

**It really IS  
rocket science!**

"IT REALLY IS ROCKET SCIENCE!" is a new documentary about the history of Sandia's aeroballistics programs, which over time earned the Labs a reputation as one of the world's leading R&D facilities for all things "aero." The image above, from the documentary, shows Army personnel at

White Sands Missile Range post-war conducting tests on captured German V-2 rockets. This isn't a Sandia image but conveys the state of rocketry at the time the Labs began its own aero programs. Read more about the award-winning documentary by Myra Buteau on pages 6-7.

**Meet 87 distinguished Sandians**



Sandia's special appointments represent employees from all areas of the Labs' operations. This year, 87 Sandians have been honored with special appointments, including Senior Administrator Elizabeth Roll (100), left. Photos of new "Ds" and "Seniors" on pages 6-7.

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# Sandia**LabNews**



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# Trustworthy **Overcoming the trust barrier in NW verification measurements**



**Method supports real-time warhead verification without revealing design data**

*By Patti Koning*

**T**rust but verify. The catchphrase for arms control popularized by President Ronald Reagan sounds simple. However, verification involving sensitive data is a very complex endeavor.

Verifying that a nuclear warhead actually is a warhead may include confirming key attributes. But the act of confirming certain technical attributes might reveal critical design information — closely guarded national secrets for any country. Confirming these attributes will likely require overcoming the hurdle of protecting sensitive design data.

Sandia physicist Peter Marleau (8727) has developed a new method for verifying warhead attributes.

*(Continued on page 4)*

BRAIN TRUST — Researchers, left to right, Peter Marleau, Patricia Schuster, and Rebecca Krentz-Wee have developed a new method for verifying warhead attributes. (Photo by Dino Vournas)

## That's that

We know the story of how the scientists and engineers at Los Alamos and other sites associated with the Manhattan Project developed the atomic bombs that ended World War II. The ultra-secret project, which brought together for a singular purpose some of the most gifted technical minds in the world, was emblematic of the changing nature of war in the 20th century, where developments in the laboratory had a profound effect on results in the theaters of combat.

But not all technical achievements in World War II were confined to the lab; the accomplishments of American industry were astonishing. The transformation of the nation's productive capacity to meet the demands of a global war is the stuff of legends. The output of America's factories, farms, forests, and mountains fueled the war effort on every front from the arctic to the tropics.

I remember reading an account of the Battle of the Bulge where a German soldier noted that he finally and truly knew the war was lost when on Christmas Day 1944 he had gone without food for several days while he watched American aircraft drop hot Christmas dinners to US soldiers on the front lines.

Every single aspect of the war had an engineering backstory. How do we feed our troops? How do we move them? Arm them? Clothe them? Heal them? Train them? How do we grow from a 350,000-man pre-war military (Army and Navy) to a force that by 1944 numbered 12 million personnel engaged in operations across the entire planet? These were immense challenges that demanded engineered systems solutions.

Airfields where there were none, pipelines laid under angry seas, bridges across raging torrents, roads hundreds of miles long through the most inhospitable terrain on Earth – these were just some of the things engineers were asked to accomplish throughout the war. Inventing solutions on the fly was standard operating procedure.

As I write this, we are about to observe the 73rd anniversary of D-Day, the landing by Allied forces on the beaches of Normandy that marked the beginning of the end of Nazi Germany. Just coincidentally, I've been reading Dwight Eisenhower's personal memoir of the war. In his role as supreme commander of the Allied forces in Europe, Eisenhower oversaw the D-Day invasion. In his book *Crusade in Europe* he marvels constantly at how Allied combat engineers accomplished the seemingly impossible to help advance the war effort.

He recounts that during the North Africa campaign, engineers worked "miracles" to improve a decrepit rail line leading to the front. "When we went into North Africa," Eisenhower wrote, "the railway could daily deliver a maximum of 900 tons of supplies. By introducing Yankee energy and modern American methods of operation, [engineers] increased the daily tonnage to 3,000. . . ."

Then there was the story of how American engineers constructed in a matter of days an airfield in seemingly impossible terrain on a small rocky island off the coast of Malta. "This story was told to me over and over again by British officers whose admiration for American engineers was scarcely short of awe," Eisenhower wrote.

Time and again, Eisenhower credits the engineers with being key enablers of victory, noting many examples in his book of what they were capable of doing "when faced with stark necessity."

Dwight Eisenhower was elected president in 1952; his wartime experience with engineers in the field, as well as his recognition of the indispensable contributions of scientists and engineers in the laboratory, left an indelible impression. He fully understood that science and engineering would play an increasingly important role in ensuring the nation's security. As a result, he established the President's Committee on Scientists and Engineers in 1956 to promote a substantial growth in what we would now call STEM professionals. In 1958, in response to the Soviet Union's Sputnik shock, Eisenhower authorized the Advanced Research Projects Agency (ARPA, later DARPA) to advance the frontiers of science and technology beyond immediate military needs and to help America avoid technological surprise.

While he always put the nation's security first, Eisenhower used the power of his office to passionately advocate for peaceful solutions to mankind's problems. He had seen up close how human ingenuity could win wars; he deeply believed that same capacity could win peace.

In his farewell address to the America people, the popular outgoing president said, "America's leadership and prestige depend not merely upon our unmatched material progress, riches, and military strength, but on how we use our power in the interests of world peace and human betterment."

That sounds an awfully lot to me like the way we express our highest purpose: "Sandia develops advanced technologies to ensure global peace." I think Ike would like that.

See you next time.

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

## Employee death

### Randy Shibata found possibilities in the impossible

As he was getting ready to retire, colleague Lori Belcher recalls, Randy Shibata had a story for every binder he picked up to pack away. Randy, a subcontract manager in Agile Procurement Dept. 10247, passed away on May 13 before his retirement became final. He was 62 and had been at the Labs for more than 30 years.



RANDY SHIBATA

Lori, who worked with Randy for just a few months, didn't know him as well as some, but found that "he was always friendly and always had a story to tell about how significantly Sandia's policies had changed over the years."

"I am totally convinced he could have done his job with his eyes closed," Lori says. "Sandia lost a great man when he retired but the world lost a great man the day he took his last breath."

Krista Smith, senior manager in Procurement Operations Dept. 10240, recalls that "Randy's knowledge of contracting was so deep that he could find the complexity and nuance in even the most simple situation. This is when we lovingly say that he 'Shibatamized' it."

"Randy's impact will be felt for years to come," says Jac Pier, Randy's manager in Dept. 10247. "He combined an incredible depth of knowledge with creativity and outside the box thinking to become a true master of his craft."

Jac says Randy was often sought out when a buyer had run out of ideas and needed help coming up with a creative solution while staying within the rules. "He had a passion for mentoring and enjoyed teaming with new buyers on complex procurements. His passion, dedication, and personality will be sorely missed and I consider myself lucky to have had the opportunity to know him."

Mark Ivey, a geosciences engineer in Atmospheric Sciences Dept. 8863 and longtime customer, says Randy helped his organization immensely with its projects on the North Slope of Alaska. "He led a procurement team that supported our division (6000) and became an essential member of our team," Mark says. "I often received emails from him on weekends and evenings, signaling the dedication he showed toward his work at Sandia."

Mark recalls the time in August 2010 when Randy joined him on a trip to Barrow, Alaska, and saw firsthand the facility that he helped build through many procurements he and his team helped complete.

"During his stay," Mark says, "we walked down to the shoreline of the Arctic Ocean. Randy took off his shoes and dipped his foot in the ocean, something he mentioned to me afterwards as a highlight of that trip and of his work with our team. We will miss Randy."

Procurement policy analyst and colleague Anne Rimbart calls Randy "the ultimate embodiment of an outside the box thinker. I often found myself amused when I reviewed his contracts because he came up with very original arguments I could not dispute," Anne says. "How he came up with them, only God knows. He found possibilities in the most impossible situations. He will surely be missed." — Bill Murphy

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## Driven to succeed



PAUL APODACA (10261), a special materials handler with Sandia's Corporate Storage team, has been honored by the New Mexico Trucking Association as a New Mexico Safe Driver of the Quarter. Criteria for the award include zero accidents (30-plus years on the job); the nature of the job (high-risk); a commitment to personal safety and the safety of others; and a commitment to the company and self. Paul competed along with drivers from FedEx, UPS, ABF Freight, Groendyke Transport, Walmart, and others. (Photo by Randy Montoya)

## Tough talks promote diversity and inclusion during two-day summit

By Jules Bernstein

Creating a culture where everyone feels valued, respected, and engaged requires honest, ongoing dialogue. That's exactly what dozens voluntarily came together to do during a recent Workplace Inclusion Learning Summit at Sandia's California lab.

Arthur Brown (8529) explains why he took the time from his busy schedule to participate on April 26 and 27: "Gaining insights about unconscious biases and their negative impacts on hiring, productivity, and general well-being of Sandians can be emotionally challenging, but it is well worth the effort."

Many attendees report the summit opened their eyes to bias in the workplace that they previously hadn't noticed. In addition to race, gender, and sexual orientation, discussions centered around the ways in which characteristics such as economic status, physical disabilities, or mental health issues can impact a person's ability to fully participate in group settings and bring their best ideas to the table.

"The activities and discussions heightened my awareness of people with characteristics that are not easily visible, and who could be trying to hide these for fear of not being accepted," says Kanamu Pupuhi (8135).

One activity in particular helped set the tone for the two days that followed. A moderator held around 40 cards, each containing a statement that could describe a facet of a person's identity, such as "I am a woman" or "I am under 35." Members of the group were asked to cross the room if they identified with a particular card. Statements became progressively more sensitive, with identifiers that included divorce or family members in prison.

Reflecting on the overall experience, Keita Teranishi (8753), says, "I would not have noticed my own biases if I did not participate in the summit. This is for sure." Going forward, Keita says he plans to emphasize a broader range of characteristics when considering applicants for intern positions.

That participants arrived with a willingness to be open with one another contributed to the success of the event, according to Erin Mussoni (8253). "I wish there was a way to give every person at Sandia this training, so they could understand that diversity and inclusion isn't about scolding people in dominant social groups," she says. "Rather, it can be about teaching people to become analytical about difficult situations and give them the skills to become allies to their colleagues."

Members of the workforce wanting to keep the conversations going should check



out the diversity and inclusion websites ([tiny.sandia.gov/z93wy](http://tiny.sandia.gov/z93wy); [tiny.sandia.gov/uox7f](http://tiny.sandia.gov/uox7f)). There, they'll find a five-year strategic plan to further promote inclusiveness as well as links to a number of supportive employee resource groups and a calendar of related upcoming events. Summit organizer Kelly Nykodym (8522) has an optimistic outlook on the future. "With honesty and effort, Sandia will continue to cultivate a culture of inclusion on campus," she says.



## Sandia recognizes innovative Livermore teachers

By Madeline Burchard

Teachers are no strangers to surprising their students, but in late April, the tables were turned on Livermore teachers Fenna Gatty and Gretchen Reynolds. In front of their students and colleagues, they were surprised as the winners of the Excellence in Teaching Award presented by the Livermore Valley Education Foundation (LVEF) and Sandia.

The award is presented annually to teachers in the Livermore Valley Joint Unified School District who use innovative ways to make science, technology, engineering, and mathematics (STEM) come alive for their students. The honor comes with a \$500 cash award to each teacher.

Gatty and Reynolds were also recognized at the May 2 LVJUSD board meeting.

### Fenna Gatty – Leading the way in elementary schools

Gatty, a science teacher at Altamont Creek Elementary School, was nominated for her student-centered approach to education and unrelenting enthusiasm. She says she believes in using the latest technology and emerging teaching best practices to engage her students.



FENNA GATTY's students videoconference with a pilot (left on screen) and a computer scientist (right on screen).

"Ms. Gatty always teaches with a smile and shows enormous grace and resilience," says Altamont Creek principal Tara Aderman. "Her collaborative mindset and positive attitude toward change and new ideas make her an innovative teacher."

Some of her most recent projects include:

- Launching the "Project Lead the Way" program for the school district, which has been so successful that she has been invited to present at conferences and train others. Project Lead the Way taps into students' exploratory nature and engages them in learning that feels like play via hands-on activities.

- "Change My World Now," a social network that



STUDENTS IN ALTAMONT CREEK'S outdoor classroom look at a flower petal under a microscope.

allows students to explore ways they can use their unique talents to make the world a better place.

- Video calls with STEM professionals such as pilots and computer scientists, allowing students to interact with inspiring individuals without having to leave their classroom.

- An outdoor classroom where students can learn about Bay-friendly landscaping, birds, nutrition, agriculture, and ecology. The garden also features an area for students to write, read, sketch, and measure.

### Gretchen Reynolds – Going against the stream

Science teacher Reynolds helps inspire students following an atypical path at Vineyard High School, an alternative school helping everyone from elite athletes to those needing more flexible study plans to achieve their academic goals.

Reynolds incorporated hands-on science and engineering activities into Vineyard's science and engineering curriculum, including adding a year-long field research study to the biology course. Her students regularly travel to Sycamore Grove Park and conduct water quality testing and wildlife identification to study how the ecosystem changes over the course of a year. When the park flooded earlier this year, she adapted her lessons to draw the students' attention to its relevance to their ecosystem studies.

Because of Reynolds' work to redesign the biology course, students may now be credited with completing

a University of California-approved lab science course.

The impact has gone beyond college credit; one of her students completed an internship with the city of Livermore's Water Resources Division, helping organize events for the international Coastal Cleanup Day program.

"I enjoy being out in nature," Reynolds says. "I find purpose in making a difference in the lives of youth. My position at Vineyard allows me to follow both of my passions."

Reynolds is not finished seeking new ways to engage students with STEM. She recently completed a master of education in curriculum and instruction from Concordia University in Portland, with an emphasis on STEM. Her thesis project examined the impact of positive academic feedback on student performance.

### STEM education a priority for Sandia

In 2007, Sandia established an endowment with LVEF to fund the Excellence in Teaching Award. School and district leadership nominate teachers for consideration. The applications are reviewed by a panel of judges composed of LVEF board members and Sandia employees. Nominees are judged on their use of unique and innovative methods for engaging students with STEM.

The Excellence in Teaching award is just one way that Sandia supports STEM education in the community. Other programs include Family Science Night, the DOE Science Bowl, and the Sandia Women's Connection Math and Science Awards.

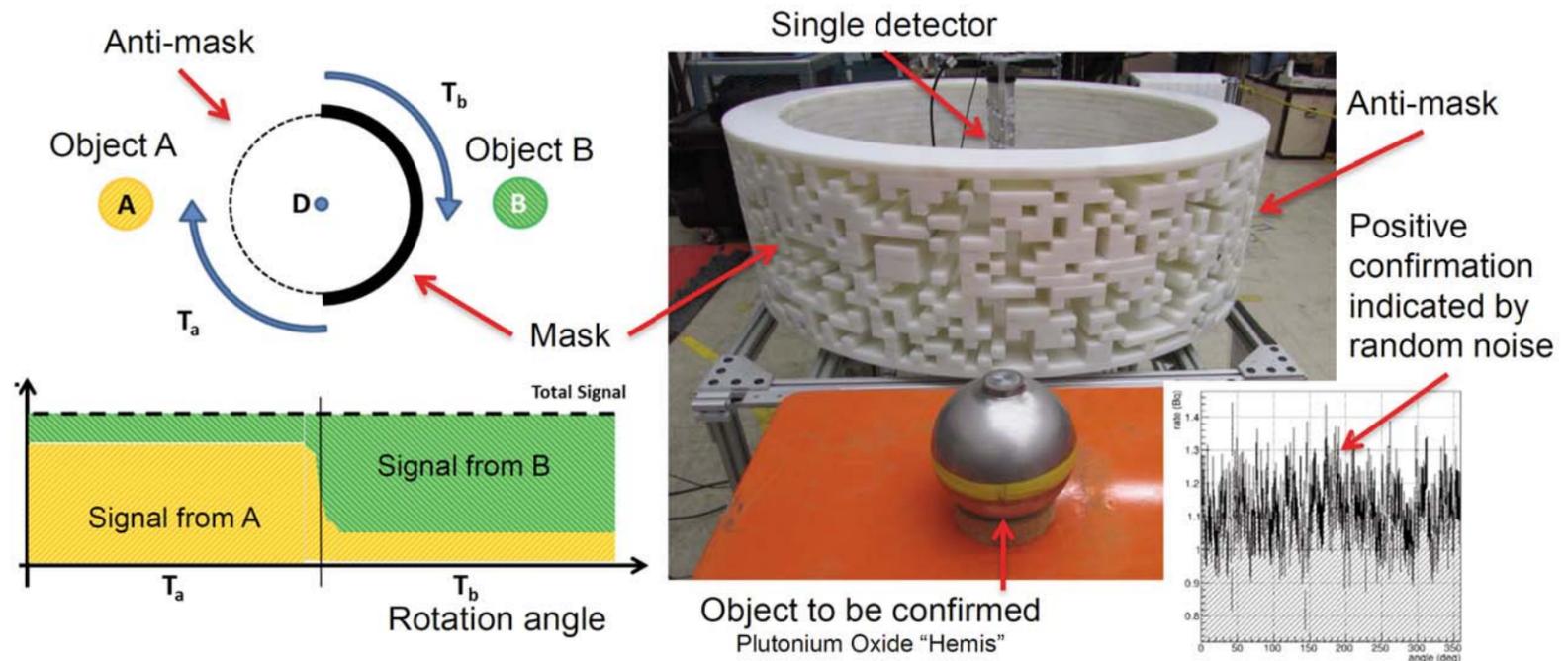


GRETCHEN Reynolds' students take data from a creek in Robertson Park as part of a year-long field research study.

# CONFIDANTE



## CONFIRMATION using a Fast-neutron Imaging Detector with Anti-image NULL-positive Time Encoding



CONFIDANTE — (Left top) Top view of the simplest illustration of the CONFIDANTE concept. One half of the mask is the anti-mask of the other. (Left bottom) If A and B are identical, then the sum of signals (y-axis) will be consistent with random noise as a function of rotation angle (x-axis) even though the contributions from A and B vary. (Right) Photograph of the CONFIDANTE prototype confirming two objects are identical as indicated by a completely random signal (right inset).

## Trustworthy

(Continued from page 1)

Called CONFIDANTE, for CONFIRMATION using a Fast-neutron Imaging Detector with Anti-image Null-positive Time Encoding, the method could help address the problem of conducting verification measurements while simultaneously protecting sensitive design information. CONFIDANTE provides middle ground for the warhead owner, or host, who wants to protect sensitive information, and the monitor, who may be seeking to verify that sensitive information to confirm the inspected item is a warhead.

“CONFIDANTE is an implementation of a zero-knowledge proof (ZKP) as a way to demonstrate the validity of a claim while providing no further information beyond the claim itself,” Peter says. “Unlike other ZKP confirmation methods, which rely on a measuring instrument that has been pre-loaded with sensitive information, CONFIDANTE allows the monitoring party to conduct the measurement in real time without accessing sensitive design data.”

### Overcoming the trust barrier with ZKP

About three years ago, DOE’s Princeton Plasma Physics Laboratory and Princeton University developed a ZKP object-comparison system to potentially support warhead confirmation while protecting sensitive design data. In mathematical cryptography, ZKP is accomplished by challenging a host to solve a problem that is only possible if the host possesses the information being authenticated. After repeated challenges, the host can prove it possesses that information without revealing any details about the information itself.

In the Princeton group’s ZKP implementation, confirmation that an alleged warhead has the characteristics of a warhead is demonstrated through neutron transmission and emission counts measured by an array of radiation detectors. To protect sensitive design data during the measurement process, the Princeton method prepares the radiation detectors with a template rather than directly comparing in real time the images of a warhead being verified with a trusted warhead.

The template is the complement of the measurement expected from a real warhead. If the two match, they cancel each other out, leaving only statistical noise, yielding no further information. The templates are effectively destroyed by the measurement, so the monitor does not have the opportunity to maintain the data to which a measurement is compared.

“But to protect the sensitive design data, the template, the process of pre-loading it, and the detector itself, will be off limits to the monitoring party,” Peter says. “All of this, including the actual measurement,

must be conducted by the host. When the monitoring party loses control of so much of the measurement process, it becomes difficult to trust its authenticity.”

### Monitor-controlled, real-time authentication

Peter, his colleague Patricia Schuster, a University of Michigan postdoctoral fellow, and Rebecca Krentz-Wee, a University of California, Berkeley nuclear engineering graduate student, set out to solve this problem.

“We asked ourselves, is there a method that maintains the nice property of a positive match indicated only by statistical noise while allowing a monitoring party to be in control of the detector during the entire

*“I believe CONFIDANTE has the potential to open new possibilities in treaty verification. With technical solutions in place, parties may be more willing to engage in negotiations.”*

— Peter Marleau

measurement process?” says Peter.

The three explored different concepts that might provide more practical and verifiable ZKP implementations. One promising solution is time-encoded imaging (TEI), a method Sandia developed over the past five years with funding from NNSA’s Defense Nuclear Nonproliferation Research and Development program.

TEI is a new approach for indirect detection and localization of special nuclear materials. It relies on encoding directional information in the time-dependent modulation of fast neutron detection rates. Sandia developed TEI to overcome the precise calibration and high cost of typical detection, which uses arrays of detectors.

TEI uses a single detector within a cylindrical coded mask. As the mask rotates, radiation from the object is modulated by a pattern of apertures and mask elements on the cylinder. Using TEI, a single detector can do the work of multiple detectors in creating an entire two-dimensional image of the object.

“We realized that if we designed the mask such that the pattern on one half of the cylinder is the inverse of the other half, an object on one side of the system will project the inverse image of an object on the opposite side of the system at all times if and only if the two objects are identical. The image and anti-image will effectively cancel each other out and the detector will show a constant unmodulated rate,” Peter says. “And we can do it without ever recording potentially sensitive information.”

Because no information other than statistical noise

is stored or recorded in the detector — unlike a template approach — the host party in theory can certify that no sensitive information is at risk. The monitor then can have full access to the data in real time, potentially even conducting the measurement themselves. Using this method, two objects can be confirmed as identical. To prove in addition that they are warheads, both negotiating parties would need to agree on an authentic warhead — a “golden” warhead to be compared to any other object measured. This authenticity then transfers to all objects that have been or ever will be measured.

### Extra layer of protection

One possible glitch is that if the two objects aren’t aligned perfectly, the measurement could reveal spatial information. “A slight misalignment could reveal outlines,” Peter says.

For the verification measurement, the monitoring party only needs to confirm that the detector is measuring a constant rate consistent with statistical noise.

“You can define specific metrics that can be updated in real time and can tell the monitoring party if the data is consistent with counting statistics,” Peter says.

Distilling the data into a single number is also irreversible — meaning there is no way to reverse engineer the data to learn design characteristics of the warhead being verified even if something happened, such as accidental misalignment, that produced a false negative result.

### First proof-of-concept

The Department of State, Bureau of Arms Control Verification and Compliance through the Key Verification Assets Fund funded Sandia to perform a proof-of-concept measurement. CONFIDANTE was tested at Lawrence Livermore National Laboratory using identical plutonium dioxide hemispheres.

“We knew these two objects were identical going into the test,” Peter says. “CONFIDANTE confirmed this with unmodulated counting statistics. We also did a successful negative test showing that two different objects did not cancel each other out.”

This test demonstrated feasibility, so now the Sandia team plans to improve CONFIDANTE with a more compact gamma ray version of the imager. Peter says he also hopes to perform another feasibility test at the Pantex Plant, a DOE facility for assembly and disassembly of nuclear weapons.

“It’s critical that we continue to develop and operationally evaluate CONFIDANTE and other warhead authentication methods,” Peter says. “These tools need to be ready to go before there is an exercise or a treaty being negotiated. At that point, there is little time for research and development. I believe CONFIDANTE has the potential to open new possibilities in treaty verification. With technical solutions in place, parties may be more willing to engage in negotiations.”

# Researchers named IEEE Fellows

By Stephanie Holinka

Two Sandia researchers have been named Fellows of the Institute of Electrical and Electronics Engineers (IEEE): Bryan Oliver for his contributions to the theory and simulation of intense particle beams and plasmas, and Ray Byrne for his work on miniature robotics and grid integration of energy storage.

Bryan, who joined Sandia in October 2005, is a senior manager in Radiation Effects Sciences and Applications Dept. 1340. He previously worked at the Institute for Non-Linear Science at the University of California, San Diego; the Plasma Physics Division at the Naval Research Laboratory in Washington, D.C.; and at Mission Research Corp. in Albuquerque.



SANDIA SENIOR MANAGER Bryan Oliver has been honored by IEEE for his contributions to the theory and simulation of intense particle beams and plasmas.

Bryan's primary research areas include the theory and simulation of intense electron and ion beam generation and propagation, magneto-hydrodynamics (MHD) and Electron Hall MHD (EHMHD), Z-pinch, X-ray radiography, radiation effects, and intense electromagnetic pulse.

He has authored or co-authored more than 100 publications, received eight NNSA Defense Programs Awards of Excellence, and is a recipient of the Department of Energy Secretary's Achievement Award.

Bryan serves on the IEEE Pulsed-Power Sciences and

Technology committee, the Plasma Science and Applications committee, and the International High Power Particle Beams committee. He has served as a guest editor for the *Transactions on Plasma Science* and as an IEEE Distinguished Lecturer. In 2013, he was chair of the Pulsed Power Plasma Science conference.

Bryan received a bachelor's degree in physics from the University of California at San Diego and a master's degree and doctorate in theoretical plasma physics from Cornell University.

Electrical engineer Ray Byrne joined Sandia in May 1989, starting his career in robotics, working on tele-robotic vehicles and miniature mobile robots. In the late 1990s his team demonstrated large numbers of cooperative miniature mobile robots as part of a DARPA effort. He was recognized by *Time* magazine with one of the "Best Inventions of 2001" as part of a team that developed a miniature mobile robot.



SANDIA RESEARCHER Ray Byrne was made a Fellow for his work on miniature robotics and grid integration of energy storage.

Several of the miniature robots were inducted into the Smithsonian American History Museum in April 2011 to "reflect the historical record of robot development" through American history. From 2001-2008 he developed fiber optic links for space

applications.

More recently he has focused on optimal control of energy storage to maximize benefit to the electric grid, as well as the grid integration of renewable generation. A paper on maximizing revenue from energy storage received the Prize Paper award at the 2016 IEEE Power and Energy Society General Meeting (best four out of several thousand submissions). He also has made contributions to target tracking for an operational system. Ray has authored or co-authored more than 85 publications and was issued four US patents. He is an associate editor of *IEEE Access*, a multidisciplinary open access journal.

Ray received a bachelor's in electrical engineering from the University of Virginia, a master's in electrical engineering from the University of Colorado, and a doctorate in electrical engineering from the University of New Mexico. He also completed a master's in financial mathematics at the University of Chicago. He has been active with the Albuquerque IEEE section since 1991, serving as chair in 1993, 2007-2008, and 2010-2011. Ray serves as an ABET program evaluator for IEEE, a non-profit, non-governmental organization that accredits college and university programs in the disciplines of applied science, computing, engineering and engineering technology at the associate, bachelor, and master degree levels. Ray is president of the UNM Sigma Xi Chapter, the Scientific Research Honor Society. He is a recipient of the IEEE Millennium medal.

"It's an honor to be recognized for my work," Ray says.

The IEEE grade of Fellow is conferred by the IEEE board of directors upon a person with an outstanding record of accomplishments in any of the IEEE fields of interest. The number selected in any one year cannot exceed one-tenth of one-percent of the total voting membership. IEEE Fellow is the highest grade of membership and is recognized by the technical community as a prestigious honor and an important career achievement.

## FOSTERING A LOVE OF READING

SANDIA EMPLOYEES recently donated more than 2,000 books to the city of Albuquerque's annual Read to Me book drive. The books were distributed to 90 schools and community groups to foster literacy skills and encourage students to continue reading throughout the summer. In the photos below left, 2nd-grade students at Dolores Gonzales Elementary School pore through donated books, looking for familiar friends and new adventures. Below right, Debbie Hassi, Youth Services manager for the Albuquerque Public Library, gives an animated reading of a *Pete the Cat* story to an audience of enthralled second-graders.

Photos by Roberta Rivera





MAKING FINAL ADJUSTMENTS — In this 1970 photo, Jack Windsor, right, and Dave Preston make adjustments to a Javelin rocket before the first development test on a new launching ramp addition to Sandia's rocket sled track.

# History of rocketry at Sandia told in award-winning film, 'It Really Is Rocket Science!'

By Sue Major Holmes

*The history of rocket testing and aerospace work at Sandia is the history of aero everything.*

"There was aeroheating and aeroballistics and aerodynamics and all things aero," says Myra Buteau, a Sandia video producer whose latest half-hour documentary, "It Really is Rocket Science!" tells the story of Sandia's rocketry work beginning in 1945. The video, released this spring, won a Gold Marcom award from the Association of Marketing and Communications Professionals.

The impetus for Sandia's decades of aerodynamics research and experiments came from its work on nuclear weapons, with an underlying push from the early space race between the US and Russia in the 1950s and 1960s.

Myra, who narrates the film, points out the first atomic bombs were aerodynamically incorrect.

"The first bomb was physics rich and aerodynamic poor, meaning that the preponderance of effort was put into the physics of the device versus the means by which it was delivered," Jerry McDowell, a former deputy Labs director who retired in 2015, said in an interview with the *Lab News*. "As the US began to build a larger and more diverse stockpile it became apparent that paying attention to aerodynamic design was vital."

Myra expands on that idea. "So they started looking at how this weapon shape functions as it drops from a plane. Then they looked at the trajectory. It just kept building and building to parachutes and what does that do aerodynamically to the weapon shape and what impact does that have and how do we get it smaller?"

The story is told through interviews with 15 people, many from the World War II generation, who worked in the Labs' pioneering Aeroballistics Group. The idea for the documentary came from Jerry, who once worked in that group. Myra conducted four interviews and Jerry did the rest. He also appears in the film.

"A lot of the story was about the people, the people who did all this amazing work,"



ROCKET SLED — Dave Bickel, left, and a colleague pose at Sandia's rocket sled track in this 1989 photo. (Photo by Randy Montoya)



NERVE CENTER — The main control tower at Sandia's Tonopah Test Range was the nerve center for the range in this 1992 photo, and remains so today. (Photo by Randy Montoya)

Myra says. "A lot of it was the passion they had. You could see them reliving these events," including traveling all over the world for tests.

Since he knew those interviewed, Jerry "knew what questions to ask, knew what information we should try and pull out," Myra says.

### Rekindling memories of a stimulating time

Jerry says, "I felt an obligation to not put words in their mouths, but rather to stimulate some long-dormant memories of their contributions."

"I hope today's Sandia employees will see a sense of pride and devotion to country in the rocket science documentary and be inspired to carry that esprit de corps forward," he says. "The film is not intended to reflect on what was done, but rather to motivate what can be. It's this generation's turn."

Jerry says much of Sandia's success is due to the little guy, perhaps someone without a higher academic degree but with experience and common sense — a dynamic he saw in rocket field testing.

"I was one of the young PhDs hired into the group, but I learned so much more from the folks who turned the wrenches, machined metal into rocket bodies, labored night and day on the cameras at Tonopah Test Range," he says. "I hope that as Sandia embraces the toughest challenges of the future they will take a lesson from the film: Even the most ordinary of people, bound together in a great cause and led forward by determination to succeed, can change the world."

Myra had no technical background in anything aero, and jokes she felt she'd earned a degree by the time she studied re-entry vehicles, heat factors, materials science, wind tunnels, and other topics. She had to understand such things as Marchant calculators, electromechanical machines that augmented hand calculations in rocketry's early, pre-computer days.

She began her research with an inch-thick typewritten manuscript by Randy Maydew, who formerly managed the Aerodynamics Department. The manuscript covered the Labs' aeroballistics history to 1985, and Myra found people to talk about Sandia rocketry up to today. Aeroballistic work continues at Sandia.



PARACHUTE — Sandia did work on parachutes as part of its research into the aerodynamics of nuclear weapons. A new Sandia documentary traces the Labs' history in aerodynamics from 1945 to the present.



A LARGE GROUP of educators participated in a National Technical Education Clinic in April 1968 that included a tour of a rocket sled track at Sandia. The Labs has been involved in rocketry development since its earliest days.



STARMATE — A Starmate I is launched from the Kauai Test Facility in 1989. A documentary, "It Really is Rocket Science!" by Sandia video producer Myra Buteau, discusses Sandia's long history of research and development into rocket testing and aerospace work.



TARGET POSITIONER — George Revels puts a target positioner through its paces back in 1975. The positioner was used to develop more sophisticated antennas.



DORCAS GABALDON uses an optical comparator to check for flaws in a circuit board in this 1968 *Lab News* photo. She started working at Sandia in 1951, continued training in electronics, and by 1968 was a staff assistant who turned an engineer's schematic into a workable design for a printed circuit board.



DAVY CROCKETT — Dick Jorgensen demonstrates the portability of a Davy Crockett, a nuclear weapon he worked on, in this 1970 file photo. Sandia began doing research into aerodynamic design in its earliest days because of its work on nuclear weapons.



NO DESK JOB — Lance Wilson adjusts optics on a tracking telescope at Sandia's Tonopah Test Range in this 1992 *Lab News* photo. (Photo by Randy Montoya)



FIELD TESTING — Sandia launched this 12-foot, single-stage rocket from Tonopah Test Range in Nevada in 1957 in early field testing to gather data from high altitudes. Sandia has worked on rocketry and aerodynamics since 1945.



Use your phone's QR code reader to launch "It Really is Rocket Science!" or go to [goo.gl/Sd5GWP](http://goo.gl/Sd5GWP)

# 87 Sandians move into Senior, Distinguished ranks

## Senior Scientist



Chris Apblett 2500  
Materials Science

## Senior Administrator



Elizabeth Roll 100  
Executive Strategy Professional

Sandia's special appointments represent employees from all areas of the Labs' operations. According to Corporate Policy System documentation, placement in the Distinguished level signifies a promotion to the fourth level of the job. This level is populated with a select group of exceptional employees who have distinguished themselves in their careers while at Sandia. It is different from the other levels in that it is subject to a 10 percent population limit to preserve the distinction of the level. Divisions are not obligated to fill all their distinguished "slots."

Employees selected for the new levels have been recognized with a special plaque and a nonbase salary award, in addition to this special mention in the *Lab News*.

Also pictured here are individuals appointed to the very select title of senior scientist/engineer or senior administrator, a unique recognition of professional accomplishment.

### Not pictured:

Kenneth Boehmer (8749), Facilities Technologist; Greg Koenig (8843), Laboratory Support Technologist; Michael Kuehl (6533), Electromechanical Technologist; Lyle Lininger (10570), Senior Administrator, Business Management Professional; Brian Patterson (8353), Laboratory Support Technologist; Margaret Vanderheide (5191), High-Risk Security Professional; Brett Wagstaff (8226), Mechanical Engineering.



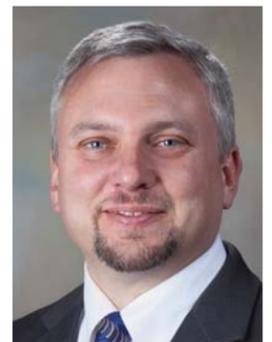
Andrew Allerman 1876  
Physics



Kathryn Aragon 1356  
Solutions Architect



Joseph Bishop 1554  
Mechanical Engineering



Keith Cartwright 1352  
Computer Science



Kevin Dowding 1544  
Mechanical Engineering



Jeffrey Gluth 1646  
Laboratory Support Technologist



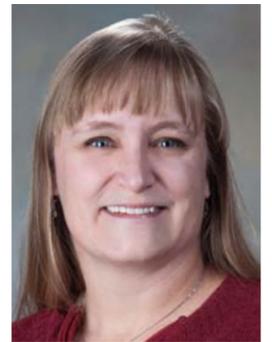
Anne Grillet 1513  
Chemical Engineering



Michael Horry 1353  
Engineering Support Technologist



Jon Ihlefeld 1816  
Materials Science



Ann Speed 1462  
Cognitive Systems



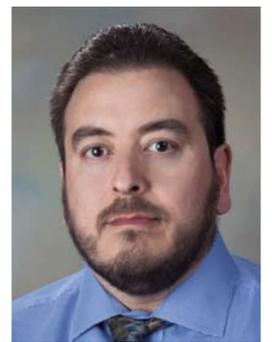
Philip M. Callow, Jr. 2635  
Electrical Engineering



Debra Clifford 2233  
Technical Writer and Editor



Evan Dudley 2553  
Mechanical Engineering



Gerald Garcia 2222  
Engineering Support Technologist



Jeremy Giron 2623  
Electrical Engineering



Regina Griego 2127  
Systems Research & Analysis



Rick Kellogg 2616  
Mechanical Engineering



Anne Lacy 2582  
Nuclear Engineering



Jesse Lai 2333  
Microwave and Sensor Engineering



Christian Maestas 2667  
Engineering Support Technologist



Albert Owen 2323  
Mechanical Engineering



Harry Pratt 2546  
Laboratory Support Technologist



Cheryl Stephens 2236  
Administrative Support



Sara Linn Szarka 2613  
Mechanical Engineering





Jason Bolles 3641  
Creative Designer



Maria Logan 3522  
Organizational Professional Dev.



Mark Olona 3653  
Test Photo. Support Technologist



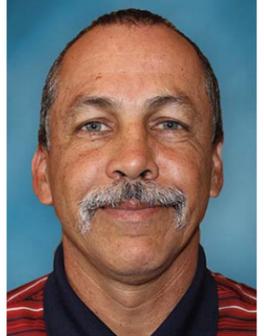
Jason James Dominguez 5225  
Electronics Technologist



Conrad James 5228  
Physics



Robert Jarecki Jr. 5246  
Electronics Engineering



David Kozlowski 5426  
Controls Engineering



Laura McNamara 5346  
Cognitive Systems



Ida Montoya 5199  
Administrative Support



Bradley Nation 5831  
Comp. Hardware Support Tech.



Jeffrey Pankonin 5352  
Microwave & Sensor Engineering

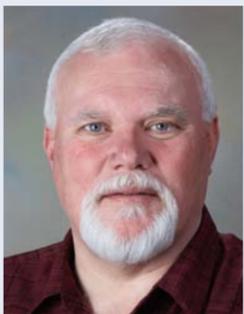


Loren Riblett Jr. 5865  
Electronics Engineering



Daniel Lynn Stick 5225  
Optical Engineering

# 87 Sandians move into Labs' Senior, Distinguished Ranks



Tim Crawford 6623  
Engineering Program/Project Lead



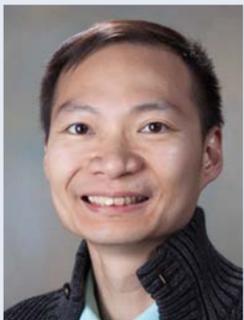
Rudy Garcia 6354  
Computer Science



William Hillbun 6756  
Physics



Karmen Noel Lappo 6648  
Materials Science



Tian Ma 6321  
Computer Science



Hans Oldewage 6634  
Engineering Program/Project Lead



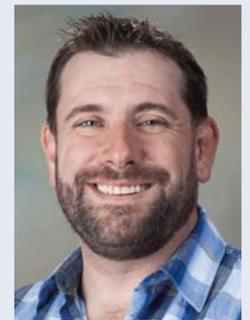
Thomas Reecer 6623  
General Technologist



John Russell 6524  
Systems Research and Analysis



Martin Sandoval 6815  
Engineering Program/Project Lead



Joshua Santarpia 6633  
Bio Sciences & Engineering



Bonnie Antoun 8343  
Mechanical Engineering



Craig Carmignani 8812  
Electronics Technologist



Robert Crocker 8737  
Chemical Engineering



Bert Debusschere 8351  
Mathematics

# 87 Sandians move into Labs' Senior, Distinguished Ranks



## Division 8000



Robert Hillaire 8248  
Systems Engineering



Larry Humphries 8852  
Nuclear Engineering



Bruce Hardison King 8812  
Systems Research and Analysis



Karen Lee Krafcik 8344  
Laboratory Support Technologist



Barbara Larsen 8516  
Environmental Tech. Professional



Peter Marleau 8727  
Physics



Jackson Mayo 8753  
Computer Science



Paul Mendes 8247  
Engineering Support Technologist



Ali Pinar 8762  
Computer Science



David Sassani 8842  
Geosciences Engineering



John Van Scyoc 8771  
Systems Engineering



Mylinda West 8155  
Database Support Technologist



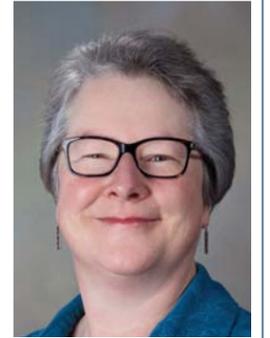
Janson Wu 8718  
Systems Research and Analysis



## Division 9000



Elmer Collins 9413  
Systems Engineering



Debra Post 9427  
Systems Engineering

## Division 10000



Diana Baca 10242  
Subcontract Manager



Manuela R. Cannady 10247  
Subcontract Manager



Delene Cox 10668  
Business Mgmt. Professional



Rose Fickling 10666  
Business Mgmt. Professional



Vicki Frahm 10601  
Project Controller



Jason David Martinez 10575  
Tech. Business Dev. Specialist



Donna Mullaney 10611  
Business Mgmt. Professional



Yvonne Petrova 10504  
Accounting Cost Analyst



Tazmin Ralph 10520  
Financial Policy & Compliance Acct.



Bridget Sipes 10519  
Administrative Support



Christopher Slater 10241  
Subcontract Manager



Michael Widmer 10742  
Solutions Architect

## Special Appointments 2017

# SANDIA CLASSIFIED ADS

## MISCELLANEOUS

**SADDLE**, Big Horn Endurance #117, 17-in., black leather & fabric, w/Weaver smart cinch, \$300. Reynolds, 505-407-4617.

**TREADMILL**, Gold's Gym, \$350 OBO; 10' x 10' shed, \$1,000 OBO. Barnard, 720-8553, ask for Mary Helen.

**LOGITECH REVUE**, used to watch Netflix & online movies (like Roku, Amazon Firestick), great condition, only used a few times, paid \$200, asking \$20. Mann, 505-604-4236, ask for Brandon.

**DELL GX280**, Pent4, w/Win7Pro, boots & runs, learn & play, free to good home w/up & coming IT geniuses, monitor separate. Jensen, 821-2373.

**WHEEL CHAIR**, \$50; full set Wilson golf clubs, \$50; a few Kachina dolls, offer. Marchi, 256-6211.

**DIERKS BENTLEY TICKETS**, w/ Cole Swindell & Jon Pardi, Isleta amphitheater, Friday, Sept. 1, sec. 7, \$85/ticket. Griffin, 822-0318.

**CUSTOM SEAT COVERS**, Coverking, taupe/black sides, Subaru Legacy/Outback (not sport) Wagon 00'-04', 50/50 bucket, \$70. Glaser, 293-8110.

**ROTATING CHILE ROASTER**, used once for testing purposes, call for details, \$1,000. Morales, 505-239-5875.

**STAIR STEPPER**, Tectrix, \$150; lateral 4-drawer file, \$150; metal cabinet, 2-dr., \$150. Logan, 459-5164, ask for Mia.

**CUFF BRACELET**, sterling silver, Navajo 'TAHE', 8mm wide, w/twisted coil in center design, have original invoice, \$45. Wagner, 505-504-8783.

**1960 BLONDE BDR. SUITE**, minor resurfacing needed, double, twin, box springs, 5-drawer chest, mirrored dresser, \$350. Jaramillo, 263-2153.

**HOUSEHOLD FIXTURES**, stove, wall heaters, furnace, air conditioners, sinks, cabinets, doors, carpet, all in excellent condition. Mozley, 884-3453.

**JEWELRY SETS**, 2, new, G. Zachary, 1 inlay design, 1 silver, text for photos/prices. Griego, 505-980-2755.

**SIDE STEP**, for '16 Chevy Colorado GMC Canyon, black tube w/footsteps, new-in-box, \$135. Sansone, 296-7945.

### 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.

**ROCKWELL PLANER**, heavy-duty, commercial, 12-in., 3-hp, 3-phase, on wheels, heavy, needs rebuild, \$50 negotiable. Crain, 265-1006.

**DRILL PRESS**, Craftsman, \$80; oak writer's desk, \$20; Lea loft bed, twin, \$200; all good condition, OBO. Vrooman, 505-249-5592.

**SAILBOAT**, Fireball US719, sound mahogany hull, rigging, sails, trailer, many regatta wins, in Albuquerque, free. Brandvold, 505-296-4394, .glen4394@msn.com.

**'09 KAWASAKI VULCAN CUSTOM**, tons of extras, 1 owner, excellent condition, \$4,200. Podsednik, 505-417-8975.

## TRANSPORTATION

**'01 DODGE RAM 1500**, 4x4, 175K miles, good condition, \$4,200. Cortez, 505-720-0190.

**'15 CHEVY SONIC LT HATCHBACK**, AT, PW, Bluetooth, 33-mpg city, 45K miles, \$9,350. Eagle, 928-699-2814.

**'06 GTO**, 6.0L, 6-spd., black w/red leather, 70K miles, \$15,500. Meyer, 505-903-8663, call or text.

## REAL ESTATE

**TRIPLEX**, two 650-sq. ft. units, 1-bdr., 1 bath, one 900-sq. ft. unit, 2-bdr., 1 bath, new roof, new waterlines, low maintenance, cap rate of 10%, 330-330-1/2 Truman NE, near Lomas & San Mateo, \$165,000 OBO. Dwyer, 505-249-6935.

**4-BDR. HOME**, 2-1/2 baths, 3,000-sq. ft., new high efficiency green home, close to base, Volterra, \$310,000. Dubuque, 505-280-3132.

**20 ACRES**, El Vado Estates, gated community, spectacular views, lakes, electric, \$6,000/acre. De La Cruz, 266-3271.

## RECREATION

**'07 MAXUM 1800 MX**, Bowrider, always garaged, well maintained, great condition, \$8,000. Stihel, 550-0614, call or text.

**'12 HARLEY-DAVIDSON 1200 CUSTOM SPORTSTER**, many options, 19K miles, excellent condition, \$7,900. Atencio. 249-8395.

## Mileposts



New Mexico photos by Michelle Fleming  
California photos by Randy Wong



Don Funkhouser  
35 6354



Joe Sandoval  
30 6513



Greg Wyss  
30 6612



Barbara Lucero  
25 10744



Sonoya Shanks  
25 631



Chris Garasi  
20 2552



Linda Manke  
20 3331



R. Anthony Vestal  
20 5845



Dannelle Sierra Aragon  
15 1554



Audrey Blea  
15 5879



Dave Henderson  
15 9364



Patrick Hunter  
15 1522



Rebecca Lopez  
15 10659



Tiffany Segura  
15 800

## Recent Retirees



New Mexico photos by Michelle Fleming  
California photos by Randy Wong



Waylon Ferguson  
34 10500



Mark Boslough  
33 1446



Steve Becker  
30 2245



Mike Rightley  
27 5786

Gina Rightley  
26 415



Juan Torres  
27 8040

### Retiring and not seen in the Lab News pictures:

Laurie Bergeron (5812), 17 years as a Sandian, 12 years as a contractor.



# Not Sandia's first rodeo

Annual Robot Rodeo offers bomb squads an unbeatable experience

By Mollie Rappe • Photos by Norman Johnson

Stopping a hazardous leak in an area too dangerous for humans to enter, climbing flights of stairs and solving dexterity challenges on each level, and defusing a suicide bomb. These were just a few of the challenges bomb squads from around the region completed during the 11th annual Western National Robot Rodeo last month.

During this thrilling four-day event civilian and military bomb squad teams got practice using robots to defuse diverse, dangerous situations. Robots are life-saving tools for these emergency response teams, providing them a buffer from danger.

The 21st Explosive Ordnance Disposal Company (Weapons of Mass Destruction) team based on Kirtland Air Force Base beat nine other teams from around the region by completing 10 events the quickest and safest. These events ranged from realistic, yet simulated scenarios like stopping a “hazardous” liquid leak to less realistic but tricky scenarios like untying a rope with a robot arm. Though the 21st EOD team received a trophy, says Jake Deuel, Robot Rodeo coordinator and manager of Advanced Field Operations and Robotics Dept. 6532, bomb squads are mostly after the bragging rights.

“The teams are usually frustrated with us by the second scenario, and that’s a good sign that we’ve developed challenging scenarios. If it’s easy, it’s a waste of their time,” says Jake. “The whole point of the Robot Rodeo is to help these guys and gals understand where the operational edge of their equipment and procedures are, so that they don’t go over that edge during a real life call.”

## ‘What a Mess’ and ‘Stairway to Heaven’

During the “What a Mess” scenario, bomb squads had to use their robots to contain a “hazardous” liquid with a bucket, turn three valves to stop the leak while maneuvering around debris, and then move the bucket to a containment area. The scenario simulated a leak in a legacy nuclear production facility or chemical plant where the liquid would be too hazardous for a person to handle safely. Part of the challenge for the squads during this scenario was to manage their time and determine priorities to best mitigate the spill.

For the “Stairway to Heaven” scenario, the robots needed to go up three flights of stairs, which isn’t a walk in the park in and of itself, and solve challenging manual dexterity problems on each level. On the first level, the robot needed to untie a rope. On the second level, the challenge was to hook three clothes hangers onto a dangling ring. However, the first challenge was finding their instructions — printed on a florescent green sign hidden high in the rafters. Commercially available bomb squad robots have a small, flat field of view provided by one camera, says Jake, an operational limitation the squads need understand.

On the third level of “Stairway to Heaven,” the robots needed to unstack six labeled orange cones and then arrange them to spell out heaven. Traffic cones are hard for robot grippers to grab, requiring just the right amount of strength and finesse, says Tech. Sgt. Joshua Rickert of Kirtland Air Force Base 377th Explosive Ordnance Disposal Flight and an evaluator for the scenario. Though it is unlikely bomb squads will encounter this exact situation, the dexterity tested will be helpful in whatever they do have to handle, he says.

Other scenarios included working with another team to get an X-ray of a hard-to-reach suspicious package, removing a “hazardous” package from a helicopter, and defusing a suicide bomb by hand.

## Challenging scenarios test robots and squads

“We keep coming back to the Robot Rodeo because it’s a training opportunity that really pushes our skill set with the robots,” says Sgt. Carlos Gallegos, commander of the Albuquerque Police Department’s bomb squad, whose team has attended the rodeo every year and won twice. “We appreciate Sandia and Los Alamos national laboratories for taking the time to put on such a beneficial week for the local bomb squads.”

Sandia works with Los Alamos National Laboratory to host the annual competition. This year instructors from the FBI’s Hazardous Devices School also ran several of the training sessions and events.

John Lee, program manager in the DOE Office of Environmental Management’s Technology Development Office, attended and observed this year’s Robot Rodeo. “It was a great event, well organized and implemented extremely well,” John says. “Many of the rodeo’s scenarios were applicable to the varied DOE EM missions and the lessons learned were extremely important. This was quite apparent with the two scenarios designed with the assistance of expert workers from our DOE EM Portsmouth, Ohio, site. It was also a very valuable learning experience for them. We look forward to continuing this valuable collaboration with Sandia, Jake, and his expert team in bringing the best of robotic technologies and training to our DOE EM sites and mission.”

The other New Mexico bomb squads that participated this year included Kirtland Air Force Base 377th Explosive Ordnance Disposal Team — the 2016 champions, Albuquerque Police Department, Doña Ana County Sheriff’s Office, Los Alamos Police Department, New Mexico State Police, and Farmington Police Department. Out-of-state bomb squads that participated included Davis-Monthan Air Force Base EOD Team; Fort Carson Army Base EOD Battalion; Dallas/Fort Worth International Airport Police; and Riverside, California, County Sheriff’s Office.

Event judges included experts from Sandia, Kirtland Air Force Base EOD, New Mexico National Guard’s Civil Support Team, and the FBI.

