Finding energy storage 'solutions' in MetILs

New family of metal-based ionic liquids could lead to next-generation batteries

By Stephanie Hobby

On the molecular scale, it resembles a traditional black-and-white soccer ball, but that molecule holds the promise of being a big player in the nation's energy storage efforts.

Sandia researchers have discovered a new family of liquid salt electrolytes, which could lead to batteries packed with three times the energy density of other available storage technologies. The findings, featured on the Nov. 21 cover of *Dalton Transactions*, offer a possible new solution to the vexing challenge of incorporating intermittent renewable energy sources into the nation's electric grid.

Energy demand is at an all-time high; as of Oct. 31, the UN Population Fund estimates that there are more than 7 billion of us roaming the planet, and exploring every energy option has become the only option to meet the energy demands of all these people. Renewable energy sources are a likely part of the solution, but incorporating them into the current electrical grid on a large scale is problematic. The world's grids were built

(Continued on page 5)

CHEMICAL TECHNOLOGIST Harry Pratt (2546) synthesizes a copper-based ionic liquid. (Photo by Randy Montoya)

Open enrollment continues

HBE

For employees . . .
Now through Nov. 10, 5 p.m. MT

For retirees . . .
Now through Nov. 23, 5 p.m. MT

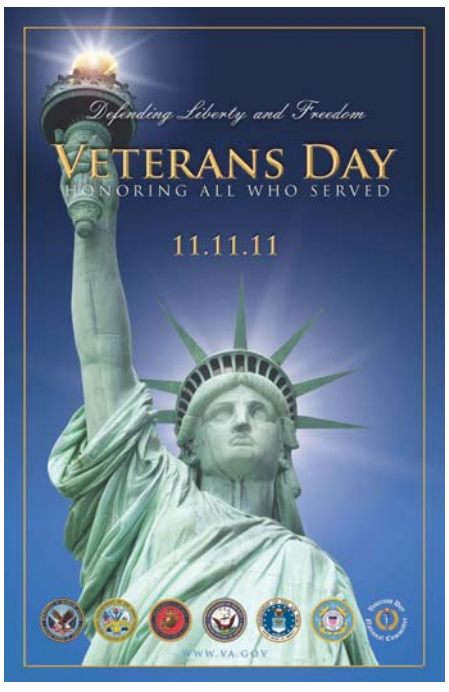
Sandia LabNews

Vol. 63, No. 21 **November 4, 2011**

Managed by Lockheed Martin for the National Nuclear Security Administration

Sandia National Laboratories

Honoring our veterans



Div. 5000 VP Jeff Isaacson, a commander in the US Navy Reserve, volunteered for active duty and was mobilized in March 2009. He completed combat training at Ft. Jackson, S.C., in April of that year and was on the ground in Kabul, Afghanistan, a month later. During his tour of duty, Jeff served as chief of Afghan National Army construction, managing the program's $5 billion budget and overseeing 20 percent of all coalition construction in the country. Read about Jeff's experiences on **pages 6-7**.

* * *

Sandia will officially observe Veterans Day 2011 on Nov. 10 with veteran-related displays and a speech by Distinguished Service Cross recipient John Tissler in the Steve Schiff Auditorium. Displays open at 10:30 a.m.; the speech is at 12:30 p.m. Read more on **page 8.**

Inside . . .

Where art and science meet . . . **page 4**

Sandia B53 team honored . . . **page 9**

FALLING LEAVES — Sondra Payne (left) and Stephanie Cisneros (both 1631) enjoy a crisp and clear fall morning during a walk outside Bldg. 800. (Photo by Randy Montoya)

That's that

Do you ever hear those ads on the radio for various products that promise to protect you from identity theft? In one ad, the CEO of the company is so confident about his product that he gives his Social Security number — presumably the right one — right over the air.

If someone gets hold of your Social Security number, they can essentially get their hooks into your entire life, leveraging each piece of gleaned information for the next until finally, they have cleaned out your bank account, maxxed out your credit cards, and stolen the family dog. Hey, even if we haven't experienced it ourselves, we can well imagine what a nightmare identity theft could be.

All this came to mind a couple of days ago when I was accessing my work email from home. To get into the Sandia Exchange server, I had to type in a random number generated by my Cryptocard. And that got me to thinking: Why not take a similar approach with Social Security numbers, credit card numbers, and any other numbers that uniquely belong to you? I'm not sure how it would be implemented — not my area of expertise — but it seems to me that there must be a technical means of making such numbers a lot more secure than they are today.

* * *

Andy Rooney, the professional curmudgeon who was a fixture on *60 Minutes* for decades until he recently announced his retirement at age 92, made a darned good living complaining about life's annoyances, large and small. With more than 1,000 commentaries delivered on *60 Minutes* over the course of 30-plus years, Mr. Rooney didn't leave much complaining room for next-generation killjoys. However, I'd bet this is a gripe he missed: Have you ever noticed how, on those websites where you can order something online — Amazon, eBay, or whatever — they have a drop-down menu option that lets you select your state? That tab is intended to make things easier. But, at least on every monitor I've owned, New Mexico never shows up on the menu's first batch of states; alphabetically it's too far down the list to appear, forcing you to scroll to New Mexico. And if you try to type in "New Mexico"" in the space provided, it always brings you to Nebraska, which isn't helpful at all. Just a small nuisance, sure, but not everything Andy Rooney complained about was that big a deal, either. In the meantime, maybe I ought to move to Alabama . . . nah.

* * *

As a big baseball fan, I was especially pleased to see that the national pastime got the Hollywood treatment recently in the excellent Brad Pitt vehicle called *Moneyball*. That movie tells the real-life story of Billy Beane, who, as general manager of the Oakland A's since 1998, has used sophisticated data analysis to identify and sign undervalued players. Using this stats-based approach, Beane was for several years able to successfully compete with much richer ballclubs.

The godfather of this statistical approach is a man by the name of Bill James. The creative genius behind the Society for American Baseball Research, James was at the forefront of the modern field of sabermetrics, which he defines as "the search for objective knowledge about baseball." His innovative forays into baseball's vast wealth of statistics certainly changed the game, or at least added new dimensions to our appreciation and understanding of it.

One of the high-visibility adherents of sabermetrics has been Boston Red Sox general manager Theo Epstein, who went so far as to hire James as a Red Sox consultant. Applying sabermetrics principles, Epstein brought the Red Sox into a modern era of success, including their World Series win in 2004, reversing the "curse" they lived under after trading Babe Ruth to the Yankees in 1919. Epstein and his team manager, Terry "Tito" Francona, rode high on the sabermetrics bandwagon until this past September, when the Red Sox started playing like they were under a new curse of some sort.

A letter to the editor of *Sports Illustrated* cited one of the ironies about the team's collapse, noting that these apostles of statistics-based decision-making effectively blamed the 2011 meltdown on "bad chemistry" in the clubhouse. The letter writer, presumably someone from the old school where intuition and hunches rule, taunted Epstein, asking "Where's the sabermetric for 'bad chemistry,' Theo?"

There's a lesson here: The numbers don't tell the whole story; there are aspects of the human condition that, so far at least, aren't quantifiable. As sophisticated as our data analysis skills may be, we still need to bring our intuition, experience, judgment, and wisdom to the table, too.

And, to be fair to Bill James, he has always held that there are intangibles in the game that will never be reduced to a mathematical formula. In 2010, Bill James was inducted into the Irish American Baseball Hall of Fame (yes, there is, apparently, such a thing, housed, appropriately, in a New York pub). In 2011, Theo Epstein signed on with the Chicago Cubs. And Billy Beane is still the general manager in Oakland, where he now owns a piece of the team and is still looking for the next competitive edge.

See you next time.

— Bill Murphy (505-845-0845, MS0165, wtmurph@sandia.gov)

Sandia LabNews

Sandia National Laboratories

http://www.sandia.gov/LabNews

Albuquerque, New Mexico 87185-0165
Livermore, California 94550-0969
Tonopah, Nevada • Nevada Test Site • Amarillo, Texas •
Carlsbad, New Mexico • Washington, D.C.

Sandia National Laboratories is a multiprogram laboratory operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corp., for the US Department of Energy's National Nuclear Security Administration.

Bill Murphy, Editor **505/845-0845**
Randy Montoya, Photographer **505/844-5605**
Mike Janes, California site contact **925/294-2447**
Michael Lanigan, Production **505/844-2297**

Contributors: Michelle Fleming (Ads, Milepost photos, 844-4902), Neal Singer (845-7078), Iris Aboytes (844-2282), Patti Koning (925-294-4911), Stephanie Holinka (284-9227), Darrick Hurst (844-8009), Stephanie Hobby (844-0948), Heather Clark (844-3511), Renee Deger (284-8997), Jennifer Jennings Carr (284-7676), Sue Holmes (844-6362), Nancy Salem (844-2739), Tara Camacho-Lopez (284-8894), Jane Zingelman (845-0433), Jim Danneskiold, manager (844-0587)
Lab News fax **505/844-0645**
Classified ads **505/844-4902**

Published on alternate Fridays by Media Relations and Communications Dept. 3601, MS 0165

LOCKHEED MARTIN

Lab News Reader Service

The *Sandia Lab News* is distributed in-house to all Sandia employees and on-site contractors and mailed to all Sandia retirees. It is also mailed to individuals in industry, government, academia, nonprofit organizations, media, and private life who request it.

Retirees (only):

To notify of changes in address, contact Benefits Dept. 3332, Customer Service, at 505-844-4237, or Mail Stop 1021, Sandia National Laboratories, Albuquerque, NM 87185-1021.

Others:

To receive the *Lab News* or to change the address (except retirees), contact Michelle Fleming, Media Relations and Communications Dept. 3651, 505-844-4902, email meflemi@sandia.gov, or Mail Stop 0165, Sandia National Laboratories, Albuquerque, NM 87185-0165.

Employees:

To address concerns regarding delivery of the *Lab News* to your facility, call Mail Services Team 10268-4, at 844-3796. At Sandia/California contact the Mail Room at 925-294-2427.

Web users:

The *Lab News* is on the external web at www.sandia.gov/LabNews. *Lab News Interactive*, accessible on the internal web, is at: www-irn.sandia.gov/newscenter/interactive.

Energy Employees Occupational Illness Compensation Program

The federal Energy Employees Occupational Illness Compensation Program Act (EEOICPA) required implementation of a program to provide compensation to employees of the Department of Energy (DOE), its predecessor agencies, and its contractors and subcontractors involved in nuclear weapons production and testing programs.

Employees (or their eligible survivors) who have suffered certain illnesses caused by exposure to workplace contaminants are eligible to receive a lump-sum payment of $150,000 and payment of the medical expenses of the covered illness from the date of the claim.

The Energy Employees Compensation Resource Center in Espanola, N.M. staffs personnel to assist with claim processing and necessary documentation. All services are free. Contact the Espanola Resource Center at 1-866-272-3622. All claim forms are available at the Center. A claimant can also get forms through the following sources:

- Download at http://www.dol.gov/esa/owcp/energy/regs/compliance/claimsforms.htm;
  or
- Request a form from the toll-free call center at 1-866-888-3322

Additional information on the EEOIC Program can be found at http://www.dol.gov/esa/owcp/energy/regs/compliance/ca_eeoic.htm

Former DOE Workers Medical Surveillance Program

Johns Hopkins University has a Former Workers Medical Screening Program in Espanola, N.M., which is administered under contract to the DOE.

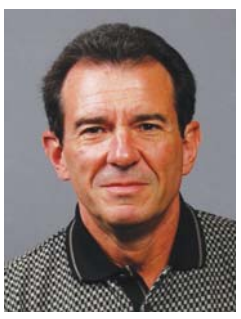
The primary objective of the Former Workers Program is to provide medical screenings for former employees to identify adverse health conditions that may have resulted from working at DOE facilities. Workers eligible for this program include all former DOE federal and contractor employees from all DOE sites.

The interview will collect information on job tasks, health history, and work history. A medical screening will be prescribed based on the contents of the interview. Medical examinations are performed by dedicated physicians at the University of New Mexico in collaboration with Johns Hopkins University physicians. After receiving results of the medical examination, individuals may elect to submit a claim with the Energy Employees Compensation Resource Center [EEOICP], also located in Espanola.

Additional information about the medical screening program may be found at http://www.hss.energy.gov/healthsafety/fwsp/formerworkermed.

Joe Schofield leads software measurement organization

On Nov. 1, Joe Schofield (9535) became the 20th president of the International Function Point Users Group, the world's largest software measurement organization.


JOE SCHOFIELD

IFPUG has more than 3,000 members in 30 countries and is the sponsor of the Functional Sizing Method standard ISO/IEC 20926:2009.

Function Points were developed in 1979; they measure the capability delivered to the customer and can be estimated as early as requirements solicitation. More recently, use-case points and story points have emerged on the software measurement scene. These measures are more project-specific, while Function Point Analysis also enables standards-based size comparisons across projects and organizations.

For the past two years Joe has served as the vice president of IFPUG after being elected by the board of directors, to which he had been elected by the membership a year earlier.

Prior to assuming VP role, Joe was director of conferences and education, and the chair and vice chair of the Management Reporting Committee. Joe holds two of his eight industry credentials from IFPUG, the Certified Function Point Specialist, and the Certified Software Measurement Specialist. His vision for IFPUG is to improve member services and products while expanding international interest.

Joe says that he appreciates the opportunities he has enjoyed to participate in industry associations as a Sandian.

Cable cars, Fisherman's Wharf, and hydrogen safety

Sandia hosts International Conference on Hydrogen Safety meeting in San Francisco

By Patti Koning

In mid-September, nearly 200 leading experts in the field of hydrogen safety, representing 24 countries from four continents, came together in San Francisco for the fourth International Conference on Hydrogen Safety (ICHS). Sandia, the Universitá di Pisa, and HySafe, an international association for hydrogen safety, were the organizing institutions.

"This meeting was by far the most successful of the series, in terms of papers — there were 118 presented — and the number and diversity of attendees," says Jay Keller (8360). While the number of attendees did not increase over ICHS-3, this was the first ICHS meeting held outside of Europe. Brazil and China were represented at the meeting for the first time in ICHS history.

The meeting began with Jay's welcome followed by opening remarks by HySafe president Andrei Tchouvelev; Sunita Satyapal, program manager for fuel cell technologies at DOE; and Marco Carcassi of the Universitá di Pisa.

Sandia CaliforniaNews

Satyapal spoke about the increasing importance of ICHS as fuel cell deployments accelerate in the US.

"More than 800 fuel cells were deployed in the last few months in the United States. What is critical and exciting for the R&D community are the major companies involved, like Coca-Cola, Whole Foods, FedEx, AT&T, and Sprint — and we are seeing more than 3,000 fuel cells purchased by companies without government funding," she said.

"Safety and understanding of lessons learned is absolutely critical at this point. We can't have a hydrogen equivalent of Fukushima or the BP oil spill. So what this community here does now can have huge implications in the next 20, 30, even 50 years of building the hydrogen infrastructure."

The topics covered in the meeting represented a broad range of hydrogen safety issues, everything from hydrogen behavior in unattended releases to hydrogen behavior in enclosures to hydrogen effects on materials to international regulations. Joseph E. Shepherd, professor of aeronautics and mechanical engineering at the California Institute of Technology, gave a well-received keynote address titled "Crisis at Fukushima Dai-ichi: the events and the consequences."

The ICHS meeting also spawned three successful sidebar meetings: the International Energy Agency Hydrogen Implementing Agreement Task 31 on Hydrogen Safety; the International Association HySafe's (IA-HySafe) hydrogen safety workshop; and the International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE) Regulation Codes and Standards Working Group (RCSWG), which launched an international round robin that will define a harmonized testing protocol for composite-wound (type 4) tanks.

"The expectation is that when we finish this round robin, the testing labs doing the qualification will all be using the same measurement protocol to ensure internationally consistent results. Then you will be able to qualify a type 4 tank anywhere in the world to these protocols, something that is not true today," Jay says.

The RCSWG round robin will tackle a timely problem that was among the topics discussed at ICHS-4. As Jay explains, General Motors wants to put type 4 tanks in their hydrogen vehicles, but those tanks are banned in China. This means that GM currently can't sell that vehicle in China, a huge potential marketplace. "Codes and standards are truly an international activity and it needs to be that way," he says.

Jay adds that for Sandia, being asked to help organize ICHS-4 is a clear and strong statement of the United States' leadership role within the international hydrogen safety community. "To have Sandia, representing the technical management of DOE's codes and standards program, as a recognized leader in this arena is critical to our programs," says Jay.

The 4th ICHS was endorsed by DOE, IPHE, and the Hydrogen Implementing Agreement of the International Energy Agency with support from National Resources Canada. DOE and NASA were silver sponsors and FM Global, Hexagon Composites, Siemens, and Universitá di Pisa were bronze sponsors. ICHS-5 will be held in Brussels in September 2013.

Chuck Mueller named SAE fellow

By Patti Koning

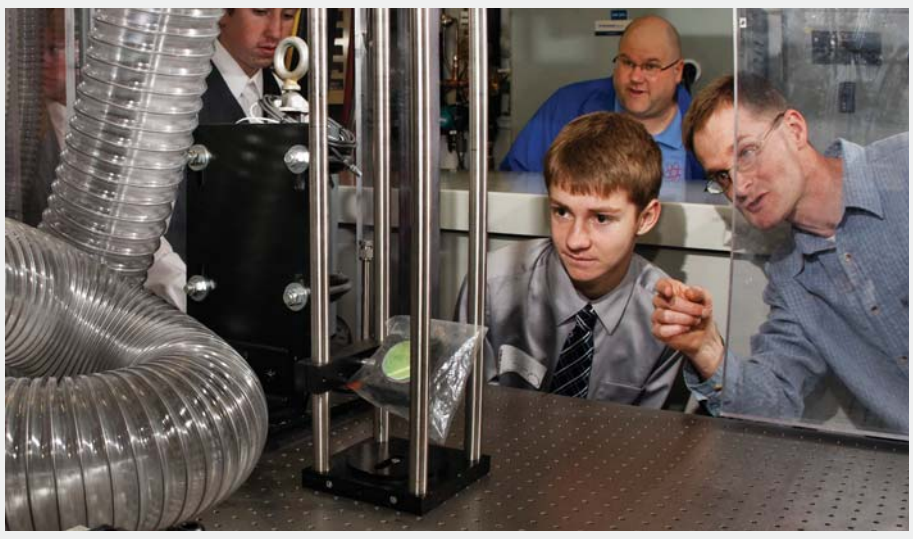
Chuck Mueller (8362) has been named a Fellow of the Society of Automotive Engineers (SAE). Established in 1975, the fellow grade honors and recognizes important engineering, scientific, and leadership achievements to enhance the status of SAE's contributions to the profession and to society.

Chuck was selected based on his outstanding accomplishments, pioneering technical contributions, and leadership in fuels research. He and the other newly elected fellows will be honored during the SAE 2012 World Congress and Exhibition in Detroit the week of April 23. Sandia has four additional SAE fellows: John Dec (8300), Dennis Siebers (8362), and Pete Witze, all named in 1998, and Paul Miles (8362), named in 2006.

CHUCK MUELLER

Earlier this year, Chuck received the 2011 SAE Forest R. McFarland Award for his outstanding contributions to the work of the SAE Engineering Meetings Board. In 2009, he received the SAE John Johnson Award for Outstanding Research in Diesel Engines in recognition of his paper, "An Experimental Investigation of the Origin of Increased NOx Emissions when Fueling a Heavy-Duty Compression-Ignition Engine with Soy Biodiesel." Chuck's other recognitions include the SAE Harry L. Horning Memorial Award, the SAE Arch T. Colwell Merit Award, and the Silver Medal of the Combustion Institute for his publications, and the SAE Lloyd L. Withrow Distinguished Speaker Award for his presentations.

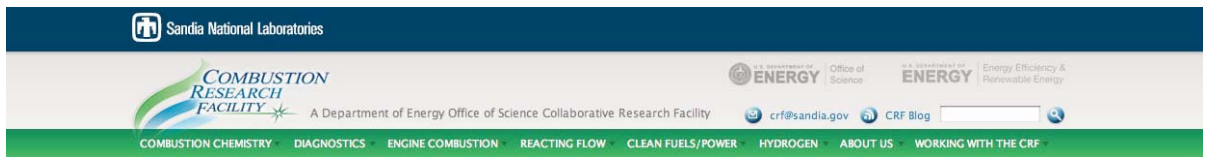
Chuck is an engineer at the Combustion Research Facility (CRF). He received a doctorate in aerospace engineering from the University of Michigan in 1996 and also holds an MScE in aerospace engineering from the University of Michigan, as well as BSc degrees in aeronautics and engineering physics from Miami University. He has authored or co-authored more than 40 technical papers in the field of engine combustion and fuels.



IN THE ALTERNATIVE FUELS LAB, Chuck Mueller shows Livermore High School student Aaron Costello a window in the piston of a single-cylinder, heavy-duty diesel engine that has been modified to provide optical access to the combustion chamber.
(Photo by Randy Wong)

Combustion Research Facility launches new website

'crf.sandia.gov' provides improved navigation, direct access to combustion research information, improved searching, and rich interactive content



The Combustion Research Facility has launched its new WordPress-based website at crf.sandia.gov. The dramatically redesigned site, sponsored by the Energy, Climate and Infrastructure Security Strategic Management Unit (SMU), embodies the CRF's forward–thinking vision and commitment to the growing needs of the combustion community.

"We launched the refreshed, engaging CRF website to easily deliver information about the collaborative research facility to our customers, sponsors, employees, the media, and many others. Our goal is to place relevant and timely communications at the fingertips of the combustion research community," says Bob Carling, director of Transportation Energy Center 8300.

The site's homepage welcomes visitors with bold new colors, a clean uncluttered design, and moving images with featured content centered on CRF as a premier research facility for developing and applying new scientific understanding, advanced detection methods, and quantitative predictive models to advance the clean, efficient use of energy sources, reduce oil dependence, and enhance national security.

The new site offers:

• General information about the CRF, how collaborators can work with the CRF, and in-depth information about the following research areas: combustion chemistry, diagnostics, engine combustion, reacting flow, clean fuels and power, and hydrogen.

• Streamlined searching and more intuitive navigation.

• Content-sharing enables visitors to share content via their favorite social media outlets.

• Direct access to subject matter experts and the CRF Visitors Program.

• CRF Blog encourages research staff to post stories and dialog with new audiences.

• Rich interactive content engages the user via the video and image libraries and the RSS events calendar.

* * *

The goal of the redesigned website is to create greater awareness and understanding of the CRF and its capabilities, increased collaboration, and partnerships.

"I encourage our customers and partners to get connected through the website — join the CRF Blog for the latest news and watch for the new interactive tour, coming in the New Year," says Bob. "Our anticipation is that this will allow for valuable exchanges of ideas and even greater engagement with the combustion community. This site will continue to evolve; we plan to expand crf.sandia.gov with new features and continued improvements. We look forward to feedback from our users and exciting new developments to come."

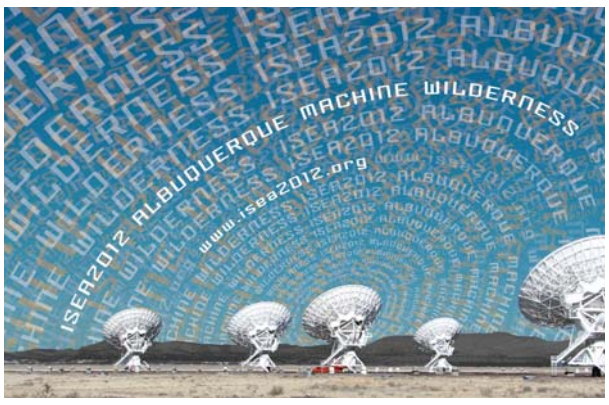
Where art & science meet

Art/technology happening looks to Sandia for ideas

By Nancy Salem

The place where art, science, and technology come together moves around the world, landing in a different city each year.

Recently it's been in Istanbul, Turkey; Ruhr Valley, Germany; Belfast, Ireland; and Singapore. In 2012 it will return to the US for the first time in six years. The spot is Albuquerque, and Sandians are being asked to play a part.



AS PART OF AN INTERACTIVE PUBLIC ART PROJECT, Mexican artists Ivan Puig and Andres Padilla Domene created this vehicle that travels on roads and abandoned rail lines. It uses photography, video, audio, and text to record surroundings in mostly remote areas of the country, and will travel from the US/Mexico border to Albuquerque for ISEA2012. (Photo courtesy of ISEA)

"This is a great opportunity for Sandia to present the latest digital technology we create here to a local, regional, national, and international audience of experts and innovators," says Juan Abeyta (3555), who sits on a planning committee for ISEA2012. "It's a coup for Albuquerque to host an international conference of this magnitude and a great way for Sandians to showcase their technologies and create new connections with colleagues worldwide."

ISEA, the International Symposium on Electronic Arts, is a prestigious, wide-ranging conference that for more than 20 years has brought together people from around the world who work in the art/technology arena. Albuquerque was presented to the international community as the 2012 host city at this year's ISEA in Istanbul.

"Normally the conference is held in much larger cities," says Suzanne Sbarge, ISEA2012 executive producer and executive director of Downtown's 516 ARTS, which worked with the University of New Mexico (UNM) on the city's host proposal. "It is very validating for Albuquerque's artistic and scientific communities to be selected."

ISEA2012 is titled "Machine Wilderness," and will include a conference in Albuquerque from Sept. 19-24, an international exhibition at 516 ARTS and The Albuquerque Museum from Sept. 20-Jan. 6, 2013, and an expansive, regional collaboration throughout the fall of 2012 including art shows, public events, performances, and educational activities. More than 1,000 people are expected to attend the core conference and about 40,000 to participate in the overall, four-month collaboration.

Juan says Sandians are being encouraged to apply to present at the conference, show in the exhibition, and participate in activities. "It's a natural," he says. "We want Sandians to submit proposals and be represented in the program." Juan says about a dozen people from the Labs have expressed interest in ISEA2012. "We would like to see a lot more," he adds.

The exhibition and conference will be juried and curated through an international call for proposals. The submission deadline for panels, workshops, papers, artworks, performances, and residencies has been extended to Nov. 15. To apply, visit www.isea2012.org. Sbarge says applying is free and simple. Proposed projects do not have to be completed, and can be in the conceptual stage.

ISEA defines electronic art as both visual and performing arts, including music and sound, in which technology, such as computer software, the Internet, databases, wireless devices, electronic components, and physical computing, played a role in the creation.

"Science and technology are central to what ISEA is about," says Andrea Polli, artistic director of ISEA2012 and an associate professor of art and ecology and the Mesa del Sol endowed chair of digital media at UNM. She's also the person who spurred Albuquerque's ISEA bid a year and a half ago. "I think especially now with some of the crises we're experiencing there's even greater need for everyone to put our heads together and use our diverse expertise to come up with innovative solutions to these issues."

The conference title, "Machine Wilderness," refers to New Mexico as an area of rapid growth and technology development alongside large expanses of open land. Its goal is to present artists' and scientists' ideas on how technology and the natural world can sustainably coexist.

"New Mexico is a strange combination of a wild, open, and natural environment holding some of the most advanced technology and science," Polli says. "The Machine Wilderness tries to bring those concepts together."

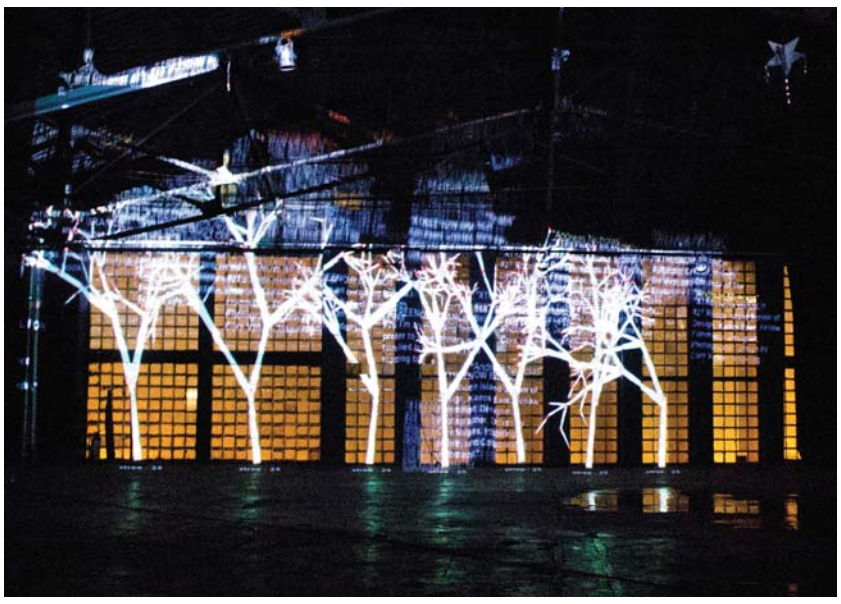
ISEA2012 themes include Power: "Gridlocked"; Creative Economies: "Econotopias"; Transportation: "Dynamobilities"; Wildlife: "Trans-Species Habitats"; and the Cosmos: "Radical Cosmologies." Sbarge says there are countless presentation options within each track and that proposals outside the tracks are welcome.

Juan says Sandia's research in energy, robotics, imaging, materials science, and biotechnology are ripe for showcasing at the event.

Among the special events at ISEA2012 is a track on science, technology, engineering, and math (STEM) education through art, spearheaded by Intel Corp. and targeted to middle- and high-school students. There's also a Latin American forum showcasing digital culture, critical theory, and media arts from south of the border. Juan is on the advisory board for that forum.

And Sandia is part of ISEA2012's New Mexico Scientists/Artists Research Collaborations (NM-SARC), a pilot series of professional artist residencies in science laboratories, field settings, and neutral zones. NM-SARC is envisioned as the start of an ongoing arts and sciences collaborative program. Sandia and Los Alamos National Laboratory have signed on as partnering science research centers.

"Art and science, when combined, demystify each other and become more mutually accessible," Sbarge says. "Some scientists may think they're not artistic or they don't relate to art, and many artists don't feel like they are scientific. But art/science collaborations engage artists in science and scientists in art, offering a tremendous opportunity for creativity and innovation in both fields."



THIS MULTIMEDIA INSTALLATION in Buenos Aires, Argentina, is part of the (x)tree project, a collaborative experiment in open source data visualization, video mapping, and participatory art. Artist Agnes Chavez of Taos worked with a team to produce the open source video mapping code that captures data live from Twitter, converts it into branches of trees and allows it to be projected onto buildings. The project's creative team will use this new medium to create a socially interactive virtual forest for ISEA2012. (Photo courtesy of ISEA)

ISEA builds electronic arts network

The symposia series was launched in 1988 to establish and maintain an international network of those active in electronic arts. The network evolved into an association, ISEA, founded in the Netherlands in 1990 as an international nonprofit fostering interdisciplinary academic discourse and exchange among culturally diverse groups and people working with art, science, and technology. Its main activity is the annual symposium.

The board and membership of ISEA have remained international. The headquarters moved from the Netherlands to Montreal in 1996 and to the University of Brighton, United Kingdom, in 2009. That same year, ISEA switched from an association to a foundation. The organization is now managed by the ISEA International Foundation Board, whose main role is to oversee content of symposia in each selected city to maintain the continuity of identity and quality.

ISEA2012 is organized by 516 ARTS and hosted with UNM and The Albuquerque Museum. The collaboration includes more than 65 partner organizations throughout New Mexico as well as in El Paso, Texas, and Tempe, Ariz., representing city government, economic development groups, businesses, scientific and technological communities, museums, colleges, arts organizations, and environmental groups.

Going with the flow . . .

(Continued from page 1)

to accommodate steady power sources and aren't equipped to deal with the peaks and valleys produced by intermittent power sources.

A long-term, high-capacity option

Energy storage technologies are one way to even out the flow of electricity from intermittent renewable sources of energy. Sandia is researching new storage technologies and materials that will help in the design of a more flexible and reliable electric grid with higher storage capacity. For the past 20 years, lithium-ion batteries have been at the forefront of energy storage research. The compact, lightweight, and affordable design is ideal for cell phones and laptop computers, but there's a nagging problem. No matter how new your cell phone is, during every charge and discharge, lithium physically moves from the cathode to the anode and back again. All this motion degrades the battery, and over time, it will just give out.

Such an option might be adequate for electronics that come and go, but the nation's electric grid needs a long-term, high-capacity option.

Sandian Travis Anderson (2546), an inorganic chemist with nine years of experience, is leading a team that's developing the next generation of flow batteries. A flow battery pumps a solution of charged metals dissolved in an electrolyte from an external tank through an electrochemical cell to convert chemical energy into electricity. Flow batteries are rapidly charged and discharged by changing the charge state of the electrolyte, and the electroactive material can be easily re-used many times.

"The system is simple, it performs very well, lasts a long time, and has a high cycle efficiency. In a lab, it can do well over 14,000 cycles, which is equivalent to about 20-plus years. That's unheard of in a lithium-ion battery," says Travis. "But these batteries are huge — about the size of a building — so they're expensive. The goal is to make them smaller and cheaper, and we do that by increasing the energy density."

Flow batteries are not easy to find — only one has been built in the US — but they are more common in Japan and Australia, where the first patented flow battery originated. Of the existing flow batteries, the highest performers use vanadium, which is moderately toxic and fluctuates in price. Furthermore, temperature impacts the performance of aqueous flow batteries. Finally, water limits how much material can be dissolved, which ultimately limits how much energy can be stored.

Non-aqueous flow battery research is largely uncharted territory, and Sandia is leading the way.

"We're not trying to reinvent the wheel. We want a liquid that flows from storage tank to cell, just like vanadium," Travis says. "But we're trying to generate a new fuel."

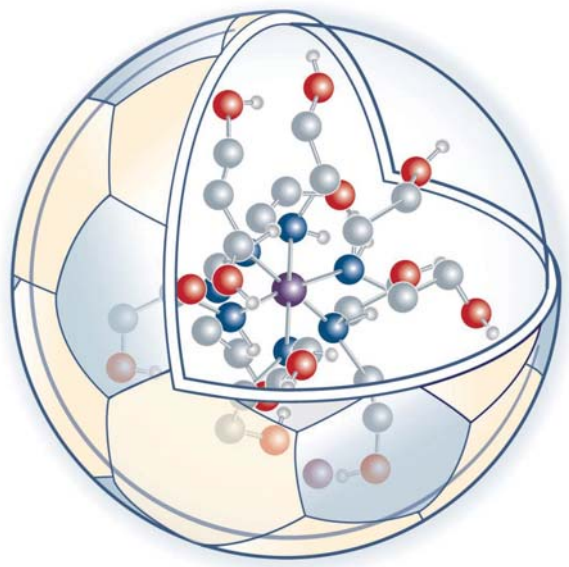
Tripling energy density

Travis pulled together a multidisciplinary team of experts from around the Labs to find that fuel, including electrochemist David Ingersoll (2546), organic chemist Chad Staiger (6124), and chemical technologists Harry Pratt and Jonathan Leonard (both 2546).

RESEARCH TEAM — Harry Pratt (2546), Chad Staiger (6124), Travis Anderson (2546), and Jonathan Leonard (2546) examine copper-, iron-, and vanadium-based compounds. (Photo by Randy Montoya)

What they've built is a new family of electrochemically reversible, metal-based ionic liquids (MetILs), and it's generating a lot of attention from the energy storage community.

"So instead of dissolving the salt into a solvent, our salt is a solvent," Travis says. "We're able to get a much higher concentration of the active metal because we're not limited by saturation. It's actually in the formula. So we can triple our energy density just by the nature of the material we have."



THE STRUCTURE of the cation developed by the Sandia team resembles a soccer ball.

SANDIANS HAVE DISCOVERED a new family of liquid salt electrolytes that could lead to batteries with three times greater energy density than other available storage technologies. The MetILs are, from left to right: copper-based compound, cobalt-based compound, manganese-based compound, iron-based compound, nickel-based compound, and vanadium-based compound.

The ionic liquids the team prepared use readily available, inexpensive, nontoxic materials that can be found in the US, such as iron, copper, and manganese.

A common problem when mixing positively and negatively charged species is that these species will want to start aggregating together, eventually causing the solution to turn gummy, crash out, and clog the battery components such as the membrane and electrode surfaces.

The team addressed that challenge by developing asymmetric cations, or positively charged ions, that resemble a soccer ball. In this analogy, the black pentagons represent negatively charged areas and the white hexagons represent positively charged regions. Such an arrangement keeps the melting point low enough to prevent the ionic liquid from bonding to itself and becoming a solid, while the partial charge still allows electrons to flow freely through the cell to generate a current.

Exceeding the ferrocene standard

Another desirable property is high electrochemical efficiency, or reversibility of the charge.

"The ease at which you can change the charge state of MetILs is by far better than anything that's ever been published," says Travis. The gold standard for determining reversibility is to measure it against ferrocene. If the compound has better reversibility, it's considered a top performer.

"We've prepared nearly 200 combinations of cations, anions, and ligands, and of those, there are five that exceed the ferrocene standard," Chad says.

The family of compounds the team discovered with reasonably desirable properties is growing; last year, there were 11, this year, there are more than 30.

"There are so many parameters we can try, and you hit more bad ones than you can hit good ones, so when you find one that's better than ferrocene, the data get very exciting," Harry says. "This is new research. We aren't following on anyone else's coattails."

The current research will apply to new flow battery cathode materials; the next step is to find similar materials for flow battery anodes.

The team is in its last year of a Sandia Laboratory Directed Research and Development project, but has also received funding from the DOE's Office of Electricity Deliverability and Energy Reliability. Imre Gyuk, an energy storage systems program manager for that office, has been a champion of Sandia's efforts and provided the necessary funding.

"There are three things you're juggling at the same time, and they aren't always related: viscosity, electrical conductivity, and the fundamental electrochemistry efficiency," Travis says. "The excitement of having all three things go right at the same time, it's like finding the treasure, but without the map. We're creating that map, and we're very excited by the possibilities."

COMMANDER JEFF ISAACSON and unit members have tea and confer with tribal leaders in Kabul.

Photos courtesy of Jeff Isaacson

Building Afghanistan

'Each full moon meant I was one month closer to going home.'

By Iris Aboytes

Seeing the tears in his 10-year-old daughter Dani's eyes was one of the toughest parts of leaving for Afghanistan, says Div. 5000 VP Jeff Isaacson. Jeff served a one-year tour of duty in the war-torn nation.

Commander Isaacson, a Navy reservist, volunteered and was mobilized in March 2009. He completed combat training at Ft. Jackson, S.C., in April of that year and was on the ground in Kabul in May.

Jeff arrived at Bagram Airfield carrying four sea bags' (military duffle bags) worth of equipment and wearing 40 pounds of body armor. Bagram Air Base is a militarized airport and housing complex located next to the ancient city of Bagram about seven miles southeast of Charikar in Parwan province. A large part of the base is owned by the US Air Force.

"We went from Bagram to Kabul in a convoy," says Jeff. "The dirt road weaves through hills and mountains all the way to Kabul. This was my first experience with unsecured roads and the threat of improvised explosives devices (IEDs).

"Kabul is covered in dust and rubble from the period after the Soviets left and the Taliban took over," says Jeff. "It is surrounded by mountains. From a helicopter one can see the beautiful country. The terrain is not unlike New Mexico in a lot of ways. It also has desert, dust, and windstorms. The winters are mild with some snow. The people are poor but very religious. The crossroads of Asia are reflected in the handsome people who blend a variety of cultures and ethnicities. The people I encountered were very warm."

Jeff was stationed at Camp Eggers, Kabul, Afghanistan, where Combined Security Transition Command-Afghanistan (CSTC-A) trains the Afghan National Security Forces. It is there that the US is helping to recruit, train, and equip Afghan National Army units and units of the Afghan National Police.

Senators and other visitors regularly come to Camp Eggers. While Jeff was there, he bumped into Secretary of Defense Robert Gates, Sen. Carl Levin, D-Mich., and Sen. Jack Reed, D-RI.

JEFF ISAACSON at Camp Eggers, Kabul, Afghanistan.

They also had a female visitor who fried her hair dryer in a socket and asked a female soldier to borrow hers. That soldier did not want the same thing to happen to hers, so she declined. It turns out that visitor was Katie Couric, who was there broadcasting for the *CBS Evening News*. The *Today* show on NBC also broadcasted from Camp Eggers.

As the chief of Afghan National Army construction, Jeff built garrisons, airfields, training facilities, and military hospitals necessary for operations. He managed the program's $5 billion budget, and at the time was responsible for 20 percent of all coalition construction in the country.

Jeff led a small team of engineers (10 or so) overseeing this work.

"They worked long hours, day-in, day-out, to accomplish the mission," says Jeff. "We often said the days were long but the weeks were short, given how much time we were focused on our work. I was fortunate to have served with some of the most capable people I have ever met."

Working with the US Army Corps of Engineers and the Air Force Center of Engineering and the Environment, Jeff travelled from construction site to construction site assessing the progress.

"The big strategic push at the time was to expand the size of the Afghan National Army in hopes of turning over the security mission to the Afghans sooner. Infrastructure was a very big part of that. In many cases, we could churn out units faster than the infrastructure to support them. Our biggest challenge was putting temporary facilities in place — tents to house and feed these soldiers."

Unrelated to his primary duties, Jeff volunteered for humanitarian relief missions in and around Kabul. These official missions served to deliver clothes, blankets, and school supplies to Afghan refugees who fled nonsecure areas of the country and lived in makeshift camps around the city.

"I saw Afghans walking almost shoeless in the snow," says Jeff. "I never realized how valuable a blanket could be. Afghanistan is the poorest place I have ever seen."

As much as he wanted to come home, Jeff had difficulty leaving his responsibilities.

"I would have stayed longer," adds Jeff. "I wanted to make sure the mission could continue without any glitches." At the time he departed, there were more than 150 major construction projects underway or in the hopper, at a value of more than $2.5 billion.

Reflecting back on his tour, Jeff says the only thing that was familiar was the moon.

"It was, of course, the same moon I saw back home," he says. "Each full moon meant I was one month closer to going home."

Though looked upon by many as a successful tour, Jeff just hangs his head and says with a far-away look in his eyes, "I wish the mission was complete, and everyone was home."

FLYING IN — The terrain is not unlike that found in New Mexico.

A SERIOUS YOUNG AFGHAN pauses during a seasonal snowfall.

AFGHAN WOMEN AND CHILDREN stand in line during a snowstorm for much-needed supplies.

SOCCER BALLS were given to children in a school for the deaf.

A MEMORIAL honoring a fallen comrade.

ONE OF MANY construction projects begins to take shape. Jeff's unit worked on more than 150 such projects.

JEFF CONFERS with Sen. Carl Levin, (D-Mich.) during a visit to Camp Eggers. Behind Jeff is Sen. Jack Reed (D-RI), who also attended the meetings.

REMNANTS of a Soviet-era tank sit on a hill overlooking the town below.

BLANKETS are a precious commodity for the people.

POVERTY is evident as children walk almost shoeless in the snow.

COMRADES ALL — Jeff, second from right, stands with some of the other members of his unit. The unit worked on more than 150 projects in Afghanistan.

Honoring our veterans

Sandia observance is Nov. 10 at Steve Schiff Auditorium

Sandia's official observance of Veterans Day 2011 will occur on Nov. 10, and will feature a collection of veteran-focused displays and a speech by a recipient of the Army's Distinguished Service Cross.

The displays, in the lobby of the Steve Schiff Auditorium (Bldg. 825), will be open starting at 10:30 a.m.

John Tissler, a Distinguished Service Cross recipient and Sandia retiree, will address Sandians at 12:30 p.m. in the Steve Schiff Auditorium.

The event is sponsored by the Sandia Military Support Committee (MSC), formerly known as the Veteran's Outreach Committee.

JOHN TISSLER circa 1969

John was awarded the Army's Distinguished Service Cross for extraordinary heroism in connection with military operations involving conflict with an armed hostile force in the Republic of Vietnam.

The Distinguished Service Cross is the second highest award for heroism awarded by the United States. John retired from Sandia in 2010 with 30 years' service. If you would like to learn about John's extraordinary heroism, visit the *Military Times*' Hall of Valor. The MSC has also arranged for John to meet with other veterans employed at Sandia. After the formal presentation, there will be an informal reception in the foyer of the Steve Schiff Auditorium to allow everyone to meet John.

From 10:30 a.m.-12:30 p.m. an Information Fair staffed by local military support organizations will be held in the Steve Schiff lobby. Representatives from numerous organizations will explain ways that they support the military and suggest ways you can help. The Blue Star Mothers will be present and are collecting items that they can send to our troops, including protein items (tuna packets, slim jims, jerky), pudding cups, fruit cups, raisins and all kinds of dried fruits, travel-size mouth wash, dental floss,lip balm, hand warmers, gum, but no candy. And, paperback books are always welcome.

The MSC welcomes all Sandians to join the committee. If you are interested in getting involved, send an email to Jody Thomas at jmthoma@sandia.gov to be put on distribution for notification of support opportunities and events. You don't have to be a veteran — just interested in supporting the military.

Poster from US Veterans Administration

Some facts about America's veterans

Here are some facts about the current veteran population of the United States:

- 9.2 million veterans are over the age of 65.
- 1.9 million veterans are under the age of 35.
- 1.8 million veterans are women.
- 7.8 million veterans served during the Vietnam War era (1964-1975), which represents 33 percent of all living veterans.
- 5.2 million veterans served during the Gulf War (representing service from Aug. 2, 1990, to present).
- 2.6 million veterans served during World War II (1941-1945).
- 2.8 million veterans served during the Korean War (1950-1953).
- 6 million veterans served in peacetime.

* * *

As of 2008, 2.9 million veterans received compensation for service-connected disabilities.

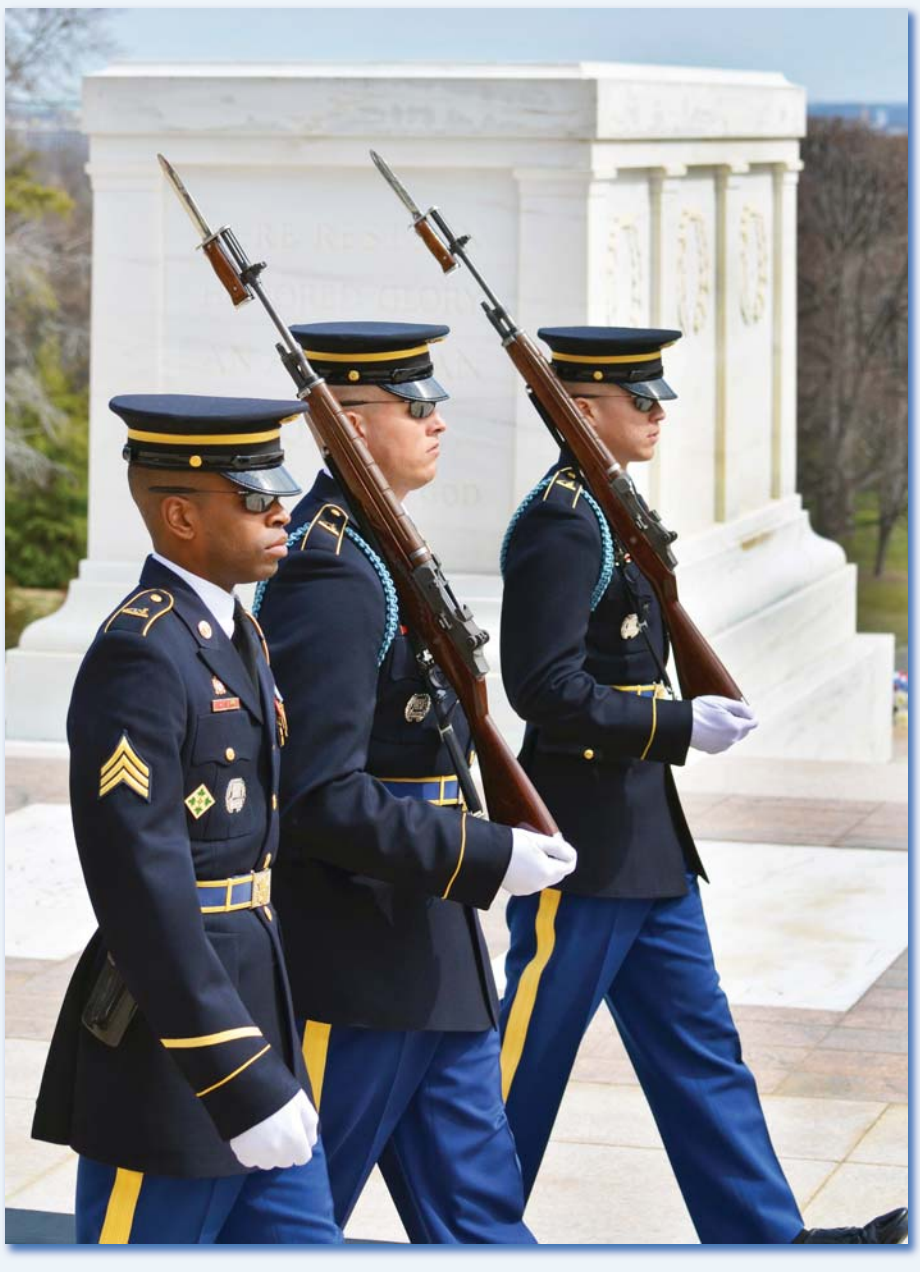
* * *

Five states have more than 1 million veterans among their population: California (2.1 million); Florida (1.7 million); Texas (1.7 million); New York (1 million); and Pennsylvania (1 million).

* * *

The VA health care system had 54 hospitals in 1930. Since then it has expanded to include 171 medical centers; more than 350 outpatient, community, and outreach clinics; 126 nursing-home care units; and 35 live-in care facilities for injured or disabled vets.

Information from US Census Bureau and US Veterans Administration



WITH HIGHEST HONORS — Members of the US Army's Guard of Honor at the Tomb of the Unknowns at Arlington National Cemetery. The Veterans Day National Ceremony is held each year on Nov. 11 at Arlington National Cemetery. The ceremony commences precisely at 11 a.m. with a wreath laying at the Tomb of the Unknowns and continues inside the Memorial Amphitheater with a parade of colors by veterans' organizations and remarks from dignitaries. The ceremony is intended to honor and thank all who served in the United States Armed Forces.

(Photo by Randy Montoya)

Sandia's B53 Dismantlement Team wins Secretary's Achievement Honor Award

By Iris Aboytes

Sandia's B53 Dismantlement Team was recognized as a Secretarial Achievement Award winner in ceremonies held at the DOE Headquarters Forrestal Building, Washington, D.C., on Oct. 27.

The Secretary's Awards Program was created in 2007 to continue the department's long history of recognizing employees whose performance exceeds the call of duty. Under this program, the secretary personally recognizes federal and contractor employees for exemplary achievements with Secretarial Honor Awards, Appreciation Awards, and Departure Awards.

The Honor Awards, which include the James R. Schlesinger Award, the Excellence Award, and the Achievement Award, represent the highest level of internal nonmonetary recognition. The Schlesinger and Excellence Awards are given to individuals, and the Achievement Award is presented to groups or teams of employees.

Sandia's team received the award for implementing the B53 dismantlement process utilizing efficiency and strict safety standards.

"This team developed and executed hazard-resistant tooling and procedures to facilitate the safe dismantlement of a 50-year-old weapon type," says B53 Dismantlement manager Phil Hoover (2111). "The B53 Dismantlement Project eliminates a weapon type that does not have modern nuclear safety features. Collaboration was established among all sites to meet the milestones and project plan on schedule as defined by NNSA."

The team developed a method and tooling to disassemble a minivan-sized bomb weighing approximately 10,000 pounds. They incorporated the latest material science expertise to address potential age-related material deficiencies.

An NNSA Nuclear Explosive Safety Study, also known as NESS, was conducted to assess the safety adequacy of dismantlement operations. The review resulted in only one prestart finding, a substantial achievement.

A lack of B53 design expertise presented a challenge, but the team researched B53 records and conducted analyses and tests on aged hardware to recreate B53 design expertise.

The team focused on safety for the dismantlement, addressed human factors, developed strong weekly communication among all sites, examined each safety scenario, and ensured that the dismantlement process was repeatable for each disassembly.

MEMBERS OF SANDIA'S B53 Dismantlement Team, recently honored with a DOE Secretarial Achievement Award, stand beside a B53 weapon casing in the display yard at the National Museum of Nuclear Science & History. (Photo by Randy Montoya)

"This is a perfect example of an outstanding team doing what we do best: serving the nation," said Deputy Labs Director and Executive VP for National Security Programs Jerry McDowell, in congratulating the team. "This is a terrific recognition of critically important work. The dismantlement of the B53 was important to complete and the right thing to do for operations. The individual and collective team effort has served our nation and represented Sandia in a good light."

Phil Hoover and Cynthia Kajder (2111), Sandia B53 Project team leader, accepted the award.

* * *

Team members from Sandia: Cynthia Kajder (2111), Mike Eckart, contractor, (2111), Earl Graff (retired, 2111), Debbie Lee Campos (2111), Phil Hoover (2111), Pat Sena (2110), Fred Trussel (412), Marty Fuentes, Anh Lai, and Henry Apodaca (432), Kim Merewether (433), Mike Rhoads (retired-Military Liaison), Jason Morris (431), Dan Summers (411), Betty Whitfield, contractor, (421), Kenneth Gwinn (1524), David Tallant, contractor (1822), Robert Galloway (2132), and Mark Greenslete (2913).

NNSA announces dismantlement of last B53

In ceremonies at the Pantex site in Amarillo, Texas, on Oct. 25, NNSA announced that the last B53 nuclear bomb has been dismantled.

An NNSA news release announcing the milestone said the dismantlement of the 1960s-era weapon system is consistent with President Obama's goal of reducing the number of nuclear weapons.

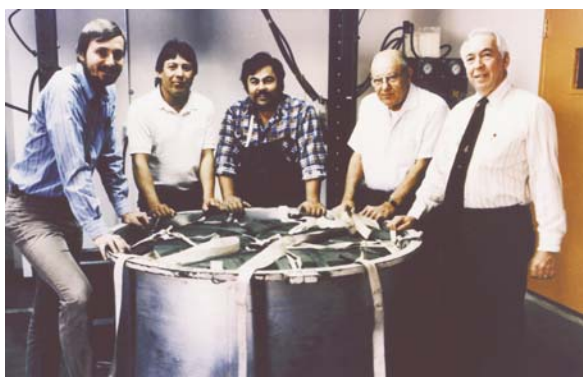
"The dismantlement of the B53 bomb — the oldest weapon in America's arsenal and one of the largest in US history — is a major accomplishment that has made the world safer and for which everyone involved should be proud," said Deputy Secretary of Energy Daniel Poneman. "Safely and securely dismantling surplus weapons is a critical step along the road to achieving President Obama's vision of a world without nuclear weapons."

"Today, we're moving beyond the Cold War nuclear weapons complex that built [the B53] and toward a 21st-century nuclear security enterprise," said NNSA Administrator Thomas D'Agostino. "I applaud the outstanding work done by the dedicated men and women across our enterprise to ensure that the B53 dismantlement program was safely completed 12 months ahead of schedule, and appreciate their continued commitment to working in challenging environments to advance a critical national security mission."

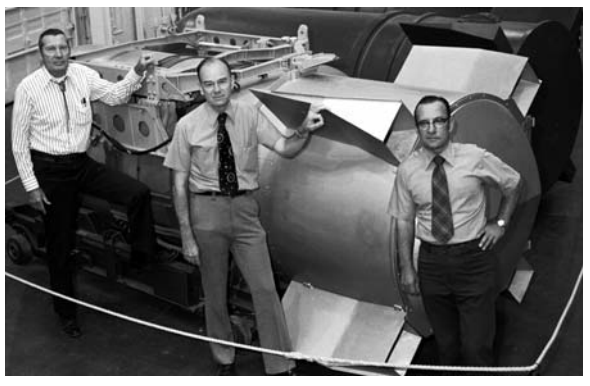
Los Alamos National Laboratory and Sandia designed the B53 bomb. After being introduced into the stockpile in 1962, the B53 served a key role in America's nuclear deterrent until its retirement in 1997. The B53 bomb is one of the longest-lived and highest-yield nuclear weapons ever fielded. Its sheer size and weight provided many challenges for the project team responsible for developing a dismantlement program that meets NNSA's rigorous requirements.

A B-52 CONDUCTS A DROP TEST of the B53 at the Tonopah Test Site during a 1995 test series. Note at lower left the drag 'chute, which deploys first and pulls the main parachute from the weapon casing.

A MISSION TEAM inspects a B53 weapon casing after a test drop at the Tonopah Test Range in April 1995.



PARACHUTE TEAM — In 1987 Jim Nelsen, Joe Archuleta, Dan Luna, Harold Widdows, and Phil Owens display their B53 packed parachute system, a cluster of three 48-foot diameter parachutes in a single container.



WEAPONEERS Ed Bruce, Charlie Jackson, Joff Myers with the B53 in this photo, published in 1976.

Mileposts

New Mexico *photos by Michelle Fleming*
California *photos by Randy Wong*

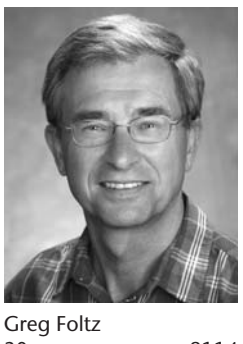
Robert Barton
35 10248

Clifford Sharp
35 5339

Recent Retirees

Kit Schmitz
37 8247

Alan Kerstein
35 8351



Greg Foltz
30 8114

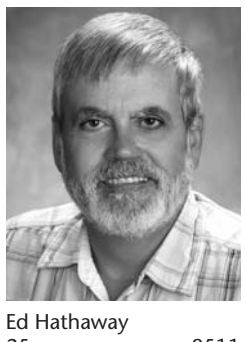
Wen Hsu
30 8128

Steve Ikebe
30 8247

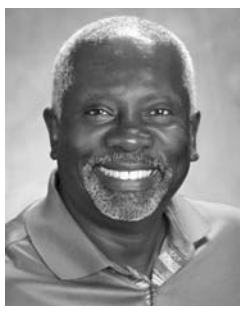
Karen Lee Krafcik
30 8223

Tracey Lamee
30 8949

Lawrence Thorne
30 8123



Ed Hathaway
25 8511



Marvin Kelly
25 8511

Mary Ortega
25 10654

Scott Bisson
20 8128

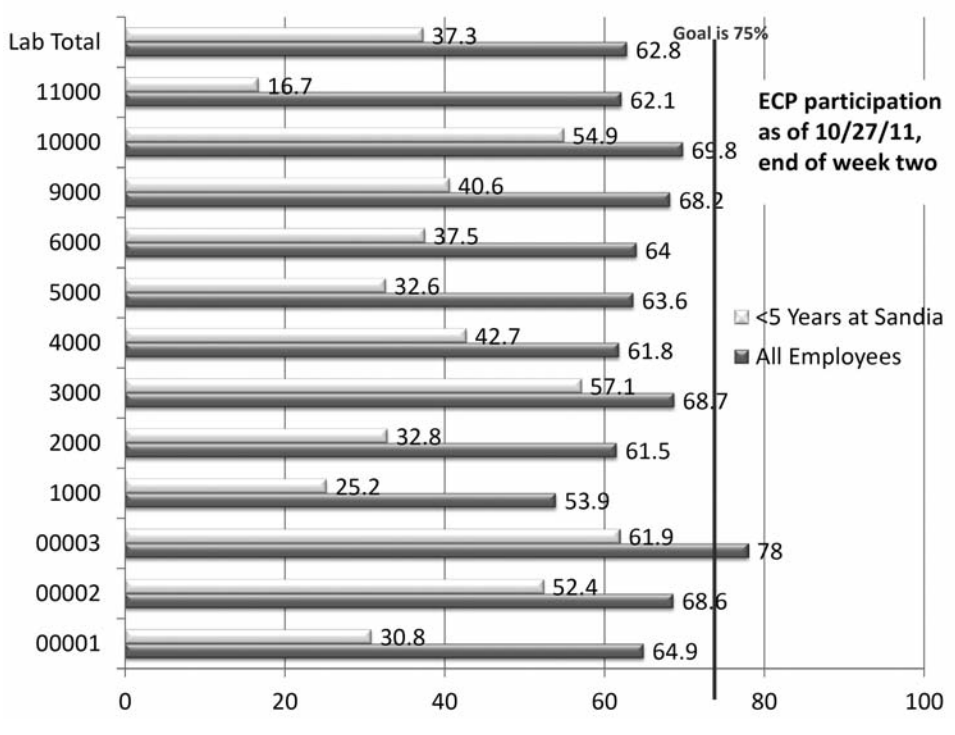
Elsa Glassman
20 3502

2011 ECP campaign winds down; many organizations nearing Labs-wide participation goal

YOUR SUPPORT AIN'T NO BULL — Diana de la Rosa's (4232) 4-year-old special-needs daughter, Jenna (See *Lab News*, Feb. 11, 2011), gets to ride a powerful and mean bull during the recent New Mexico State Fair. With the help of several United Way agencies, Jenna gets to experience life just like everybody else.

Employee Caring Program

The chart at right shows the participation rate — by years of service and by organization — among Sandians in the annual Employee Caring Program campaign at the end of the second week of the three-week effort. Although the Sandia/New Mexico ECP campaign officially closes on Nov. 4, the interactive website for contributions will remain active — and results will be tallied — for an additional week. Help push Sandia over the top — and help our friends and neighbors in need — by going to give.sandia.gov and making an investment in the community.



Mary Abt
15 5212

Michael Rector
15 5763

Will Wente
15 2552

Patti Hough
15 8954

'I am a scientist through and through'

Magazine highlights Bernadette Hernandez-Sanchez as one of 'Forty Under Forty' rising stars in science, technology, engineering, and mathematics

By Iris Aboytes

The fall issue of *Hispanic Engineer & Information Technology* highlights Bernadette Hernandez-Sanchez (1815) as one of the Forty Under Forty rising stars in science, technology, engineering, and mathematics, or STEM.

The publication is devoted to promoting engineering, information technology, science, and technology to Hispanic Americans.

Bernadette works on luminescent materials for radiation detectors along with biofouling- and corrosion-proof coatings for devices that harness the ocean's kinetic and thermal energy. In the seven years Bernadette has been at Sandia, she has been published in 23 journals and has three patent applications.

Bernadette's journey in becoming a scientist began at Sandia. As a high school intern, she worked under Timothy Boyle (1815).

"I just had fun," says Bernadette. "I liked chemistry because you got to work with your hands. I liked mixing solutions, seeing colors change, and growing crystals."

This experience fueled her desire to become a chemist. She attended New Mexico Institute of Mining and Technology for her undergraduate degree and Colorado State University, where she earned her PhD in chemistry in 2004.

Bernadette's love of the Labs and strong work ethic shaped her early career.

"From an early age my parents taught me about work ethics," says Bernadette. "That was later reinforced by my mentors and teachers. I attribute my work ethic, along with my passion for working in the lab, as the catalyst for my success. The lab is where I still feel most comfortable because I enjoy learning about how things work."

Outside the lab, Bernadette's love is educational outreach. She leads Sandia's MANOS ChemisTRY program, is an Explora Portal to the Public (PoP) scientist, and also mentors students (K–12 to graduate students) in her lab. As a postdoc, she helped design the CSI Dognapping Workshop, which she helps coordinate. The two-hour workshop, held at Sandia every year since 2006, introduces elementary school children to science, engineering, and nanotechnology.

"By engaging them as 'junior scientists' and guiding them to pore over evidence at various stations, students help solve the mystery of a missing dog," says Bernadette.

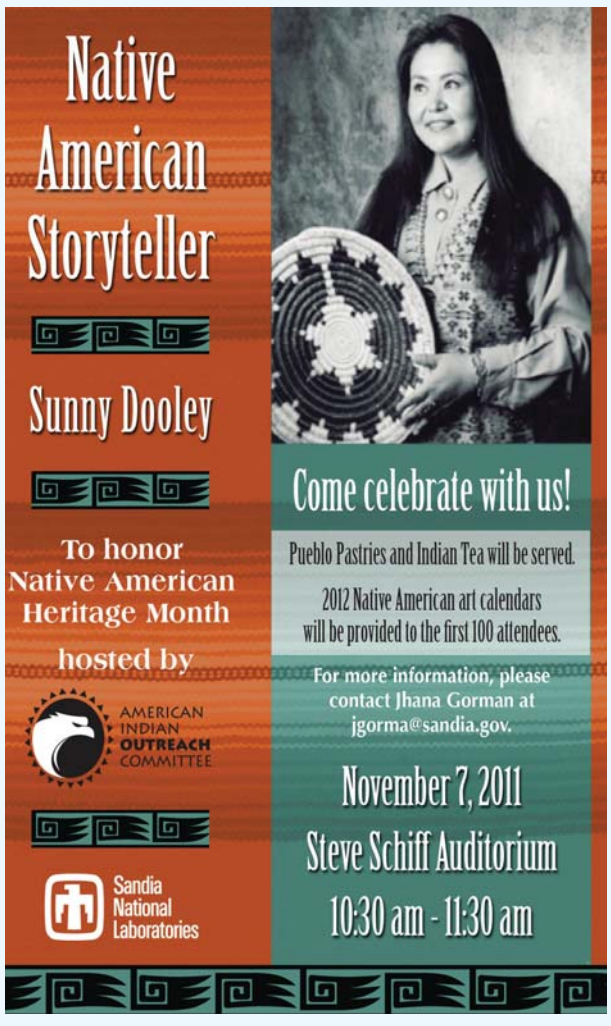
Giving back to Sandia

She is dedicated to encouraging young scientists-in-training to follow their dreams and to giving back to Sandia through her outreach.

"I am grateful to Sandia and my scientific family in Center 1800 for supporting student programs," says Bernadette. "They made my and other new staff members' early research experiences memorable. It encouraged us to return to Sandia and begin our professional careers.

"I felt excited and honored to hear I was selected for my early career contributions to science. It made me reflect on my own personal struggles, my experimental triumphs and failures, and what I have learned through those processes. I know this sounds silly, but this reflection helped reinforce my self-perception of who I am. Yes, I am a scientist through and through and am living my dream! However, I am not done yet, and am on my way to new scientific adventures."

BERNADETTE HERNANDEZ-SANCHEZ, at home in her lab, is one of *Hispanic Engineer and Information Technology* magazine's "Forty Under Forty" rising stars. (Photo by Randy Montoya)



Make a difference day

MAKE A DIFFERENCE DAY 2011 — Some 250 Sandia employees, contractors, retirees, family members and friends spent Oct. 14, 20, 21, and 22 helping to complete projects throughout the community. In the photo above, Sandia volunteers repaint the US map on the Sandia Base Elementary School playground. (Photo by Patty Zamora)