

Dry casks take the heat

Sandia measures simulated spent nuclear fuel temperatures in a dry cask to gather verification data

By Kristen Meub

Sandia researchers have built a scaled test assembly that mimics a dry cask storage container for spent nuclear fuel to study how fuel temperatures change during storage and how the fuel's peak temperatures affect the integrity of the metal cladding surrounding the spent fuel.

Regulators could use the data to help verify computer simulations that show whether nuclear power utilities are complying with regulations that specify how much heat a dry cask can safely handle.

Nationwide, nuclear power plants are running out of room in the cooling pools they use to store spent nuclear fuel when it is removed from the reactor and at its hottest. The United States does not have an operating geologic repository for the permanent disposal of spent nuclear fuel, so many power plants use dry casks that can house spent fuel for up to 60 years, as an interim solution that allows them to move groups of fuel rods, or fuel assemblies, out of the pools.

"New cask designs are storing more spent fuel, from 17 pressurized water reactor assemblies up to 37 now," said Samuel Durbin, a Sandia mechanical engineer. "They are

(Continued on page 4)



HOT, DRY AND SIMULATED — Sandia designed and constructed a dry cask simulator for boiling water reactor assemblies to study how hot spent nuclear fuel will get during storage and how the fuel's peak temperatures affect the integrity of storage casks over time. Electrical heaters shaped like fuel rods were used instead of spent nuclear fuels in the otherwise prototypical fuel assembly.

(Photo by Randy Montoya)

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Diesel doesn't float this boat

By Jules Bernstein

Marine research could soon be possible without the risk of polluting either the air or the ocean, thanks to a new ship design and feasibility study led by Sandia.

Hydrogen fuel cells have existed for decades, and there are multiple advantages to using them instead of diesel engines to power research ships. Fuel cells are zero-emissions technology, so they won't contaminate air or water samples collected in sensitive ecological areas. They make almost no noise, so they won't upset marine life or interfere with the many sensors scientists use to listen to sound in the ocean.

Despite these and many other advantages, the feasibility of a hydrogen-powered research vessel has never been studied or proven.

Until now.

A recent Sandia report shows it is technically and economically feasible to build such a vessel in a manner consistent with marine regulations. The project team nicknamed the vessel the Zero-V, short for zero-emissions research vessel.

All hands on deck partnership

The project, led by Sandia, brought together the Scripps Institution of Oceanography at the University of California, San Diego; Glosten, a naval architecture firm; and DNV GL, a global quality assurance and risk management company working for the maritime industry. It was funded by the Department of Transportation's Maritime Administration.

One of the biggest additional benefits of using

hydrogen to power a boat is the absence of ecologically damaging fuel spills. According to Sandia chemist and project lead Lennie Klebanoff, it is impossible to have a polluting hydrogen spill on the water. More buoyant than helium, hydrogen rises on its own and eventually escapes into outer space.



CLEAN RIDE — Artist's rendering of the Zero-V hydrogen-powered research vessel.

(Image courtesy of Glosten)

"If you're working in a sensitive ecological area and you spill liquid hydrogen there, the fuel not only removes itself from this environment, it removes itself from the planet," Lennie said.

Fuel cells even generate water so pure that the ship's crew can drink it (with conditioning), or use it for scientific experiments, reducing the need to desalinate seawater, which currently consumes large amounts of energy. Also, fuel cells are electrical devices and, as such, they offer a faster power response than internal combustion engines.

Sandia's expertise stems from a portfolio of hydro-

gen projects that aim to develop efficient transportation solutions with clean domestic fuels. Sandia's role was to lead the project, choose the kind of fuel cell to use and the method of storing the hydrogen and provide information on the safety-related properties of hydrogen to the U.S. Coast Guard and the regulatory partner, DNV GL.

Sailing on the winds of earlier success

The Zero-V project evolved from earlier Sandia work on the SF-BREEZE, a hydrogen-powered passenger ferry designed to operate in the San Francisco Bay.

Small hydrogen-powered pleasure crafts made for very short distances already existed. But prior to the SF-BREEZE, there hadn't been a project that looked at the technical and economic feasibility of powering large, fast commercial boats with hydrogen, according to Joe Pratt, who led the SF-BREEZE project for Sandia.

"Until we did the SF-BREEZE, very few people thought you could power a real ship, a business venture, on hydrogen fuel cell power,"

Joe said. "In addition to proving it was technically possible, we had to show that it would pencil out economically, so that it would have a chance of going out into the marketplace."

Based on the SF-BREEZE and other related work, Joe came to believe so strongly in hydrogen's commercial potential that he took entrepreneurial leave from Sandia to start Golden Gate Zero Emission Marine. The company builds hydrogen fuel cell powertrains for the maritime market.

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The amazing growth of renewable energy from solar cells: A lesson for how we fund research?

By Carleton Seager, Sandia retiree

Does it seem like rooftop solar panels are popping up everywhere in New Mexico? Have you been to Europe recently and seen massive solar cell arrays beside many roads? Solar cell industry statistics confirm these observations.

Since 2004, the rate at which solar cell power is installed has doubled every 22 months and is now in excess of 0.1 terawatts per year.

Research driving some of this expansion began right here at Sandia more than 40 years ago. When the Arab oil embargo produced major gasoline shortages and price increases, the federal government responded by funding research on renewable energy sources. Sandia began programs on wind energy, geothermal power, solar thermal energy and photovoltaic (solar) cells.

While most of Sandia's solar cell funding aimed at processing expensive single crystal silicon cells for concentrator use, a second initiative involved fundamental research addressing the issues involved in producing cheap flat-panel cells. The program initially focused on developing thin-film silicon solar cells, but it later included work on other types of silicon cell structures.

Single-crystal silicon wafers, where all the atoms are perfectly aligned in a single orientation, were far too expensive to meet program goals, so inexpensive growth techniques that produced silicon layers consisting of many randomly oriented crystals were investigated.

However, it was known then that the regions where these misoriented crystals came into contact, grain boundaries, could degrade solar cell performance. The electronic structure of these regions was disturbed by the atomic misalignment and, possibly, by the tendency of these boundaries to attract impurities. Little was known then about the relative importance of either of these effects.

The program to understand these grain boundary regions and their effects on solar cells involved cooperation with other national laboratories, high-tech companies, numerous Sandia staff members and a visiting faculty member from the University of Rochester. These efforts spanned seven years and enjoyed continuous funding from both Sandia and, later, the National Renewable Energy Laboratory, then called the Solar Energy Research Institute.

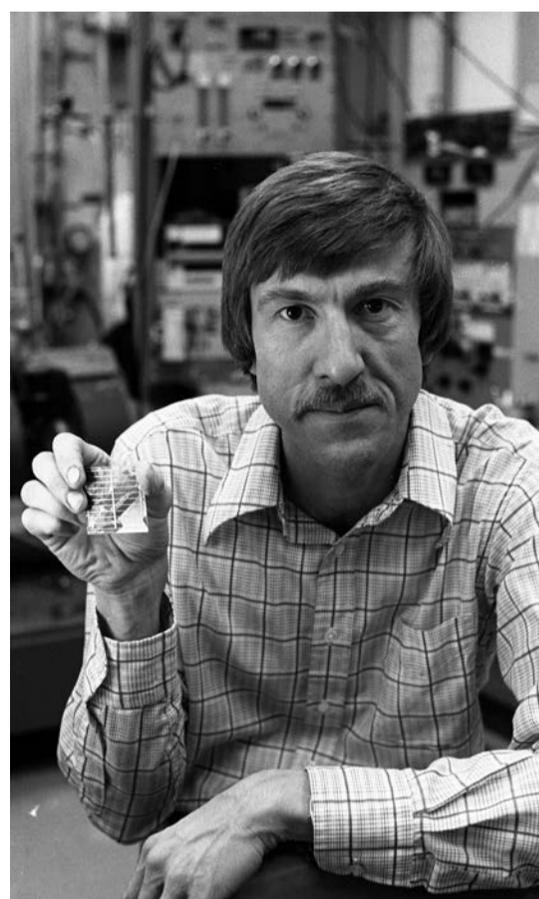
In addition, scientists from Oak Ridge National Laboratory helped initiate the program by supplying special polycrystalline silicon material. With these samples in hand, new electrical techniques were devised to measure the electronic properties of the grain boundary regions, and several theoretical studies were completed that allowed this new data to be used to deduce the actual density of the "bad" electronic states in these regions.

These initial investigations allowed Sandia researchers to quantitatively characterize grain boundary properties in routine fashion, and it became clear that the next step should be to thermally or chemically modify these boundaries. Based on emerging information from studies of amorphous semiconductors, equipment was constructed to expose the silicon grain boundary samples to atomic species of fluorine, hydrogen and other gases, which involved creating low-pressure plasmas of these gases at elevated temperatures.

The hope was that these species would diffuse into the silicon and tie up, or passivate, the "missing" chemical bonds that were created by the structural disorder at the grain boundaries. To monitor the effects of these treatments, researchers observed the resistance of these structures when electrical currents were forced across them. While little change was seen in boundary resistance for most of the gases that were tried, remarkable changes were seen when hydrogen was used. In some cases, reductions of boundary resistance by factors of 100 or more

Lab News Notes

Editor's Note: Lab News seeks guest columnists with observations on life at the Labs or on science and technology in the news and in contemporary life. If you have a column (500-750 words) or an idea to submit, please contact Jim Danneskiold, the acting editor.



SOLAR REVOLUTION — Carl Seager displays an example of a polycrystalline silicon solar cell, in a 1984 file photo. Note that the light reflection differs on the surface of the various crystals in the material. Sandia developed the hydrogen passivation technique that improved the photovoltaic performance of this class of relatively inexpensive solar cells.

(Photo courtesy of Sandia National Laboratories)

were seen, and it became clear that these chemical treatments might hold promise for improving solar cell performance.

From this point on, the focus of the program changed to observing the effects of these passivation treatments on real solar cells. Prototype polycrystalline silicon cells were obtained from Honeywell Corp. and Mobil Solar Energy, and other Sandia researchers with expertise in ion beams were brought into the program. Their equipment produced directed beams of hydrogen ions that had specific energies and fluxes, so modeling of the hydrogen passivation process could be made more quantitative. Using this approach, it became clear that short exposures of typical polysilicon cells to hydrogen ion beams could improve typical efficiencies by 20-30 percent. More importantly, the statistical spread in cell outputs could be significantly narrowed, and the resulting improvements were extremely impervious to repeated illumination and thermal cycling.

While the results of this research attracted considerable attention, the full economic impact of this work would only emerge more than 30 years down the road. The growth and slicing of silicon wafers and ribbons continued to be expensive and time consuming, and the costs associated with photovoltaics were not competitive with conventional power sources.

But things were beginning to change. In the early 1990s scientists at Mobil Solar found a way to introduce hydrogen by heating a hydrogen-rich layer applied to cells to reduce reflection. In the early 2000s, the cost of growing and slicing polycrystalline silicon ingots began to drop sharply, and production of cells in countries with cheap labor accelerated a reduction in reduced cell costs. From 2004 to the present, the total investment in polycrystalline silicon solar cells is more than \$300 billion. This truly is a remarkable growth industry with no end in sight, and the passivation process discovered at Sandia is still an important key to cell efficiency.

Are there lessons to be learned from this story? I think so. Federal investments in renewable energy can have big impacts that can't be predicted. It's important to take a long-term approach if we wish to see future payoffs similar to these Sandia-led successes in photovoltaics.

Some of the research described appeared in the paper, Passivation of grain boundaries in polycrystalline silicon, by C.H. Seager and D.S. Ginley of Sandia. Appl. Phys. Lett. 34, 337 (1979); doi: 10.1063/1.90779.



SILICON'S NOT SILLY — In a 1994 file photo, Jack Cannon inspects photovoltaic cells for long term exposure deterioration at Sandia's Photovoltaic Test Facility. (Photo by Randy Montoya)

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Computer science educator garners 2018 Sandia Excellence in Teaching Award

Top teacher programs inclusion into everything he does

By Madeline Burchard

Miguel Baez, Granada High School computer science teacher, was recently getting his students motivated after welcoming them back from lunch. After getting his class settled, he was interrupted by P.J. Daley, the school's principal.

The class murmured to each other, trying to figure out why their principal had entered their classroom and why their teacher looked equally surprised. That was until Kelly Bowers, superintendent of the Livermore Valley Joint Unified School District, and Madeline Burchard, Sandia community relations officer, entered the classroom with balloons, flowers and an oversized check for \$500 from the Livermore Valley Education Foundation.

"Out of hundreds of teachers in the district, your teacher is the winner of the Sandia Excellence in Teaching Award," Bowers said. "He is being recognized for what many of you already know, which is that he is dedicated to finding new and interesting ways of teaching you all."

Baez was initially speechless, but it didn't take him long to find his words again and speak to his class. He impressed on the class that, in the end, they are the reason he goes above and beyond.

"You all are my motivation," Baez said. "Every time I

see you all overcome a hurdle and not give up on yourselves and each other, you give me the inspiration to do even more. So, thank you for building me up every day."

Baez was nominated for his dedication to making his computer science curriculum interactive and inclusive. One of his classes is a computer class for English-language learners, comprised of mostly Spanish speakers. Instruction is provided in both English and Spanish and includes talks by Spanish-speaking scientists and engineers.

Baez's dedication goes beyond the classroom walls. He coaches CyberPatriots teams, including a team of mostly Spanish-speaking students. As a coach, he focuses on making his teams as inclusive as possible for all students, including those who have not taken a single computer science course. His teams have won cybersecurity competitions in San Francisco's Bay Area and



SURPRISE — Granada High School students try to figure out why principal P.J. Daley (second from right) and school superintendent Kelly Bowers (right) had entered their classroom as their teacher Miguel Baez (second from left) is surprised with the 2018 Sandia National Laboratories Excellence in Teaching Award.

(Photo courtesy of Sandia National Laboratories)



TOUTING TEACH — Miguel Baez, Granada High School computer science teacher, was recently surprised with the 2018 Sandia National Laboratories Excellence in Teaching Award. (Photo courtesy of Sandia National Laboratories)

have served as examples that diversity makes groups stronger.

"Walking into Miguel's class is like walking into a startup," said Regina Brinker, the district's science curriculum specialist. "The energy is high. Everyone is sharing ideas and collaborating. Miguel gives students the tools and boundaries to allow them to work at their

highest capacities. He makes extra efforts to include Hispanic students, girls and other typically underrepresented groups in STEM."

The Sandia Excellence in Teaching 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 come alive for their students. The honor comes with a \$500 cash award. The award is managed by the Livermore Valley Education Foundation and funded by Sandia's Corporate Contributions program.

Burchard said being part of the surprise is one of the reasons why she loves her job.

"Walking in and witnessing Miguel's expression was priceless," Burchard said. "It was as if we had just handed him a Publishers Clearing House check for a million dollars. Seeing the students cheer was a true testament of Miguel's dedication to his profession."

Zero-V Boat

(Continued from page 1)

The SF-BREEZE design accommodates 150 passengers on four, 50-mile round trips in the San Francisco Bay per day while traveling at a top speed of 35 knots (roughly 39 miles per hour). Ensuring the ferry could achieve that speed meant adopting a 100-foot catamaran design, slightly longer than usual.

All the plan elements, including ship design, weight distribution and refueling options had to be re-evaluated for the Zero-V.

"Instead of going fast for short periods and carrying a lot of people, the research vessel goes slower for much longer distances, carries fewer people and must allow the operation of sensitive scientific instrumentation," Lennie explained. "The research vessel is a different animal from a passenger ferry."

Navigating around design challenges

While working on the SF-BREEZE, Joe and Lennie approached the Scripps Institution of Oceanography to see whether researchers there were interested in a hydrogen-powered vessel. They were, if the Zero-V could complete tasks that are routine for ocean-going research missions, such as marine ecosystem studies, physical oceanography, tsunami risk and ocean chemistry research.

Mapping or installing equipment on the ocean floor requires a vessel to be stable over a single point for long periods, even in high winds or rough seas. Glosten determined that installing propulsion devices in each side hull would enable the Zero-V to maintain its position with more than 25 knots of wind and waves from any direction.

Whereas the SF-BREEZE requires refueling after 100 miles, the Zero-V needs to go at least 2,400 miles or 15 days before requiring a refuel; enough to get from San Diego to Hawaii. Given the great distances it needs to travel, a refueling terminal in one central location isn't what is needed. The Sandia team found an innovative approach that allows liquid hydrogen suppliers to drive

fuel trucks directly to the ship at ports of call. Thus, the Zero-V would require little investment in fueling infrastructure.

In addition to the aforementioned requirements, Glosten's Sean Caughlan said finding a way to store the heavy hydrogen tanks while accommodating at least 18 scientists, 11 crew members and three laboratories was a challenge. Part of the solution was selecting a trimaran boat design. A trimaran has three parallel hulls, and is usually used for high-speed boats. The design offers a great deal of space above deck for the tanks, and adequate below-deck space for other science instrumentation and machinery.

Toward fair winds and following seas

The team designed the Zero-V using proven, commercially available hydrogen technology so they could be sure it would work. Once completed, the vessel design was reviewed by DNV GL and the U.S. Coast Guard. Both regulatory bodies independently came to the same conclusion: there are no "show-stopping" technical issues with the Zero-V design.

In fact, DNV GL hydrogen expert Gerd Petra Haugom says the Zero-V design shows an essential understanding of the safety-related properties of hydrogen, and how it can be used safely and securely on a vessel.

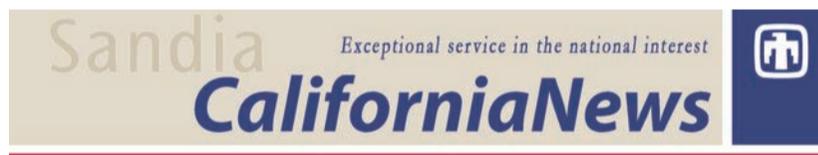
"This project has been a good test of our own rules and the alternative design approach for using hydrogen and fuel cells," she said. "The results from the Zero-V will be part of a benchmark to guide our assessment of similar vessels in the future."

With a solid design in place, the next step for the Zero-V is finding the funding to build it. The Zero-V has similar capital costs to diesel-powered vessels, but would cost roughly 7 percent more to operate and maintain. Given its benefits — much quieter, zero emissions and no risk of polluting fuel spills — Bruce Applegate, who oversees the Scripps fleet, is hoping that like-minded donors will step up to support the project.

"Like other game-changing ideas, this approach initially seems expensive. But solar power was very expensive not too long ago, and now it's affordable and widely adopted. Hydrogen fuel cells are just as transformative a technology. They produce clean, quiet, non-polluting power to ships while enabling superior scientific capabilities," Applegate said. "Building and operating the Zero-V will significantly advance U.S. marine transportation technology."



CREW OF THE GOOD SHIP ZERO-V — Joe Pratt (left) currently on entrepreneurial leave from Sandia, and Sandia California hydrogen and materials researcher Lennie Klebanoff are seen here in Norway on a trip to visit Zero-V partner firm DNV GL. (Photo courtesy of Lennie Klebanoff)



It's up to you... to stay safe out there

Employee Health Services talk offers tips, techniques for personal safety

By **Stephanie Holinka**

To stay safe, observe and assess your surroundings wherever you are, and take personal responsibility for yourself and others, retired Albuquerque Police Department public information officer Trish Hoffman told a Sandia crowd at a recent talk hosted by Employee Health Services.

"I get asked to talk about personal safety and self-defense. What I can tell you is that Albuquerque is a violent city," Hoffman said. "But the key to personal safety and self-defense everywhere is being responsible for your personal safety."

Hoffman retired from APD in December after 23 years as a public information officer, as well as filling positions in Internal Affairs and the Aviation Division. With more than 10 active certifications and specialty trainings in leadership, self-defense, defensive tactics and crisis intervention, Hoffman now trains women to take back power through Women Against Crime self-defense programs.

Hoffman urged attendees always to be aware of their surroundings. Though she's retired from the police, she said she observes and assesses every situation in the same way she did then.

"When I was working, I could call for back-up. Now, there's just me," she said. "But everyone has a story. Where you come from, what's happened to you, sets the stage for what you feel about personal safety."

Hoffman said people often set up for interactions by the way they walk.

"If I am distracted, versus if I'm walking into the room confident, it changes how I'm perceived. It's always better not to be the path of least resistance," Hoffman said.

People have to train themselves to stay safe every day, Hoffman said.

dominant hand free for defense.

"The first option to consider in a dangerous situation is always to run and scream," Hoffman said. "The more distance you can make between you and an attacker, the more time you have to assess the situation and decide what to do."

Hoffman encouraged people to assess quickly when an attacker confronts them, then decide how

to respond based on the type of threat the attacker represents.

"Anything in your purse and wallet can be replaced. But when you are personally threatened, such as when someone tries to take you to another location, that's the time to respond," she said.

Robbers prefer to take the path of least resistance, just like potential victims.

Lighting, sensors, alarm systems and a dog can deter burglars and make a home less attractive to them. Leaving attractive things in a car, especially visible garage door openers or documents with personal information, can be an invitation to thieves.

People bear the primary responsibility for their personal safety and the security of their

property. Police response can feel like it takes a very long time. Hoffman encourages people to work with law enforcement to keep people safe.

"Law enforcement can't do their job without the community, and the community can't be safe without law enforcement. We have to work together. If something's going on that isn't right, pay attention to it, and follow through," Hoffman said.



GOTCHA NOW — Trish Hoffman shows some defensive moves to Sandia business operations intern Trey Patterson during her discussion of personal safety and property security, sponsored by Employee Health Services.

(Photo by Randy Montoya)

"Athletes and martial artists have to train, every day, to be good at what they do. What if, every day, you pay attention to what's around you when you do things like go to the ATM, when you are getting gas, etcetera," Hoffman said. "Another thing to think about is learning a few key moves you can use."

Hoffman suggests people carry purses, backpacks or briefcases on the non-dominant side, to keep the

Dry casks

(Continued from page 1)

increasing the pressure in the casks to increase convection, which transfers the heat out to the environment while the cask shields the radiation."

More storage demands more data

Durbin said the additional storage capacity of modern dry casks provides cost savings to operators and utility customers, but new data and computer models were needed to help verify existing computer modeling predictions that the fuel wouldn't be too hot, under any conditions, to affect the integrity of the fuel cladding.

The inaccessibility of the cask interior and high radioactivity of the spent fuel make it difficult to directly monitor the temperature, but Sandia's dry-cask simulator is providing answers on how spent fuel will age in the newly designed dry casks and how hot the spent fuel and cladding in the casks will become.

Simulating decades of temperature measurement

During a three-year project for the DOE and the Nuclear Regulatory Commission, Durbin and Greg Koenig, an advanced nuclear fuel cycle technologist, led a Sandia team that designed and constructed a dry-cask simulator for boiling water reactor assemblies and ran tests to measure the highest temperatures the cladding inside the canister would be exposed to under a variety of set conditions during decades of storage. No radioactive materials were used in the testing.

"The simulator is fitted with more than 750 data-gathering instruments, and about 700 of those are thermocouples, or devices that measure temperature,"

Koenig said. "We have special programming software that takes user parameters and determines the hottest temperature within the simulation. We control the power and pressure and can have many different decay heats.

Heaters stand in for nuclear fuel

Everything inside the cask is built to closely simulate the way it would be for a utility. The only difference is that Sandia's cask simulator uses electrical heater rods the same length and diameter as spent fuel rods instead of actual spent fuel.

"A lot of survivability and degradation issues are driven by the hottest part of the fuel," Durbin said. "By modeling these peak temperatures, we are providing knowledge about the fuel, which is important because a lot of phenomena are tied to the temperature the cladding sees while it's sitting inside the dry cask. So, the better you know what temperatures the fuel will reach during a set of conditions, the better you can predict the integrity of the fuel and the cask."

The team used the dry-cask simulator to measure temperatures for both above- and below-ground storage systems. For below-ground storage, they positioned a wind machine over the cask to replicate crosswinds between zero and 12 mph.

"Our simulator is very heavily instrumented so we can get a lot of quality information about the fuel," Durbin said. "We can take a known condition, collect data for it, and then model it."

Utility companies typically evaluate the performance of a dry cask through detailed analytical modeling of the cask's thermal performance. The analysis is used to demonstrate performance and regulatory compliance before commissioning a new cask, and the Nuclear Regulatory Commission independently verifies the results. The new data from Sandia could help regulators verify the accuracy of the analytical modeling.

Retiree deaths

Judy Davenport (age 66)	March 22
Theodore Sneddon (78)	April 12
James Sweet (79)	April 14
M. McLaughlin (91)	April 24
Jarvis Bumgarner (98)	April 24
Jose Ignacio (79)	April 28
Richard Wright (77)	May 4
Dallas Allen (77)	May 6
James Doggett (92)	May 7
J. Lochtefeld (86)	May 12
Raymond Clark (81)	May 14
J. Michael Stephenson (77)	May 16
Billy Thorne (80)	May 17
Richard Eifert (98)	May 18
Clifford Blossom (93)	May 21
Karl Livingstone (96)	May 24
Charles Johnson (83)	May 26
Robert Graham (83)	May 31
Fred Perea (67)	May 31
David Cole (66)	June 1
Earl Minor (97)	June 1
Donald Bush (92)	June 4
William Byroads (92)	June 5
Lawrence Posey (82)	June 6
Andrea Breckenridge (85)	June 7
Elwin Schaefer (92)	June 8
Marjorie Rabel (99)	June 9

'Never allow others to place their limits on you'

Sandia materials scientist inspires students through STEM program

By Lindsey Kibler

For 32 years, Sandia's Black Leadership Committee has brought science, technology, engineering and math to more than 3,000 middle and high school students through the Hands-On, Minds-On Technologies program.

And for materials scientist Olivia Underwood, volunteering with HMTech is one way to make a difference in the community.

HMTech began as an after-school program to inspire African-American students to pursue STEM careers. Ten years later, it became a Sandia-sponsored summer program open to sixth- through 12th-grade students, primarily African-Americans.

More than 100 students participated in this year's program, attending four six-hour Saturday sessions



UNDERSTAND MECHANICAL PROPERTIES — A student uses rubber bands, ice-pop sticks, paper clips and a wire hanger to illustrate the elastic and plastic regions on the stress and strain curve and to characterize each material failure as ductile or brittle. (Photo by Lindsey Kibler)

comprising two-hour blocks of instruction and hands-on learning. Students chose classes based on their grade levels in such subjects as anatomy, physics, chemistry, fractals, video game programming, coding, renewable energy, robotics and website design with HTML and CSS. HMTech also offered personal development classes, including money management and career planning.

'Exposure is key to success'

This is Olivia's second year working with the program and her first year as an instructor. In her class — "What is Materials Science?" — students learn how to identify metals, ceramics, composites, polymers, semiconductors and other materials by disassembling items like a scooter, waffle maker, handheld mixer and electric stovetop.

The students also made replicas of the atomic structure of crystals using Styrofoam balls and toothpicks to better understand such concepts as atomic packing and



CAN YOU REBUILD THIS? — Olivia helps her students disassemble a scooter during her materials science class. This is her first year as an instructor for Sandia's summer HMTech program. (Photo by Jacelyn Jefferson)



MATERIALS SCIENTIST — Olivia Underwood hopes to inspire others through her work with Sandia's Hands-On, Minds-On Technologies program. Olivia, a postdoctoral research assistant turned team lead, was the first African-American to receive a doctorate in materials science from the University of Alabama Huntsville. (Photo by Stephanie Blackwell)

stacking sequence. They made slime to observe the behavior of an amorphous solid.

Olivia taught mechanical properties by having the students use gummy worms, ice-pop sticks, paper clips, ceramic tiles and rubber bands to illustrate the elastic and plastic regions on the stress-versus-strain curve and to characterize material failures as either ductile or brittle. The curve provides engineers and designers a graphical measure of the strength and elasticity of a material, and allows them to predict the behavior of materials used in a given application.

"It's important to give back to the community, to show these kids that there are other people who look like them doing great things and they can do them too. Exposure is key to their success," said Olivia, who began her career at Sandia three years ago as a materials mechanics postdoctoral research associate. She's now a product realization team lead for an electronics group.

Faith, hard work and determination

Olivia grew up the youngest of seven children in Brent, Alabama. She remembers spending childhood hours taking things apart and analyzing them, and knew she wanted to be an engineer or a scientist. Her teachers encouraged her because she excelled in math and science. But her parents were her first teachers, instilling in her that with God, hard work and determination, she could do anything.

"What my parents wanted was for their children to be better than them," said Olivia. "My parents only have a ninth-grade education, but they have Ph.D.s in life lessons. They made sure I was prepared for it."

She learned from her siblings never to let her age, size or gender keep her from doing what she wanted, and refused to be told she couldn't do something.

"Never allow others to place their limits on you," she said.

Olivia earned her bachelor's and master's in metallurgical engineering from the University of Alabama in Tuscaloosa. She had several internships, including one at Los Alamos National Laboratory. She also worked as a

failure analyst engineer with CGI Federal Defense at Red Stone Arsenal, home to the U.S. Army's Aviation and Missile Research Development Center, and did research at the Center for Nanophase Materials Science at Oak Ridge National Laboratory.

At the University of Alabama in Huntsville, she felt challenged because initially she was the only African-American in her classes.

While the coursework was not difficult, she grew tired of fighting to prove herself, she said. She lost more than 10 pounds her first semester.

"I constantly had to remind myself that I was not built to be broken and I was not going to leave without my Ph.D.," she said. "As a black woman, it's easy for someone to tell you what you can't do, but no one is going to tell me what I can't do."



PUMPING IRON — Weight lifting is one way Olivia relieves stress. She competed in her first body building competition in 2014, where she secured two second-place finishes. (Photo courtesy of Olivia Underwood)

In 2015, she became the first African-American to earn a doctorate in materials science at UAH.

"It's never easy to be the first one to do anything, but it's always worth it when you are able to see others cross the finish line after you," said Olivia. "I will continue to blaze those trails and remove those glass ceilings."

Olivia knows African-Americans are underrepresented in math and science fields. To address the issue by helping others toward STEM careers, she established the Dr. Olivia D. Underwood Scholarship at her alma mater, Bibb County High School.

In addition to volunteering with HMTech, Olivia also serves as outreach co-chair of the Sandia Women's Action Network, where she works to "engage members of Sandia's workforce and the local community to support activities for local youth in math, science and engineering," and to promote "opportunities to improve visibility of women in science and act as a force for good in our local community."

Olivia said she hopes her work with HMTech will show the students that they are capable of anything. "Change starts with me, and I do that when I lead by example. It's important to give back and show our youth that they can do it too, because they are our future."

Mileposts



New Mexico photos
by Michelle Fleming
California photos
by Randy Wong



Patricio Abeita 40



Dean Mitchell 40



Dino Pavlakos 40

Recent Retirees




Jerry Adams 38



Dennis Bateman 35



Stephen Foiles 35



Sharon Trauth 35



JD Patrick 30



Demmy Edwell 40



Steve LeTourneau 30



Eric Thulin 30



Duane Vermeire 30



Patrick Brady 25



Rich Detry 25



Steve Lott 29



Albert Nunez 20



Basil Hassan 25



David Gibson 20



Brian Milesosky 20



Cindi Reyes 20



Mark Platzbecker 35



Debbie Stephens 37



Alex Tappan 20



Alisa Bandlow 15



Nathanael Brown 15



Amanda Dodd 15



Jennifer Franklin 15



John Franklin 15



Benjamin Huff 15



Tanya Meyer 15



Steve Monk 15



Ellen Pope 15



Karen Pruett 15



Margeri Velasquez 15

Travel safely

Luggage packed? Check. Passport or ID handy? Check. Whether you are on your way to that important conference or zipping off to Disneyland with your family, an unexpected injury will sure spoil the trip.

If you're driving

- If you are driving a rental vehicle, familiarize yourself with the car and all of its equipment (horn, brakes, hazard lights).
- Use a smartphone app such as Waze or Google Maps to guide you around traffic jams. No GPS app is infallible, especially in remote areas, so bring a detailed map or road atlas as a backup.
- Before beginning a long drive, always get enough sleep and eat something. Pull over and take breaks every couple of hours, even if you don't feel sleepy.
- If you're driving alone, turn on the radio or put on some music, and keep your window cracked open.
- If you do have to pull over, move your vehicle off the road. Never park on the shoulder or in the breakdown lane for any reason except an emergency.
- Lock all of your valuables in the trunk or glove compartment, and stow all luggage in the trunk.

If you're flying

- Watch your step in unfamiliar airports and cities to minimize trips and falls. Avoid walking while using your mobile phone.
- Keep an eye out for other travelers – they are unfamiliar with the area, too, and might not be paying attention.
- Stay hydrated and well rested.

See more at livesafe.sandia.gov.



SANDIA CLASSIFIED ADS

MISCELLANEOUS

iPHONE 6, A1586 unlocked phone, brand new, w/Otterbox case, glass screen protector, \$180 OBO. Bigman, 505-331-2478.

DOG CRATE, large, new, \$40; hanging candle chandelier, iron, new, \$90; Everlast punching bag, new, \$90. Logan, 505-459-5164.

WASHER/DRYER, \$250; entertainment center, \$25; couch, \$250; queen frame, \$300; Wii, \$150; full bed frame/mattress, \$175. Barnard, 505-480-4109.

DALLAS COWBOYS TICKETS, 2, sect. 454, row 3, seats 1 & 2, \$300/pair. McCandless, 505-553-5281, leave message for Suzanna.

TABLE SAW, Rockwell, 10-in. contractors, 220-volt, \$250; drill press, Rockwell, 32-in. \$150. Assink, 505-730-5469.

AV RECEIVER, Pioneer Elite VSX-60, 7.2 channel, 6 HDMI inputs, Airplay, Zone 2 audio, 1080p video, \$85. Witek, 505-296-5198.

VACATION, Cabo MX, Cabo Azul Resort & Spa, Sept. 14-21, Sept. 30-Oct. 7, 2 bdr., \$600/wk. Luther, 505-822-1187.

GUITARS W/CASE: vintage Gibson ES335TD, \$3,000; Gibson SG Supreme, \$1,950; Yamaha CG-110CE, nylon-string acoustic, \$350. Baca, 505-792-1941.

DOLL HOUSE, KidKraft Wood Products, w/furniture, tri-level, 33"x16"x48", \$50. Valdez, 505-550-1993.

DINING TABLE W/CHAIRS, Amish Connection, bar height, 4'x6', solid oak, great condition, \$4,000 new, asking \$2,500. Bennett, 505-291-1912.

TABLE SAW, Ridgid R4510, heavy-duty, 10-in., portable, w/stand, new condition, \$300. Bradley, 505-379-7028.

BICYCLE FOOT PUMP, Bikemate model 63784, German, adaptable for balls, 16 bar, excellent condition, \$15. Wagner, 505-504-8783.

FAX MACHINE, Brother model 1270, \$20. de la Fe, 505-459-4685.

TABLE SAW & DRILL PRESS, Craftsman, heavy-duty, w/blades & accessories, good condition, \$150. Romero, 505-379-8875.

GOLF TRAVEL BAG, hard cover, roller, Bag Boy, \$75; golf travel bag, soft, roller, Titleist, \$50; twin recliner sofa, moss green, microfiber, 85"L x 36"H x 38"D, \$350. Record, 505-243-5103.

TRANSPORTATION

'11 DODGE DURANGO HEAT, V6, garaged, only 31K miles, like new, \$15,900. Pulliam, 505-362-6084.

'08 BMW X5 3.0si, AWD, loaded, 22/26-mpg hwy., champagne exterior/brown leather, no accidents, excellent condition, 79.8K miles, well below book, \$9,800. Dwyer, 505-249-6935.

'11 KIA SPORTAGE EX SUV, 4WD, loaded, burnt bronze color, 130K commuter miles, excellent condition inside/out, \$9,200 OBO. Goodson, 505-407-1688.

'06 HYUNDAI SONATA, AT, 93K miles, good condition, \$3,200. Cochran, 361-676-1212.

'13 F150, 4x4, Lariat, supercrew, loaded, new tires, brakes, B2B warranty 2020, 60K miles, <KBB, \$25,000. Horowitz, 505-400-3781.

'67 INTERNATIONAL TRAVELALL, 2WD, V8, manual transmission, lots of good bodywork & glass, \$250. Shapnek, 505-366-4586.

How to submit classified ads

• EMAIL: Michelle Fleming (classads@sandia.gov)
 • FAX: 505-844-0645
 • MAIL: MS 1468 (Dept. 3651)
 • INTERNAL WEB: From Techweb, search for 'NewsCenter.' At the bottom of that page, click the 'Submit an article' button. Due to space constraints, ads will be printed on a first-come basis.
DEADLINE: Friday noon before week of publication unless changed by holiday.
 Questions to Michelle Fleming at 505-844-4902.

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 poor taste.

'16 NISSAN SENTRA S, AT, deep blue, factory warranty, 25K miles, excellent condition, \$12,500. Crowder, 505-792-2133.

'85 F250 XL EXPLORER, 460-ci V8, 4x4, single cab, new clutch, transmission rebuilt, \$5,500 OBO. Moore, 505-220-8311.

'05 TOYOTA HIGHLANDER, hitch, roof racks, floor mats, 130K miles, good condition, \$6,000. Ghanbari, 505-400-6837.

'98 MERCEDES E32, silver, high miles but lots left, clean, \$2,500 OBO. Waddoups, 505-865-7952.

'06 MERCEDES SLK350, 2-dr., roadster, convertible, hardtop, leather, 89K miles, great condition, \$12,000. Gonzales, 505-250-4788.

HOMESITE, 2 acres, gorgeous, new road, level, square, mountain views, near Crest Road turnoff, \$120,000, easy terms. Mihalik, 505-816-8469.

4-BDR. HOME, Hidden Valley, near Four Hills, beautifully remodeled, Zillow.com: 713 Fennel Ct. SE, neighborhood pool, \$263,000. Volker-Rector, 505-710-6290.

3-BDR. HOME, 2 baths, 2,510-sq. ft., contemporary/custom, 3.06 acres, bordering National Forest, Tijeras, \$400,000. Jones, 505-235-5110.

~25.7 ACRES, in San Ysidro Land Grant, \$231,300. Christilaw, 505-620-5235.

WANTED

LOVING HOME, for adorable 4-yr.-old Chihuahua mix, house trained, in good health. Moore, 505-507-7092.

AFTERNOON CHILDCARE, responsible student or adult, provide childcare 3 hrs. daily after school, starting Aug. 13. Villegas, 505-480-6290.

TRANSDUCTANCE TUBE TESTER. Larsen, 505-292-7896 or lawrence4201943@gmail.com.

PICKUP, for student, small, AT, extended cab preferred, <\$6,000. Ashby, 505-281-1573.

GOOD INSIDE HOMES, 3 kittens, initial vet fees paid, in Tijeras. Preston, 505-205-9916, send text.

RECREATION

'10 NEWMAR DUTCH AIRE MOBILE HOME, diesel, 43-ft., fully loaded, call for more info, \$167,000. Ward, 505-296-2207.

'97 SMOKERCRAFT PONTOON BOAT, 24-ft., Dolphin series, 115-hp Mariner motor, very clean, low hrs., \$9,100 OBO. Argo, 505-235-2484.

'17 CAN AM COMMANDER UTV, 4-seater, red, roof, stereo, half windshield, 45 hrs., like new, \$16,000. Vallejos, 505-328-2081.

REAL ESTATE

2-BDR. TOWNHOME, 2 bath, many extras, minutes from Eubank gate, \$130,000. Romero, 505-573-7909.

20 ACRES, El Vado, northern NM, gated, electricity, shared well, lakes, beautiful views, \$4,500 per acre. DeLaCruz, 505-266-3271.

Remembering Rick Glaspy

Rick Glaspy, an electronics engineer in Sandia California's Homeland Security and Defense Systems Center, died of heart failure on June 20.

Rick's colleagues in California and in the organizations where he used to work in New Mexico — defense mission assurance and stockpile evaluation — remembered him for his "Rick-sized bear hugs" and for being a positive, enthusiastic and dedicated team member.

Yalin Hu, lead for Rick's product realization team at Sandia/CA, said he worked with her department as a quality engineer for nuclear weapons modernization projects and later as lead on Joint Test Assembly projects. But he was well known to the team from his time as a customer, when he worked in surveillance.

"I still cannot believe Ricky G didn't come to our last team lunch, which he had organized; it was his turn!" Hu said. "His energy, dedication and humor brought a lot to our team. He never hesitated to take on hard jobs. His passion for work and love for family were so strong."

Another member of his team in California recalled eating a banh mi with Rick and walking through various exhibits at a lunchtime safety fair at Lawrence Livermore National Lab on the day he died. He said how he always enjoyed Rick's "great, upbeat personality" and called him "a sounding board and just a nice person to hang out with."



ARRR! — Rick was known for his playful nature. He went to great lengths to make people smile, even if it meant dressing the part for International Talk Like a Pirate Day.

(Photo courtesy of Sandia National Laboratories)



FAMILY MAN — Rick is remembered by colleagues not only for the positivity he brought to the workplace, but also for his dedication to his family.

(Photo courtesy of Rick Glaspy's family)

"I remember him looking over a hot rod with a gas cell and nitro bottle in the trunk, and saying that there should be an external cutoff switch; always the engineer," his colleague commented.

Rick was hired in December 2010 and worked in a variety of national security and space satellite programs until he took a job as a surety and quality engineer at the California site in December 2015. In March 2017, he took a job in a telemetry organization to support Detonation Monitoring Assembly efforts.

He was a key contributor to quality engineering of the environmental testing work on an important satellite program. His team was responsible for "overseeing and documenting every wrench turn, lock tight application" and for verifying that more than 16,000 parts were inspected. "The number of hours that Rick spent in the clean room never went unnoticed," another colleague said, pointing out that his dedication and commitment live on as the program continues to deliver for the nation.

Peter Stromberg, who worked with Rick on the same program, recounted how Rick stopped work when another engineer tried to connect a tester to the flight unit. "He was doing exactly what a quality engineer should," Peter said. "I respected his judgment and I will miss him."

Marlo Maxson said Rick introduced innovative methods to produce a complete record of assembly, and completed a configuration audit that resulted in the customer writing, "In my 20-plus years of working satellite programs, I would rate your record-of-assembly process as a best practice."

Many of Rick's colleagues, past and present, offered comments:

"He was also a true professional in everything that he did. Our projects had far better results because of his involvement."

"Rick was very genuine. He had a warm personal presence and a no-nonsense approach to work that earned him respect and trust from his peers. Rick demonstrated common sense and intuition. He remained calm in the face of adversity."

"I will miss his positive attitude, enthusiasm, helpfulness, and just a fun person to be around."

"He was a great mentor to me. Rick was an awesome gentleman who knew his stuff, guided folks well and got along very well with all."

Sandia to celebrate 40 years of solar power research

In 1978, Sandia began a unique program of research on concentrating solar power at the newly constructed National Solar Thermal Test Facility. Forty years later, the facility is still the only one of its kind in the United States.

Sandia will mark the solar tower's 40th anniversary on July 31 with an event that will include tours of the test facility and talks by Sandia researchers, leaders, sponsors and industry representatives.

The facility's primary goal is to provide experimental engineering data for the design, construction and operation of components and systems for industrial-scale concentrating solar thermal electrical plants for large-scale power generation.

How it works

The facility's heliostat field comprises 218 com-

puter-controlled, mirror-like devices that concentrate sunlight into a single beam that is directed to a receiver on the 200-foot tall solar tower, with a total thermal capacity of five megawatts. The facility also has a solar furnace, a high-flux solar simulator, a dish test facility, an optics lab, an engine test facility, concentrated photovoltaics, a rotating platform and a molten salt test loop.

Besides testing and proving a variety of concepts for concentrating solar power plants, the facility is used for a variety of other defense and space applications that require high heat flux and temperatures for materials testing or aerodynamic heating simulation, as well as large field optics for astronomical observations or satellite calibrations.

— Kristen Meub



MIRROR IMAGE — Aerial photo of the solar tower taken in April 1978, while under construction. (Photo courtesy of Sandia National Laboratories)



SUNSTRUCK DIGNITARIES — Vice President Walter Mondale visited Sandia's solar research facilities on January 10, 1978. Foreground from left, Morgan Sparks, Mondale, Herman Roser, Governor Jerry Apodaca, Senator Pete Domenici. (Photo courtesy of Sandia National Laboratories)

NNSA breaks new ground



DUST IN THE WIND — Unearthing the first shovelful of earth for the foundation of the new NNSA Albuquerque Complex on Eubank Boulevard, just south of the Center for Integrated Technologies, are (left to right) Greg Bloom from Sen. Tom Udall's office; Bob Nanney and Tyler Stephens, both of Caddell Construction; Sen. Martin Heinrich, D-NM; Lisa E. Gordon-Hagerty, Undersecretary for Nuclear Security and NNSA Administrator; Rep. Michelle Lujan Grisham, D-NM; Cheree Peterson, U.S. Army Corps of Engineers; Lt. Col. Larry (Dale) Caswell, U.S. Army Corps of Engineers; and Dawn Harder, NNSA federal project director. (Photo by Randy Montoya)



ONE BRICK AT A TIME — At a July 2 groundbreaking ceremony, Lisa E. Gordon-Hagerty, Undersecretary for Nuclear Security and NNSA Administrator, describes plans to build the new NNSA Albuquerque Complex as Rep. Michelle Lujan Grisham, D-NM, and Sen. Martin Heinrich, D-NM, listen. After approximately 2½ years of construction, the 330,000-square-foot building will house 1,200 NNSA employees and contractors and will meet LEED standards. (Photo by Randy Montoya)