated. Cordova, 505-604-5307.

WANTED

OWNER'S MANUAL, '07 Crown Victoria. Chavez, 864-4893.

WOMEN'S ROAD BIKE, for training/tour this summer in CO, age not important as mid/high-end frame/components. Sais, 433-1270.

BABYSITTER, responsible high school or college student, to watch 2 6-yr. olds occasionally. Schutzberger, 505-908-7587.

ROOMMATE(S), in Volterra, 5 mins. to KAFB, $500/mo., utilities & Wi-Fi included. Guillen, 505-385-8189.

HOUSEMATE, nonsmoker, share 3-bdr. home, Juan Tabo/Menaul, extra security, washer/dryer, sauna, large pool, $450/mo. Hannah, 293-1450.

BUNK BED FRAMES, sturdy, safe, good condition, w/wo mattresses. Raglin, 797-7950.

DESKTOP COMPUTER, to replace 7-yr. old Dell, just the tower or complete setup, good condition. Jackson, 270-6387.

LOST AND FOUND

FOUND: silver earring, feather shape, found awhile back, submitted Lost/Found but didn't get a response, describe to get. Wright, 844-8681.

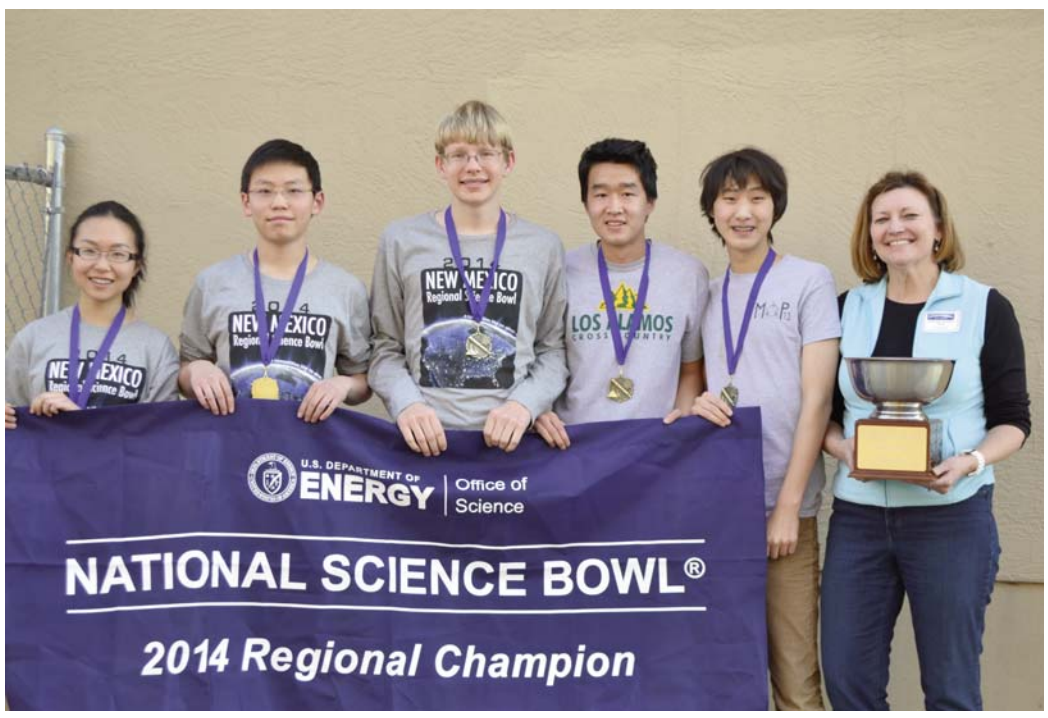
Los Alamos High School wins DOE Regional Science Bowl

Team will travel to Washington, D.C., to represent New Mexico in Nationals

The 2014 DOE Regional High School Science Bowl was held on Saturday, Jan. 25, at Highland High School in Albuquerque.

Sandia continues to the lead the effort on this annual event for DOE. More than 130 students from 12 New Mexico high schools participated this year. The winning team, from Los Alamos High School, will receive an all-expenses-paid trip to the nation's capital in late April to compete as the New Mexico representative at the DOE National Science Bowl. Albuquerque Academy's team took second place and Eldorado High School claimed third.

STAGING THE DOE Regional Science Bowl, coordinated by Community Involvement Dept. 3652, wouldn't be possible without a dedicated team of volunteers. (Photo by Rachel Baros)



AS THE WINNING TEAM, Los Alamos High School will receive an all-expenses paid trip to Washington, D.C., to represent New Mexico at the National Science Bowl.

(Photo by Cheryl Garcia)

22 middle school teams design cities of the future

Twenty-two teams competed for New Mexico's first regional title at the National Museum of Nuclear Science and History in Albuquerque on Jan. 25. Xenex City from Albuquerque Academy took home the Winner's Cup.

The Future City Competition is a national, project-based learning experience where students in 6th, 7th, and 8th grades imagine, design, and build cities of the future. Students work as a team with an educator and engineer mentor to plan cities using SimCity software; research and write solutions to an engineering problem; build table-top scale models with recycled materials; and present their work to a panel of judges. More than 70 students from 22 New Mexico schools participated in this event. The New Mexico regional competition provides a unique opportunity for middle school children to sharpen their skills in engineering, planning, writing, and art to create a vision for the future. Learning how the infrastructure of towns is built and how the resources are shared are essential for ensuring sustainable growth for communities. The winning team from Albuquerque Academy will represent the New Mexico region at the national competition in Washington, D.C., this month.

Sponsors of the regional event included Sandia, Los Alamos National Laboratory, the UNM School of Engineering, and other organizations committed to encouraging STEM education. (Photos by Randy Montoya)

Mileposts

New Mexico *photos by Michelle Fleming*
California *photos by Dino Vournas*

Vernon Koonce
40 6621

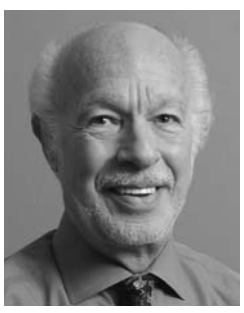
Robert Martinez
35 6811

Neall Doren
30 5962

Recent Retirees

Keith Almquist
35 241

John Nevers
34 5644



Warren Klein
30 260

David Kozlowski
30 5416

Dean Rovang
30 1688

Jeffery Adams
25 10264

Gary Richter
30 8116

Jeff LaChance
15 6231

Jill Micheau
15 8539

Joe Aranda
25 4847

Michael Garcia
25 2663

Patrick Garcia
25 4237

Jay Jakubczak
25 2800

Barbara Wampler
25 5788

Michael Lopez
20 2728

Chris O'Gorman
20 2159

Paul Resnick
20 1719

Mark Spoonamore
20 9547

John DeBassige
15 433

Jason Krein
15 5447

James Romero
15 4236

Joe Rudys
15 1353

Dennis Wilder
15 6532

Timely training by Sandia Emergency Management saves lives

By Bill Murphy

Ricardo Paz (4236), an Emergency Management trainer, has built his career around training first responders in the skills they need to keep a patient alive, to buy precious minutes until a patient can be handed off for more advanced medical treatment.

It's often the case in Ricardo's line of work that the rewards are a bit abstract: You trust you're making a difference but the tangible evidence is elusive. That's why an email Ricardo received recently made his day. It's the kind of message that anyone in the lifesaving professions treasures. The email, from a Bernalillo County Fire Department Emergency Medical Services (EMS) captain, read:

"Hello Ricardo,

"I just wanted to say thank you. With your push to get tourniquets into the protocol, you have saved several lives that otherwise might not have had a chance this month. Thank you."

Here's the rest of the story:

Now a fulltime Sandian, Ricardo started out as a part-time contractor, during which time he also provided training to another agency, including tourniquet training and wound care training.

In researching the merits of tourniquet training, Ricardo came across an FBI study on law enforcement officers down. In the study, which looked at 3,000 cases, 44 percent of those who died in the line of duty died because they didn't know how to manage or stop an extremities bleed or manage an extremities wound on themselves. Knowledge of tourniquet use would have made the difference between life and death in many of those cases.

Convinced of the lifesaving potential of the training, when Ricardo became a fulltime Sandian he approached his manager, Eugene McPeek (4236) in Emergency Management, and requested support for offsite training to qualify fire department trainers to teach tourniquet use/wound care training. Eugene was immediately agreeable.

With that go-ahead, Ricardo began training Albuquerque Fire Department (AFD) instructors, who in turn started training hundreds of Albuquerque Police Department (APD) officers on how to use tourniquets.

At the same time, Ricardo was serving as the Sandia Clinical Services representative at the Bernalillo County EMS Providers Advisory Committee, made up of representatives from the various agencies in Bernalillo County that provide EMS services. The group meets periodically to discuss needed improvements and changes to protocols, the guidelines that define how to treat patients in the field.

Recalls Ricardo, "With this tourniquet training and the exposure that I've had, I strongly felt that we needed to include commercial tourniquets into that protocol and into all EMS units in Bernalillo County. I made the case and the consensus of the group was yes, let's make that happen."

RICARDO PAZ (4236, right) worked closely with Albuquerque Police Department Det. Cameron Johnson and Albuquerque Fire Dept. Lt. Stephany Perea to provide tourniquet training for APD officers. Under Ricardo's leadership, Sandia's Emergency Management organization hosted the courses Johnson and Perea needed to complete the instructor training. The two, in turn, taught tourniquet use to the hundreds of APD officers. The skills taught have already helped save lives. (Photo by Randy Montoya)

In addition to adding tourniquets to EMS units in the metropolitan area, Emergency Management's offsite training support has resulted in hundreds of APD officers being trained on tourniquet use. According to AFD Lt. Stephany Perea, lead instructor for the tourniquet training provided to APD, plans are in the works to ensure commercial tourniquets become part of officers' individual first aid kits.

> *"The greatest good is human life. The fact that this training is working, that it's making a difference, that means a lot."*
>
> **— Ricardo Paz**

Within the course of a single week, two civilians in separate cases suffered leg injuries in accidental firearm discharges. In both cases, the first responders on the scene were APD officers who had received the tourniquet training.

As Ricardo describes one of the two civilian cases, "[The police officer] applied a tourniquet on the patient's leg, he applied a pressure bandage over the wound itself, and he knew how to properly cover that patient to prevent hypothermia. That's vital because when you bleed out you're at a higher risk for hypothermia. And when you're hypothermic if affects your clotting ability and so you continue to bleed."

A third case was the high-profile shooting last fall that involved police officers and a Bernalillo County Sheriff's officer, Robin Hopkins, who was shot in the leg and was bleeding profusely.

"Because her fellow officers had the tourniquet and the training, she is alive today," Ricardo says.

"It's humbling," he says. "The greatest good is human life. The fact that this training is working, that it's making a difference, that means a lot."

Ricardo says the training and integration of tourniquets in the protocols has been an ongoing process.

"I'm just one person. It's been a collaboration from the start and everyone who's been a part of it feels the same way I do."

In addition to the support from his manager, Ricardo cites the support of Senior Manager Mike Schaller of Security and Emergency Management Organization 4230 and Clinical Services Dept. 3331 Manager Anna DeCoste.

Sandia Medical and Emergency Management's Emergency Response Team added tourniquets to their EMS equipment; Ricardo notes that the Sandia ProForce is in the process of getting the same training and equipment that have been provided to APD and AFD. "The same protection that is now there for people living in Albuquerque," he says, "will also be there for members of the workforce here at Sandia."

TOURNIQUET TRAINING during recent Robot Rodeo event at Sandia. (Photo by Randy Montoya)

Tourniquet use has overcome long-standing stigma

Battle-tested research has demonstrated convincingly that properly applied tourniquets can save lives. However, as recently as the 1980s there were no commercial purpose-made tourniquets available. Tourniquets were treated as ad hoc devices, something improvised in the field as needed. A belt, a strip of cloth, a triangular bandage — anything at hand might serve as a tourniquet, but those solutions, while they helped some, were not reliable at stemming a severe bleed. Hard to get them tight enough, and that's vital. An effective tourniquet needs to be tight, tight, tight — tight enough to hurt.

According to Sandia Emergency Management trainer Ricardo Paz, a lack of good information gave tourniquet use a bum rap.

"For years there was a stigma around them," Ricardo says. "For instance, let's say we were hunting and you accidently shot yourself in the leg. The old stigma was that if you have a tourniquet on for more than an hour, you are going to have to amputate that leg or that arm. For emergency medical technicians (EMTs) and so on, that stigma, that false information, influenced treatment guidelines. It turns out, though, that a study performed by the US Army shows that tourniquets on soldiers in Iraq for six, eight, 10-plus hours were observed. Not one limb loss was due to tourniquet use."

Stopping the bleeding is the all-important issue; in a significant arterial bleed, you bleed about a liter per minute. "If you don't have a tourniquet on that wound," says Ricardo, "in as little as two to three minutes you're gonna die."

Learning proper tourniquet use, Ricardo says, doesn't make law enforcement personnel medical professionals, but it buys them time.

"The beauty of this training is that it's not that complicated," he says. "Learning how to stop a significant extremity bleed is simple to do. That's why law enforcement likes it: because it's effective and it's easy to do.

"What's taught is that every drop of blood counts. If you have already lost blood, you need to save every drop you still have. Blood is life."