MOUNTAIN MAJESTY — Clouds and snow blanket the Sandia Mountains on a chilly November morning. Early storms gave many parts of New Mexico a snowy Thanksgiving. (Photo by Randy Montoya)

Good News for BaDx

Popular Science magazine has named the Sandia-developed, pocket-sized anthrax detector BaDx one of the year's top 100 technology innovations. **See page 2.**

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SandiaLabNews

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Gil Herrera awarded UNM Lobo Award

Story by Mollie Rappe ***Photo by Randy Montoya***

GIL HERRERA

Gil Herrera (1000), longtime director of Sandia's Microsystems Science and Technology Center 1700, has been awarded the University of New Mexico Alumni Association's Lobo Award, which recognizes a UNM alumnus who has given outstanding personal service to the university or whose career achievements reflect credit on the university.

(Continued on page 4)

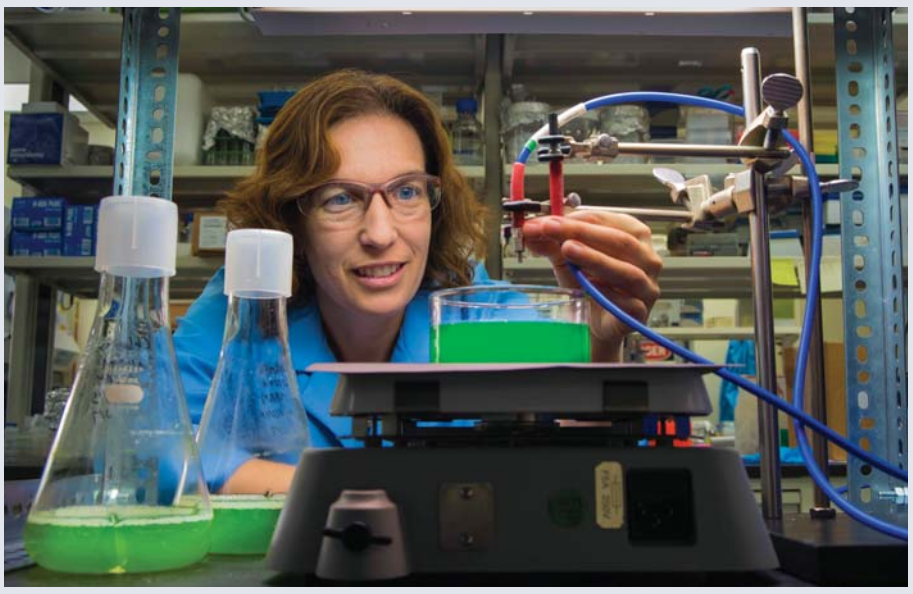
Sandia, ASU collaborate on algae computational modeling, look for early warnings of predators in algae ponds

Work part of a broader framework for funding energy-related science, technology

By Michael Padilla

Sandia and Arizona State University (ASU) have teamed up to further improve computational models of algae growth in outdoor raceway ponds that can predict performance, improve pond design and operation, and discover ways to improve algae yield outdoors.

In addition, Sandia and ASU will further develop spectroradiometric techniques to optically monitor the growth and health of algae pond cultivation in real time and detect early warnings of predators and pathogens in outdoor algal ponds.



ALGAL PREDATORS — Jerilyn Timlin (8631) serves as a principal investigator for the Algal Predator and Pathogen Signature Verification project. (Photo by Randy Montoya)

The work is part of a newly signed Cooperative Research and Development Agreement (CRADA) between ASU and Sandia to collaborate on algae-based biofuels, solar fuels, concentrating solar technologies, photovoltaics, electric grid modernization, and the energy-water nexus. The umbrella CRADA also covers international applications of the technologies and science and engineering education. The scope of the CRADA was described in a 2013 memorandum of understanding between Sandia and ASU focusing on collaborations to support science, technology, engineering,

(Continued on page 3)

Tech park school

A year and a half in the planning, the Technology Leadership High School opened in the Sandia Science & Technology Park. Its 90 students are getting a hands-on, project-based education through the lens of technology. **See page 8.**

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That's that

Mars is in!

In the real world and in the world of imagination, Mars is commanding our attention.

One of the most popular movies of the year, The Martian, looks to be on its way to garnering several Oscar nominations. The novel upon which the movie was based, by the way, was written by one-time Sandia intern Andy Weir, as we reported in our October 2 issue. As fun and as gripping as the movie was, it was just a story — a believable and well-thought-out story to be sure, and based mostly on hard science — but fiction nonetheless.

It's in the realm of non-fiction, otherwise known as reality, that the news out of Mars gets really exciting.

Over the past four decades, an astonishing succession of American spacecraft have orbited, landed, and roved around on the surface of Mars. These remote extensions of ourselves have sent back terabytes of data that have helped us refine and sharpen our understanding of our closest planetary neighbor. And the surprises keep coming.

The latest finding, derived from data gathered by NASA's Mars Reconnaissance Orbiter, is perhaps the biggest news yet: The space agency announced in late September that the Red Planet has flowing water on the surface. The water is not exactly potable; the data suggests it's probably a briny brew of H2O and a family of minerals called perchlorates. But it's water — flowing water at the surface! — and that ups the stakes in the search for life beyond Earth. To which I think our proper response is that we need to start getting very specific, with a timeline and budget, to get human beings to the Red Planet, before (dare I say it?) the next decade is out. If there is life there, let's find it. If not, let's inhabit and explore it anyhow. As science fiction writer Ray Bradbury observed and Andy Wier suggested with the very title of his book: Yes, there are Martians . . . and they are us!

So much for fiction and non-fiction; how about a bit of Mars fantasy? Seems that in poring over NASA's image archives, one intrepid "researcher" has found a photo that shows a large rodent-like creature scurrying across the frame in the background. This same researcher has found tons of other "evidence" of life: fossilized skulls of dinosaurs, alien babies, Elvis Presley, and Jimmy Hoffa. The researcher concedes that the mouse on Mars is "probably" an optical illusion. Yeah, "probably." But come to think of it, given that it's not certain that isn't a giant rodent in the photo, maybe our first human travelers to Mars ought to take along a ship's cat.

* * *

One could argue that the modern world began exactly 100 years ago. It was in November 1915 that Albert Einstein laid out the key principles of his General Theory of Relativity. That theory, along with his earlier Special Theory, has probably done more to change our ideas about the nature of reality than any other concept in science.

Because the implications were so profound, people around the world were hungry for a good solid layman's elucidation of relativity. As such, over time the theory begat a cottage industry of professional explainers, some far more effective and coherent than others. Not surprisingly, the best explainer was Einstein himself. He was often asked to expound on the general theory of relativity and could do so with a great deal of technical specificity or with a light-hearted and common touch: "Put your hand on a hot stove for a minute, and it seems like an hour," he once declared. "Sit with a pretty girl for an hour, and it seems like a minute. That's relativity!"

* * *

We all know that Einstein was one of the smartest people who ever lived. What a lot of people don't know is that his brilliance was not limited to the field of physics. His wisdom was so highly regarded that he was sought out for his views on almost everything. He was even viewed as a sage in the matter of domestic relations. He once shared his secret for a happy home life: "When we first got married," Einstein said, "my wife and I made a pact. It was this: In our life together, it was decided I would make all of the big decisions and my wife would make all of the little decisions. For 50 years, we have held true to that agreement. I believe that is the reason for the success in our marriage. However, the strange thing is that in 50 years, there hasn't been a single big decision."

See you next time.

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

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Dennis Cronin (85). . . . . Sept. 30
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A good day for BaDx

Popular Science named Sandia-based anthrax detector technology one of 100 best innovations of 2015

Popular Science magazine has named the Sandia-developed BaDx anthrax detector as one the year's top 100 technology innovations. It is one of nine technologies listed in the Security category of the magazine's annual "Best of What's New" list.

BaDx, which has been licensed by Aquila, an Albuquerque-based, woman-owned small business that specializes in the design and manufacture of technologies and services for nuclear security and international safeguards, is a credit-card-sized detector that is simple to use and inexpensive to produce.

Sandia scientists, from left, Jason Harper (8631), Melissa Finley (6825), and Thayne Edwards (1714) show a BaDx anthrax detector. (Photo by Randy Montoya)

In its description of BaDx on the "Best of What's New" website, *Popular Science* editors wrote: "Anthrax, a bacterial disease of grazing animals, can be a deadly terrorist tool. Now Sandia National Laboratories and security-technology company Aquila are making it simple to detect. They're producing a credit-card-size lab-on-a-chip that's akin to a pregnancy test: Inject a sample and wait a few hours for a line to appear. Because the test is portable, samples won't accumulate in labs — which is a security risk. It will help ranchers around the world detect the disease in their livestock. Aquila, which is producing the tests in partnership with Sandia, began shipping units earlier this year and plans to adapt the technology for other bacteria like E. coli."

BaDx needs no battery or electric power or special laboratory equipment. It's hardy against wide temperature variation and can detect very small numbers of *B. anthracis* spores. A field technician puts a sample swab into the amplification chamber, which contains selective growth media. The device then uses a lateral flow assay, similar to a common pregnancy test, to detect *B. anthracis.* Magnetically operated valves allow the sample to advance from stage to stage to complete the testing process. A colored line appears on the device several hours later, if the test is positive for the bacteria.

The technician can then initiate a chemical process that sterilizes the device, avoiding the risk of positive samples accumulating and falling into the wrong hands.

A Laboratory Directed Research and Development (LDRD) project in Sandia's International Biological Threat Reduction Program led to BaDx.

Melissa Finley (6825) was principal investigator of a large team that helped develop the detector. Jason Harper (8631) and Thayne Edwards (1714) developed the microfluidics platform with the patent-pending magnetic valves that move the sample through the testing process. Bioscientist Bryan Carson, with technologists Jackie Murton and Bryce Ricken (all 8631), developed the selective media and worked on building and testing the device, as well as helping to develop the decontamination strategy. Nanotechnology researchers George Bachand (1132) and Amanda Carroll-Portillo (8631) are working on improved strips for the lateral flow assay. Bill Arndt (6825), a researcher in the International Biological Threat Reduction Program, who regularly works in the developing world, provided guidance on device design.

Thayne says the recognition by *Popular Science* has a special meaning for him.

"As a teenager I remember reading *Popular Science* magazines and being wowed by science and technology so advanced it often seemed unreal. In a real way though, it helped encourage me to pursue engineering as a field of study. So I was elated to find out that something I helped to create was being recognized in *Popular Science's* pool of Best of What's New. This has reminded me of why I love engineering and science."

In addition to its recognition by *Popular Science*, BaDx has won a 2015 TechConnect Innovation award, a 2015 R&D 100 award, and the Federal Laboratory Consortium's 2015 Award for Excellence in Technology Transfer.

Algae

(Continued from page 1)

and mathematics, or STEM, fields.

This is the first CRADA Sandia has executed with a university in nearly 15 years and is currently the only active umbrella CRADA with an institution of higher education. The algae cultivation modeling and monitoring projects are the first two efforts funded under this umbrella CRADA.

Sandia researcher Ron Pate (6926) says Sandia brings distinctive capabilities for physics-based modeling of algae cultivation systems performance and for remote spectroradiometric monitoring and diagnostics of algae growth and state of health, while ASU has a variety of algae species under cultivation in outdoor ponds in a range of scales in which to take measurements.

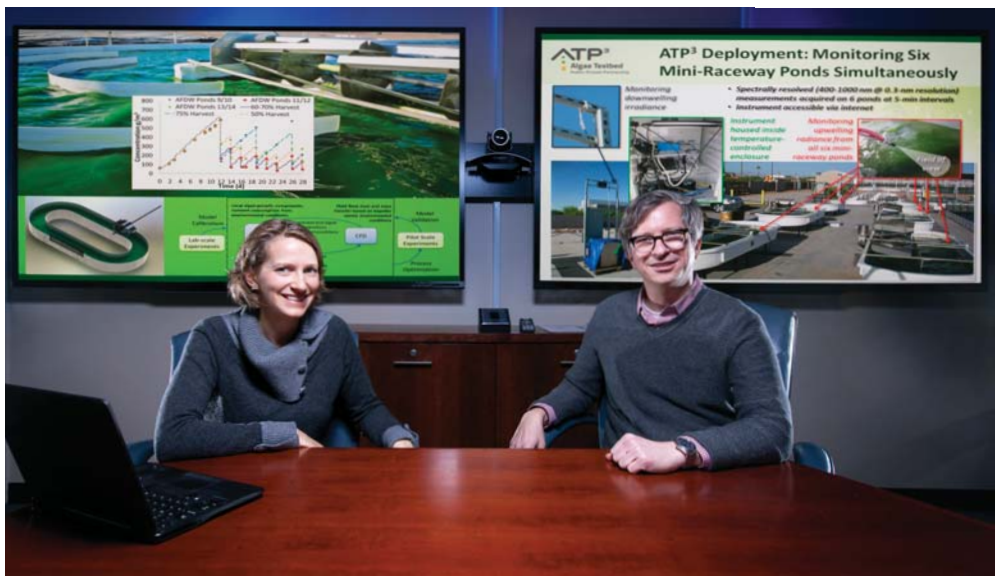
"Sandia is excited about the collaboration with ASU," Ron says. "This agreement allows Sandia to continue modeling and monitoring work that we have been pursuing with ASU since 2013 under the original ATP3 (Algae Testbed Public-Private Partnership) project." Ron is deputy director for ATP3, overseeing Sandia technical tasks under the project.

The ATP3 project was established to support the algae research and development community and industry to advance the field and help accelerate progress toward more rapid and successful commercialization of algae-based technologies for fuels and products. ATP3 is funded by DOE's Energy Efficiency and Renewable Energy Bioenergy Technologies Office. ATP3 partners include Sandia, ASU, the National Renewable Energy Laboratory, California Polytechnic State University in San Luis Obispo, the Georgia Institute of Technology in Atlanta, and the algae companies San Diego-based Cellana Inc. with algae cultivation facilities in Kona, Hawaii; Commercial Algae Management in Franklin, North Carolina; and Florida Algae in Vero Beach, Florida.

Two projects exercise new Sandia/ASU CRADA

The first project under the agreement, Algal Cultivation Growth Dynamic Modeling and Analysis, focuses on Sandia's further development of a Sandia algae growth model based on the effect of light, temperature, nutrients, pH, and salinity integrated into an open raceway pond hydrodynamic computational fluid dynamics model. The algae growth model has been partially validated using multiple data sets from partners involved in ATP3. Under the CRADA, the modeling will be further refined through improvement of the paddlewheel-driven pond circulation flow and mixing portion of the model based on the application of hydrodynamic measurement data taken from experimental testing with progressively larger scale outdoor ponds operated by ATP3 partners.

The 12-month project, led by principal investigators Patricia Gharagozloo (8253) and John McGowen from ASU, will be conducted in two phases. The first phase will study the flow dynamics of turbulence models and control parameters in open raceway ponds, which are currently the most promising outdoor cultivation system approach for cost-effectively growing algae at the large scales required for producing fuels. Such ponds consist of an oval-shaped closed-loop channel – or raceway – in which the cultivation mixture of water and algae is propelled to flow around the raceway and undergo mixing by a paddlewheel powered by an electric motor. In this phase, ASU will measure the spatial variations in velocity of the flow of algae-water mix in the ponds at various paddlewheel speeds.



ALGAL DYNAMICS — Patricia Gharagozloo (8253) and Tom Reichardt (8128) discuss Sandia's work with ASU. (Photo by Randy Wong)

The second phase will calibrate the model and verify the appropriate turbulence physics to be accounted for at certain scales of ponds for one paddlewheel speed. After the two phases, a study will be conducted to compare the data with model results at additional paddlewheel speeds.

The second 12-month project, Algal Predator and Pathogen Signature Verification, looks at exploring and exploiting the various detailed optical signatures that arise when the algae cultivation pond surface is monitored using Sandia's optical spectroradiometric techniques that can differentiate algae growth and state of health and provide an early warning of the active presence of predators and pathogens in outdoor algal ponds. Jerilyn Timlin (8631) and McGowen are the principal investigators for this project. Tom Reichardt (8128), who pioneered the original technology as part of a Bioscience LDRD project, also serves as technical contributor to the project.

During the first phase of this project, controlled experiments will be conducted in the laboratory with a host-pathogen/predator pair that the team has seen cause problems in the field. The researchers' goal is to understand the parameters that control culture collapse and identify spectral markers that indicate the presence of the pathogen/predator. The second phase will consist of experiments in the field to determine how well the identified spectral markers predict the presence of the pathogen or predator in the challenges of an outdoor environment.

"The continuation of the technical work related to algae biofuels, which began under the ATP3 project, is a great opportunity to exercise this new Sandia-ASU CRADA," Ron says. "However, collaborative work on the other STEM topic areas could also be pursued in the future as funding becomes available and the mutual interest exists at ASU and Sandia."

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Sandia chemists discover new pathway in mechanism of soot formation

By Michael Padilla

Chemists at Sandia's Combustion Research Facility have discovered a new mechanism leading to soot formation, providing new facts to make models of soot formation more predictive, furthering DOE's goal of reducing soot formation in practical combustion devices.

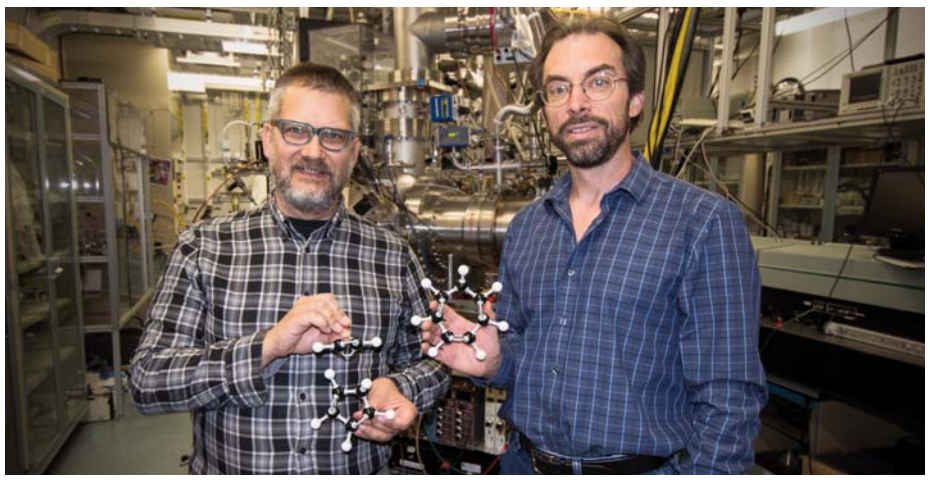
"This work is important because it shows how the process of molecular weight growth that eventually leads to large carbon-rich soot precursors is not simply a path through the lowest-energy structures," says Craig A. Taatjes (8353) a co-author on the paper. "We discovered that the kinetics is more complex than first imagined, and the preferred route may in fact lead through higher energy isomers."

The work is featured in the October issue of *Journal of Physical Chemistry Letters* in a paper titled, "Time- and Isomer-Resolved Measurements of Sequential Addition of Acetylene to the Propargyl Radical." Authors of the study include John D. Savee, Talitha M. Selby, Oliver Welz, Craig A. Taatjes, and David L. Osborn (all 8353).

The Sandia team directly measured a reaction sequence in which multiple acetylene molecules (C2H2) react with a propargyl radical (C3H3). In a flame where more fuel is present than is needed, harmful soot can form. Acetylene is a ubiquitous molecule formed in such rich combustion environments, regardless of the fuel being burned. Many modelers have suggested that reactions of small free radicals with acetylene represent an important pathway to soot formation in these rich flames. However, the exact chemical mechanism — the pathways by which the atoms in the molecules form new bonds and rearrange during reaction — had not been measured directly.

Using tunable energy photons from the Advanced Light Source synchrotron at Lawrence Berkeley National Laboratory, the Sandia team discovered the reaction mechanism, and the fact that it changes significantly over the relatively small temperature range of 800-1,000 K.

Surprisingly, the C7H7 reactive intermediate (i.e., a propargyl that has added two acetylene molecules) in this sequence is not the most stable C7H7 species, the benzyl radical (a six-membered benzene ring with a –CH2 substituent), as normally assumed in combustion models. Rather the authors could show through the photoionization spectrum that the intermediate is the tropyl radical, a seven-membered ring. This finding agrees with very recent, independent theoretical predictions of the reaction that adds the second acetylene. Finally, the team discovered that the reaction sequence terminates, after addition of the third acetylene molecule, in a two-ring aromatic compound known as indene, demonstrating a pathway to a polycyclic aromatic hydrocarbon that does not pass through a six-membered ring intermediate like benzene or the benzyl radical.



SOOT DISCOVERY — Craig A. Taatjes, left, and David L. Osborn (both 8353) were part of a team that discovered a new mechanism leading to soot formation. (Photo by Loren Stacks)

David Osborn (8353), the lead author on the study, says one of the biggest challenges in conducting this research was measuring reference spectra of the benzyl and tropyl radicals. The authors needed to independently and reliably create these reactive intermediates by methods other than the propargyl + acetylene reaction.

"Once we proved to ourselves that we had reliable reference spectra, we could use these spectra as fingerprints of each intermediate, like a forensic scientist would do when investigating DNA evidence on alleged suspects of a crime," David says. "With that information in hand, the result was definitive: We were quite surprised to find that this reaction forms only the tropyl radical, not the 'usual suspect' benzyl radical."

The next big challenge, now that this reaction mechanism has been documented over a reasonable temperature range, is to determine how important this pathway is in formation of soot precursors in real fuel-rich flames. There are several other pathways, notably the reaction of two propargyl radicals, that almost certainly form significant soot precursors in flames, but the relative importance of these mechanisms, and how they change with temperature and other conditions in the flames, remains unknown. By unraveling all the details of each pathway, researchers will move closer to a predictive computer simulation that faithfully reproduces reality.

And then there was one

The continued adventures of the Sandia start-up mPower

Entrepreneurial life holds both attractions and unknowns for Sandians considering that path. In an effort to shed more light on the realities of starting a high-tech business, the Lab News *is following the efforts of the fledgling company mPower to grow its own wings. On Oct. 2, our first installment was titled "Why attempt the entrepreneurial life?" Following is the second installment on the mPower effort, from a perspective of two months later.*

By Neal Singer

At a meeting of science writers in Boston this past October, an MIT professor described so many companies he had spun-off and papers he had published that he seemed as prolific as a salmon.

A reporter in the audience interjected, "Professor, do you think your students would be better served if you started fewer companies and published fewer papers and spent more time teaching?"

MURAT OKANDAN

The professor replied that the spawned companies were continuations of his teaching. They were staffed by former students who didn't want to go elsewhere and start something new, he said, but rather wanted to continue research they had already begun with him. He put together business plans with them, applied for financial backing, and his former students went entrepreneuring.

Murat Okandan, a Sandian on entrepreneurial leave to support the start-up photovoltaic company mPower (i.e., empower), was interested in the professor's success in pollinating companies, because start-ups from Sandia are still relatively few.

Murat ticked off a few obvious factors that conceivably helped the professor's success:

• Newly minted graduates used to working long hours for low pay;

• Great potential promised by a startup, with no alternative to fall back upon;

• Money available nearby in the Boston area from "high-tech angels" who prefer start-up companies to be within an hour's driving time for close supervision.

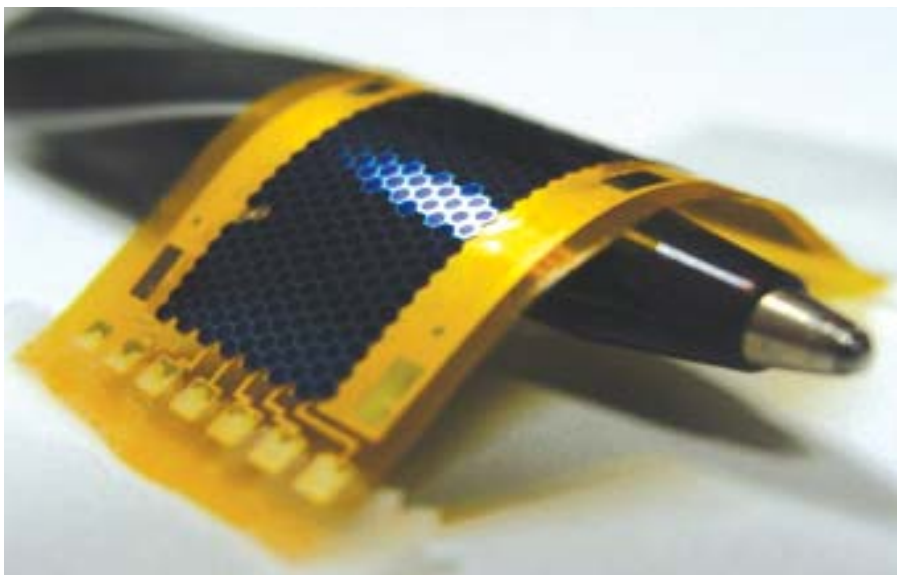
The environment is quite different in Albuquerque, says Murat.

Sandia entrepreneurs might be characterized as generally more mature, with families to support.

High-tech ideas take time to develop and require significant capital outlays. Both factors can generate impatience rather than tolerance from hard-to-find financiers, who "don't hang out at the Flying Star," as one past entrepreneur put it.

Finally, Sandia's generous return policy — a pathway back to the Labs that is the beauty of its entrepreneurial leave program — can tempt the nascent entrepreneur to return to Sandia if the enterprise doesn't shine within two or even three years.

These problems have not discouraged Murat, who has plans to welcome business advisers aboard and already has proposals out to large federal agencies to make use of (among other capabilities) the uncanny ability of the company's extremely thin, lightweight solar cells to unfold from a small packet to form a very large photovoltaic surface to generate electricity from sunlight, a potentially great plus for vehicles in space.



These solar cells on a flexible substrate draped over a ballpoint pen are an early Sandia prototype of interest to mPower. An exact replica is currently being tested in the International Space Station.

However, the negatives did finally overwhelm Murat's partner Jose Luis Cruz-Campa, who left the company in early November to return to Sandia.

As Jose Luis put it, his initial experience of entrepreneurship was a kind of exhilarating rollercoaster, a sine wave of heightened amplitude and sped-up frequency:

"One day they love you, the next they hate you; you're worth millions, you're worth nothing," he said laughing, early on.

But after eight months, his excitement had diminished. "Life as an entrepreneur isn't as glorious as you might think," he told the *Lab News*. "There's too big a difference between that and a regular job. Your free time, your personal life, your afternoon, everything is tied up in the same thing. You can't detach. In a regular job, the weekend is different. For entrepreneurs, it's the same."

He doesn't regret the effort, but has reservations: "It's a very good learning experience, but it's hard on your personal life and your wallet. [Starting an enterprise is] going to take probably three times longer, and require three times more money and effort, than you thought."

His advice? "Remember that once you're out, no one cares about research. They just care about how much you're going to make things for and how much you're going to sell them for. Researchers should have a big grant coming their way and a really good team of business people lined up before they leave."

Jose Luis still is hopeful about the technology and expects to help mPower's efforts from the Sandia side. "So I wouldn't say, don't do it," he says. "But before you leave Sandia, you have to have everything planned for two years, and it's hard to plan when you have a fulltime job."

If that bleak picture is really the case, what keeps Murat going? "Hopes, dreams — a vision — I want to see it work out," Murat says.

He agrees that though mPower's photovoltaic technology is quite far along, "our business case needed further development." And "while Sandia does limited products incredibly well," he says, "scaling a technology to commercially attractive volumes is a challenge. And meeting high-volume production targets by making things simpler and cheaper is difficult as well."

Still, he sees opportunities and is taking steps to achieve them. "We have interactions with colleagues that have entrepreneurial and general business expertise," he says. "We have several business advisors, and others in solar providing general guidance."

The company didn't get a hoped-for grant from ARPA-E, but did land a New Mexico Small Business Association grant used to build early prototypes at a fabrication facility at the University of New Mexico. A Cooperative Research and Development Agreement with Sandia is nearly completed, and Murat looks forward to mPower collaborating with Sandia to work on projects that include a good-sized one at NASA.

"NASA and aerospace partners are excited about what we plan to provide," he says. His company has applied for a mid-six-figure grant — "the first phase of a potentially larger effort, to be decided in May" — to determine the ability of solar power to function in extreme environments like the low temperatures of Jupiter, a NASA target. "It's five astronomical units out from the sun at minus 130 degrees C, so there's only 1/25th the amount of solar power available. We plan to study the feasibility of a configuration that will provide sufficient power and make possible new capabilities to support a possible mission."

He also has proposals to DOE's new Small Business Voucher program and EERE Sunshot program for projects that would require a cost-match component from mPower and its collaborators.

Will Murat's hands-on efforts put the young company on increasingly solid ground? Find out next time.

Gil Herrera

(Continued from page 1)

This accolade has been given every year since 1951. The Lobo Award is the most significant Homecoming award. Past recipients include luminaries such as Bess Popejoy, Tony Hillerman, and James Zimmerman. Gil, as well as the Inspirational Young Alumnus Award and Zia Award recipients, were honored at an Alumni Association breakfast Oct. 17 in Albuquerque.

Gil, who is currently serving as the director of the Laboratory for Physical Sciences at The University of Maryland, College Park, says, "I feel very strongly that we all have a vested interest in improving the state of New Mexico and the two most important institutions to that, Sandia and UNM, have roles to play and we're most effective if we do it together."

Over the years Gil has been on the External Advisory Board for UNM's Electrical and Computer Engineering Department, the College of Engineering Advisory Board, and the Community Partners Advisory Council for the College of Education. He was the Sandia deputy campus executive for UNM and has been an adjunct professor of electrical and computer engineering.

"Gil Herrera is a shining example of the innovation and creativity that the UNM School of Engineering is known for," says Joseph Cecchi, dean of the UNM School of Engineering. "Gil has not only passionately served UNM and the school through his dedication, but he has made a significant impact on the nation's science and research footprint. We're proud to call him one of our own."

"[The Lobo Award] was quite an honor and an acknowledgement of the long relationship I've had with UNM and things I've done to try to help support the institution," says Gil.

Synergic service since '74

UNM has had a profound impact on Gil's intellectual development. When he was a freshman at West Mesa High School, Gil participated in a regional science fair held at UNM. During the fair the students were given a tour of a brand-new computer lab, and were taught a bit of programming. Gil was so intrigued he held onto the account and password and later — illicitly — taught himself to program.

About a year later, Gil was caught running a really complicated — and inefficient program — to calculate 1,000 factorial, after using $2,000 worth of computer time. Upon critiquing Gil's algorithm, Professor Mueller of the computer engineering department gave Gil his own legitimate password, provided he never ran his factorial program again. This generous act only fostered Gil's fascination with computers.

After three semesters at West Point and a football career ended by injury, Gil returned to UNM, where he completed his bachelor's degree in computer engineering and became quite active outside of the classroom.

Gil honed his leadership skills while expanding the Hispanic Engineering Organization from a small group of the "smartest students at UNM" to a university-recognized group of more than 100 involved in tutoring and career fairs.

Also, in association with the chairman of the university's math department, Gil taught a Saturday morning computer class to minority and underprivileged kids from Albuquerque. This class inspired some of these students to go into STEM, and led to Gil's first academic presentation at an Institute of Electrical and Electronics Engineers conference.

Gil is a Fellow of the American Association for the Advancement of Science and serves on an advisory board for NASA's Jet Propulsion Laboratory. Among his many honors, Gil esteems the three medals he received from the US Army, including the Commander's Award for Civilian Service.

American Society for Nondestructive Testing names Sandia researcher as fellow

By Sue Major Holmes

David Moore (1522), who holds three patents in the field of nondestructive testing (NDT), has been named a fellow of the American Society for Nondestructive Testing (ASNT).

The award recognizes individuals who demonstrate outstanding service in the field of NDT. Those selected must have at least 15 years of professional experience in the field and have been a member of ASNT for 10 continuous years.

According to a Wikipedia entry, "Nondestructive testing is a wide group of analysis techniques used in science and industry to evaluate the properties of a material, component, or system without causing damage. . . . Because NDT does not permanently alter the article being inspected, it is a highly valuable technique that can save both money and time in product evaluation, troubleshooting, and research."

"I am both honored and humbled," says David, who has been at Sandia for 22 years. "It is an exciting time to be in this field and my interest in NDT continues to grow as new methods are introduced. I would encourage young engineers to consider becoming a member of the ASNT organization."

DAVID MOORE

The national selection committee determined David has made significant contributions to the field in testing and evaluation in the areas of engineering, science, education, and research, as well as supporting the society at the local and national levels. He joined the society in 1984 and became a lifetime member in 2013.

David, who has more than 32 years of experience in the field of nondestructive testing, was the technical editor of *Nondestructive Testing Handbook, Third Edition, Vol. 8, Magnetic Particle Testing*, and currently is editor of the *Nondestructive Testing Handbook, Fourth Edition, Vol. 1, Penetrant Testing*, and of ASNT Levels I, II, and III *Study Guides for Magnetic Particle and Penetrant Testing*.

ASNT inducted the seven members of the Fellow Class of 2015 at the society's annual banquet in Salt Lake City in October. The last time a Sandian was recognized as an ASNT fellow was 34 years ago, when Lutz W. Dahlke of Sandia California was inducted.

Sandian honored with inaugural technologist award from American Vacuum Society

By Sue Major Holmes

The American Vacuum Society has honored Sandia technologist Catherine Sobczak (1832) with its inaugural Thin Film Division Distinguished Technologist Award for providing exceptional technical support of thin film research and development.

Catherine will be formally recognized next fall by the society's Thin Film Division at the society's 63rd International Symposium & Exhibition in Nashville, Tennessee.

"It's an honor to receive this award. The people who nominated me are high-level folks in the vacuum technology field. It's nice to be recognized for all your years of service doing this," Catherine says.

The award cites her contributions over the course of her career, both at Sandia and earlier at the Phillips Research Site at the Air Force Research Laboratory at Kirtland Air Force Base. She works with thin films, a form of coating used in everything from eyeglasses to microchips.

Manager Deidre Hirschfeld presented her a certificate last month that goes along with the honor, and Catherine says colleagues made sure it would be a surprise. "They told me to dress up because we were all going to get an award for something else," she says.

Deidre calls Catherine one of the outstanding technologists working in thin film coatings. "She takes the initiative to fully understand any work assigned to her, then uses her knowledge and experience to help develop process improvements," Deidre says. "This international award recognizes the important contributions of technologists who are working in the background and often overlooked. It is the technologists who do the experiments then collect, organize, and help interpret data while ensuring that equipment is in working order."

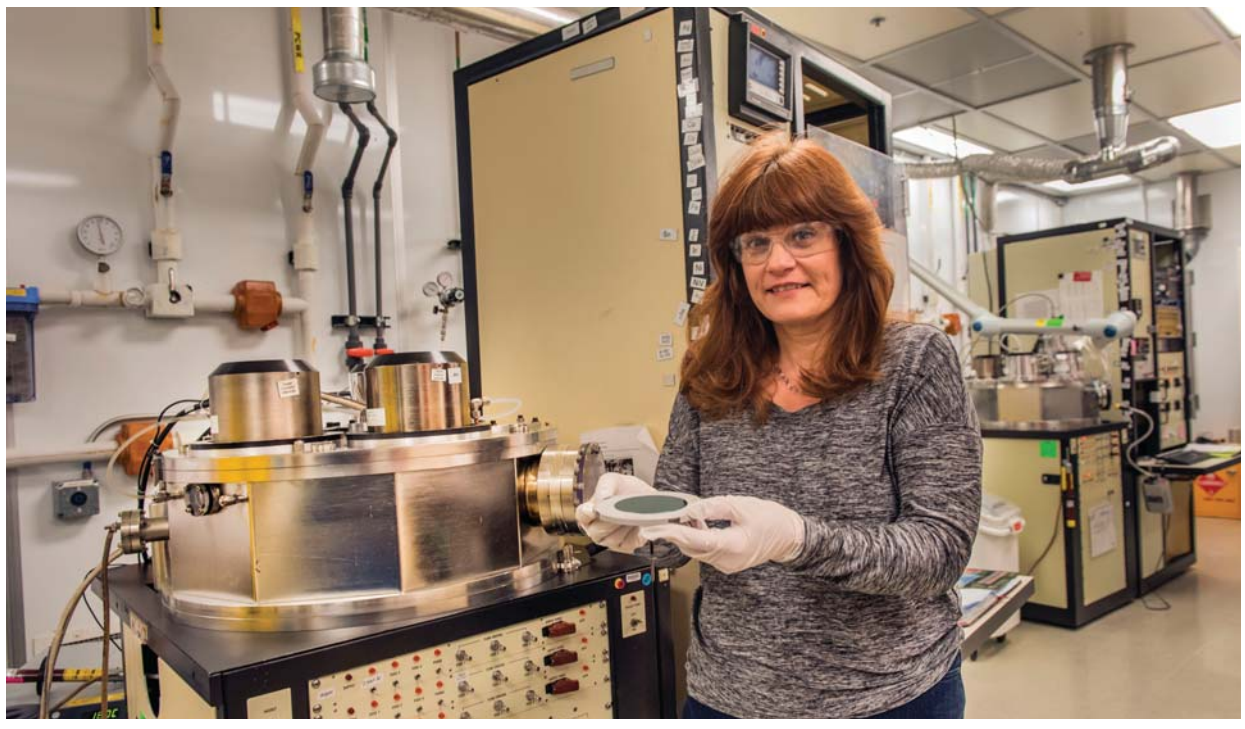
Catherine started her career in thin films at CVI Laser Corporation and was trained in physical vapor deposition by Mark Halliburton, now in Dept. 6560 at Sandia, and former Sandian Eric Jones Jr. Among her mentors at Phillips were the late Chuck Carniglia; David Reicher and George Luke, both now retired; and Bradley Pond, now with the Jet Propulsion Laboratory in California. Sandia mentors include Ron Goeke, Juan Romero and David Adams (all 1832).

"Everyone I have worked with has been enormously supportive," she says.

The New Mexico Chapter of the American Vacuum Society (AVS) created and endowed the award to honor its founders and their contributions.

The Thin Film Division, in a call for nominations earlier this year, said, "We are all indebted to the support provided at some point in our careers by outstanding technologists and technicians, and this award is meant to recognize the importance of that role in thin film research and development."

AVS, founded in 1953, supports networking among government, industrial, academic, and consulting professionals in such disciplines as engineering, chemistry, physics, biology, mathematics, and business through common interests related to the basic science, technology, development and commercialization of materials, interfacing, and processing. It has about 4,500 members worldwide.



TECHNOLOGIST CATHERINE SOBCZAK (1832) prepares a silicon wafer to load into a sputtering system. Catherine has been honored with the inaugural Thin Film Distinguished Technologist Award from the American Vacuum Society. (Photo by Randy Montoya)

NNSA Administrator Gen. Frank Klotz visits Sandia/California

On Nov. 30, Lt. Gen. Frank G. Klotz, USAF (Ret.), under secretary for Nuclear Security and NNSA administrator, visited Sandia/California. Klotz shared NNSA's priorities and answered questions at an All-Hands meeting, toured the Livermore Valley Open Campus and Combustion Research Facility, and was briefed on the site's work in nuclear weapons, cybersecurity, and nonproliferation. In the photo, John Dec (8300) describes Sandia's extensive, decades-long efforts and accomplishments in combustion research in the Low-Temperature Gasoline Combustion Engine Laboratory.

(Photo by Randy Wong)

Sandia CaliforniaNews

New Mexico Electric Car Challenge

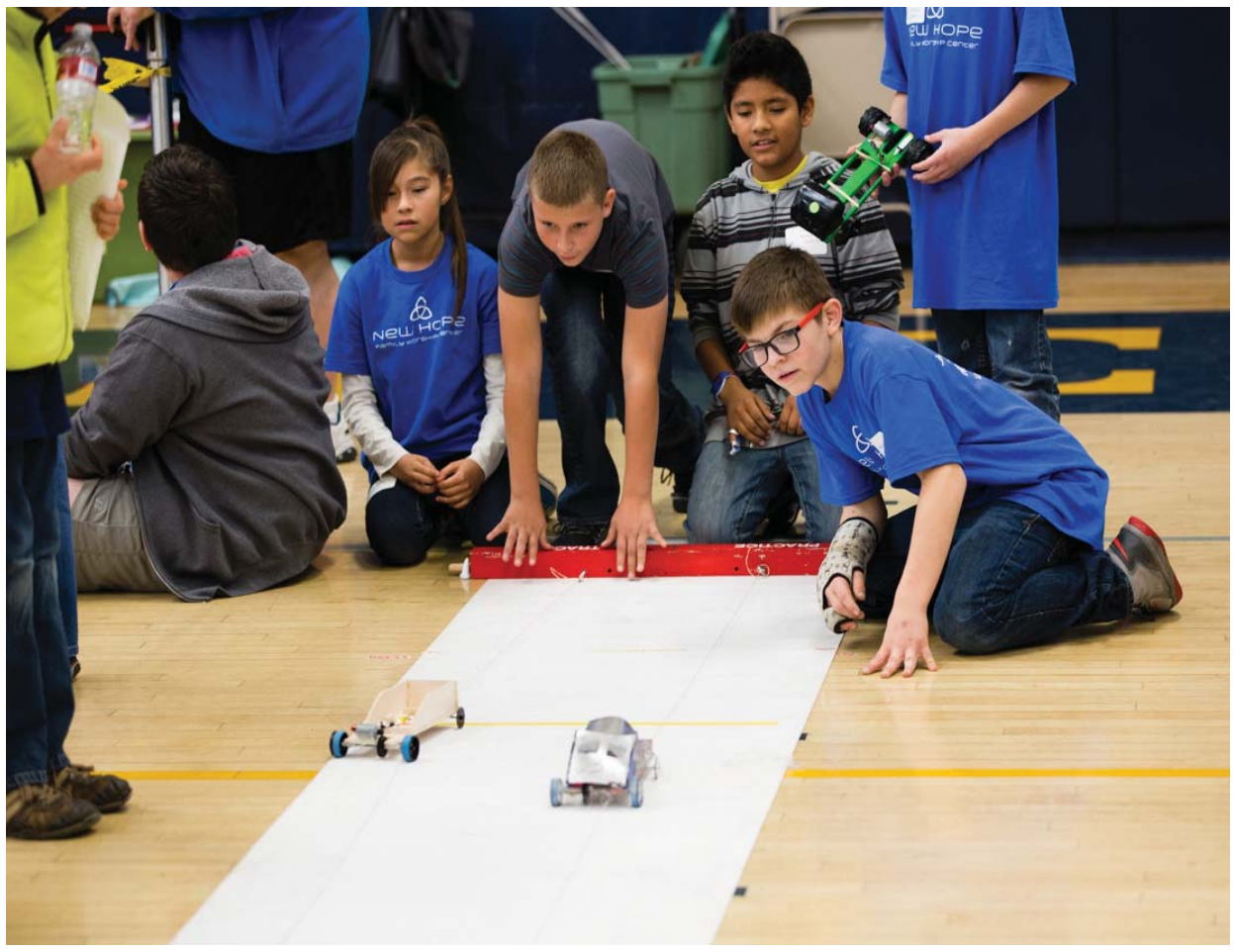
By Valerie Larkin • Photos by Nicholas Kerekes

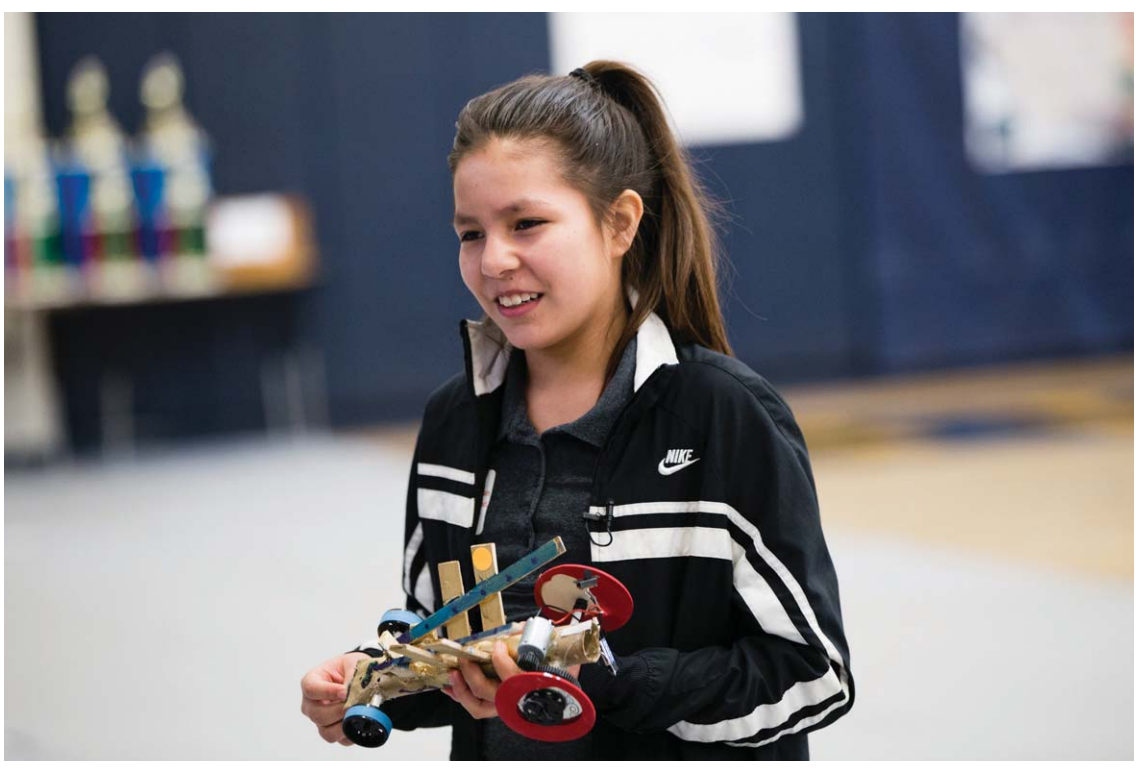
STUDENTS, START YOUR ENGINES – More than 200 young engineers from middle schools across the state recently competed in the New Mexico Electric Car Challenge at Albuquerque's Highland High School.

At the beginning of the school year, the student teams were given a lithium-ion battery, a direct-current motor, and other materials such as a chassis and wheels. Over the next several weeks, the teams designed and built electric cars to race on Nov. 21. Twenty Sandia volunteers helped organize and run the event, now in its ninth year. The full-day event, sponsored by Sandia, Los Alamos National Laboratory, Intel, and PNM, also included a design competition and an optional oral presentation.

Teams from P.R. Leyva Middle School in Carlsbad took first and third place, and the Sixth Grade Academy at Alta Vista Middle School, also in Carlsbad, took second place.

"The challenge introduces a diverse group of students to engineering. They encounter problems, even on race day, and they figure out solutions – just like our engineers," said Amy Tapia, manager of Community Involvement (3652).





SANDIA CLASSIFIED ADS

Due to the winter shutdown, the deadline to submit a classified ad for the January 8, 2016, issue will be Wednesday, Dec. 23, at noon.

MISCELLANEOUS

ARMOIRE & HUTCH, dark cherry, $600/both. Hennessey, 505-269-6243.

SINGLE STROLLER, City Mini, red & black, w/standing glider attachment, $200; double stroller, Britax B-Ready, blue, w/2nd seat & car seat adapter, $400. Knapp, 301-919-7549.

DVDS, set of two, 'Sviatoslav Richter' & 'The Enigma', award-winning film, Bruno Monsaingeon, in English, French, German, Russian & Japanese, a rarity, $25. Wagner, 505-504-8783.

PLASMA HDTV, Panasonic, TC-P50UT50, 50-in., 1080p, 3D, excellent condition, $350 OBO. Cioce, 201-575-0319.

CUSTOM DASH COVER, for '11 Dodge Ram 1500, black, matching console cover, $50. Garner, 269-3350.

PELLET STOVE, 3,000-sq. ft., new & still boxed on pallet, $1,000. Carlson, 505-238-9058.

ARMOIRE, genuine mahogany, ruggedly crafted, rubbed finish, 3-shelf, 4-drawer, pull-out table & chair, excellent condition, $895 OBO. Menicucci, 235-8501.

TiVo PREMIER, 320 GB, brand new, unused, undamaged, in original pkg., HD 1080p, $80. Lujan, 299-2218.

SNOW TIRES & CUSTOM RIMS, full set of 5, Goodrich All Terrain, LT265/70R17, $500 OBO. Alam, 363-7369.

CRAFT FAIR, Dec. 12, 8 a.m.- 4 p.m., last minute hand-made gifts, 1621 Arizona NE. Pape, 505-263-7130.

BIRD CAGE, w/stand, 30" x 30" x 18", w/stand 56", excellent condition, $100 OBO. Stetson, 899-4847.

PUSH LAWN MOWER, $40; new mattress, box spring, $375; TV/stereo hutch, $45; BMX/Motocross clothes, $50/all or $25 ea.; BMX Intense bike frame, $75; River of Lights tickets, adult, 3, 10 ea. Brewster, 238-4704.

DOUBLE STROLLER, sit & stand, great shape, $125; convertible crib w/matching dresser, high quality, heavy, sturdy, $375. Davis, 505-610-1309.

COFFEE & END TABLES, 3, matching, solid wood w/glass tops, photos available, $75/set. Wimpy, 822-0223.

AQUARIUM, 70-gal., corner, curved front glass, w/stand, good condition, $125. Hammond, 505-823-9619.

BEDFRAME, solid oak, queen, 2 lengthwise drawers on wheels, good condition, you pick up, $300. Thompson, 505-296-9591.

RADIAL ARM SAW, Sears Craftsman, 10-in., barely used, text for photos, $600 OBO. Kohler, 505-206-0250.

DINING ROOM TABLE, new, oak, double pedestal, 4' x 6', 2 16-in. leaves, >8-ft. long, $600, will consider offer. Amend, 505-453-4751.

SLEEPER SOFA, twin, beige fabric, 2 pillows, excellent condition, $300 OBO; lamp/table combo, $30. Edenburn, 505-869-2911.

MEN'S TUNGSTEN RING, size 12, tungsten carbide triton comfort fit band, sterling silver inlay, 9 round diamonds, $350 OBO. Rose, 505-550-0954.

MATTRESS & BOX SPRING, queen, fairly good condition, $350 OBO. Hidalgo, 505-980-5737.

GLASSWARE GOBLETS, Homer Laughlin Fiesta Elegance, 10 glasses, cobalt blue bands at bottom, discontinued, $40. Hall, 280-4344.

How to submit classified ads

DEADLINE: Friday noon before week of publication unless changed by holiday.
Submit by one of these methods:
- **EMAIL: Michelle Fleming (classads@sandia.gov)**
- **FAX: 844-0645**
- **MAIL: MS 1468 (Dept. 3651)**
- **INTERNAL WEB: On internal web homepage, click on News Center, then on *Lab News* link, and then on the very top of *Lab News* homepage "Submit a Classified Ad."**

If you have questions, call Michelle at 844-4902.
Because of space constraints, ads will be printed on a first-come basis.

Ad rules

1. Limit 18 words, including last name and home phone (If you include a web or e-mail address, it will count as two or three words, depending on length of the address.)
2. Include organization and full name with the ad submission.
3. Submit ad in writing. No phone-ins.
4. Type or print ad legibly; use accepted abbreviations.
5. One ad per issue.
6. We will not run the same ad more than twice.
7. No "for rent" ads except for employees on temporary assignment.
8. No commercial ads.
9. For active Sandia members of the workforce, retired Sandians, and DOE employees.
10. Housing listed for sale is available without regard to race, creed, color, or national origin.
11. Work Wanted ads limited to student-aged children of employees.
12. We reserve the right not to publish any ad that may be considered offensive or in bad taste.

TOTAL GYM 1000, w/all attachments for complete body workout, folds for easy storage, $75. Wells, 292-0179.

TRANSPORTATION

'94 HONDA CIVIC EX, 4-dr., rebuilt engine, needs work, 135K miles, $1,000 OBO. Flores, 610-1474.

'12 NISSAN ALTIMA, white w/black interior, push button start, 67K miles, great condition, moved to mountains need AWD vehicle, $11,500. Pohl, 917-5188.

'12 SCION XB HATCHBACK, 5-spd., manual, lots of cargo room, excellent condition, photos on AutoTrader/Craigslist, $11,500. Wolfgang, 414-1483.

'98 ACURA TL 3.2, gray leather, silver exterior, 123K miles, Kelley Blue Book 'fair' price, $1,500. Milton, 274-7255.

'02 ACURA RSX-S, 1 owner, great gas mileage, new brakes/belt, 131K miles, excellent mechanical condition, $4,700. Sansone, 505-296-7945.

'15 FIAT ABARTH, 5-spd., turbo, 1,100 miles, perfect new condition, expecting baby, need 4-dr., $16,500. Martin, 623-687-7673.

'08 VOLKSWAGEN GTI, 6-spd. manual, 4-dr., gray, new tires, sun roof, stereo aux input, 125K miles, $9,800. VanGemert, 505-620-7145.

'03 HONDA CIVIC LX4D, manual, little used since illness 2008, 82K miles, good condition, in California, $2,950. Mrowka, 925-672-2386.

'05 HONDA CRV, AWD, red, sun roof, 1 owner, 215K miles, good condition, $2,900 OBO. Larson, 286-8237.

RECREATION

'02 FLEETWOOD SOUTHWIND , class A motor home, fully loaded, 36-ft., 58K miles, excellent condition, $35,000 OBO. Sanchez, 505-980-3532.

REAL ESTATE

5-BDR. HOME, 3 baths, 3,000-sq. ft., tri-level, Mossman, near Sandia high school, Madison middle school & Comanche elementary, excellent floor plan, $330,000. Norwood, 331-8608.

4-BDR. HOME, 1-3/4 baths, 2,174-sq. ft., Uptown area, remodeled, corner lot, backyard access, additional storage, MLS#851363, $225,000. Velasquez, 505-280-6095.

4-BDR. HOME, 2 baths, just built, many amenities, NW Petroglyphs, easy access to I 40, must sell, $245,000 OBO. Sanchez, 505-515-5997.

5-BDR. HOME, 3 baths, 2 master suites, 4,000-sq. ft., 1 acre, art studio/family room, furniture, fireplaces, mature trees, garage, $424,000. Connelly, 575-770-0252.

3-BDR. HOME, 1,541-sq. ft., single level, 2 living areas, 5 mins. to Sandia, MLS#843999, $128,500. Gutierrez, 505-681-8578, ask for Michael.

4-BDR. HOME, 2-1/2 baths, 2-car garage, 2,676-sq. ft., far NE Heights, extremely well-maintained, gorgeous, $425,000. Cygan, 298-5126.

4-6-BDR. HOME, 3,921-sq. ft., multi-generation, in-law suite, views, pool, foothills, must see, $500,000. Baczek, 505-450-7895.

WANTED

MALE ROOMMATE, quiet, nonsmoker, updated, newer, 3-bdr. home, on Kirtland AFB, $550/mo. Bonner, 925-324-6995.

TO SHARE A HOME, clean, quiet, 50+ male, new hire, looking for room or apt., split. Maynard, 240-394-0527.

Know where to go when winter weather hits

By Lindsey Kibler

When winter weather strikes, do you know where to go for information about Sandia work delays or closures?

Should overnight weather conditions make the Labs' parking lots unsafe until they are cleared, Sandia's Emergency Operations Center (EOC) will distribute a workforce message about the delay, including a specific time to report to work, and other relevant details including how to charge time for the delay.

Under typical snowy conditions, messages will be sent no later than 5 a.m. the day of the delay, and will include a stipulated start time dependent on the severity of the storm.

Messages will be delivered in a variety of ways, beginning with Sandia email, allowing employees to monitor the information sources most convenient to them.

These sources include:

- Sandia email
- Sandia Bulletin Board (Dial 845-6789 and follow the menu choices; 925-294-3333 for California-specific events)
- Radio Sandia, 1640 AM
- Alert banners on Sandia's external homepage, www.sandia.gov, and internal Sandia Techweb
- News coverage through local television and radio stations
- Sandia Facebook, facebook.com/SandiaLabs, and
- Sandia Twitter, twitter.com/SandiaLabs

During inclement weather, employees should follow arrangements made with their manager for weather delays, including any telecommuting work. Information regarding road conditions can be found at www.nmroads.com/ in New Mexico, or http://511.org in California.

SHOULD OVERNIGHT WINTER WEATHER conditions make parking lots and walkways unsafe, Sandia's Emergency Operations Center will deliver a workforce message about the delay. (Photo by Randy Montoya)

When at work, as weather deteriorates, pay attention to email notices and keep in mind proactive winter precautions from Security and Emergency Management:

Emergency, Safety & Health

- Do not overload yourself with hand-carried items while walking. High winds combined with the inability to use your hands and arms to balance make you prone to falling.
- Be aware that the wind may stir up debris causing ear, nose, throat, and eye vulnerabilities. You should consider eye protection and respiratory guards/masks to mitigate any airborne debris hazards.
- Be mindful of doors blowing open in windy conditions.

If it should snow or become icy, be aware of slipping hazards. Sandia annually averages two to three slips in parking lots as the result of slippery surfaces and inadequate foot wear.

- Assist others if you recognize they may be compromising their safety or the safety of others. Let's look out for one another.
- Situational awareness is paramount when an unrecognized hazard surfaces. Situational awareness provides reaction time and space to recover from incidents that could result in injury.

Security

- High winds may prevent security area (i.e. Limited Area, Property Protection Area, etc.) entry/exit points from securing properly. When entering or exiting a security area, please ensure that those entry/exit points are properly secured to prevent the compromise of classified, critical infrastructure, and personnel.
- Report any urgent facility issues that could lead to a compromise in security to the Facilities Management and Operations Center (FMOC) at 844-4571.

HIGH TECH

Charter school on Sandia's doorstep gives kids hands-on exposure to science

By Nancy Salem
Photos by Randy Montoya

Katie Wieck hated math in elementary school. Middle school was another story. "I really got good at it and started to like math," she says. When it came time for high school, Katie heard about a special technology-focused charter school forming in the Sandia Science & Technology Park (SS&TP) and gave it a shot.

She hasn't regretted the decision. "I wanted something different, and this has been really challenging and fun," she says. "I'm learning math and science in new ways."

The Technology Leadership High School, a public charter located in the Sandia tech park, opened in August with 90 students in grade 9. The school will add a grade level each year until it reaches 12th grade.

"We love having high school students engage in our tech park programs," says Jackie Kerby Moore, manager of Technology & Economic Development Dept. 1933 and executive director of the SS&TP. "These students have already participated in several activities including Entrepreneur Exploration Roundtables and Manufacturing Day tours."

The school was a year and a half in the planning and is one of three in the Leadership Network, along with Health Leadership and Architecture, Construction and Engineering, or ACE.

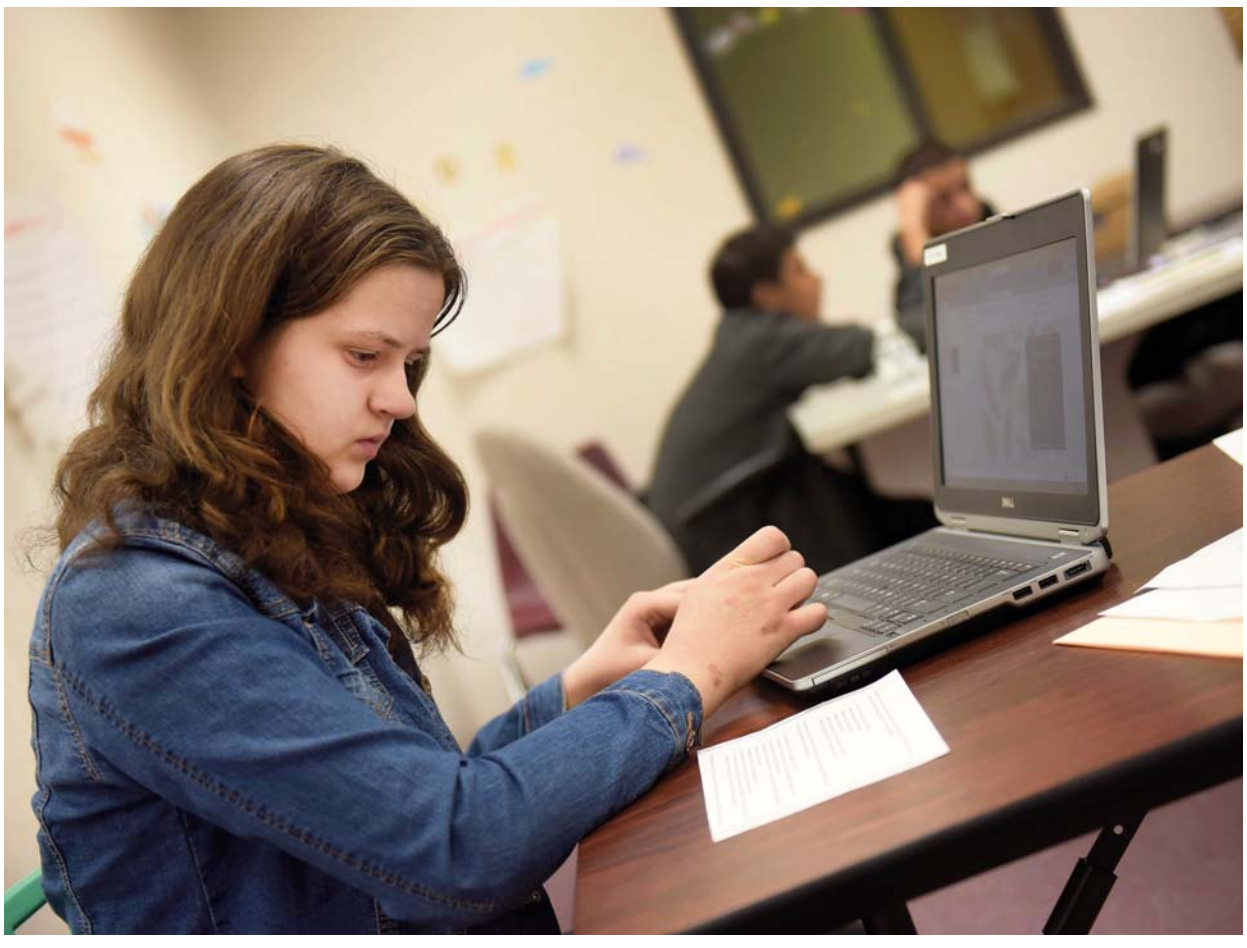
Velina Chavez, director of community engagement at Technology Leadership High, says the network shares a philosophy and method of teaching. "We take a different approach to education than traditional schools," Chavez says. "We offer hands-on, project-based learning that is interdisciplinary."

Students get a problem to solve at the beginning of each trimester and have 12 weeks to investigate and explore it. A final presentation reveals a solution and demonstrates the student's knowledge. The school's first trimester project was learning algebra through computer coding, with the final assignment being development of a video game.

Katie's team of four students came up with Pac Man's Revenge. "Making the video game has been my favorite thing so far," she says. "We're doing algebra in a cool way."

Chavez says project-based learning gives students the "why" piece of subjects like algebra and physics. "It provides a real-world connection to the concepts they are learning," she says. "It shows the relevance to their lives."

Chavez says the school was strategically placed in the tech park to be close to Sandia and to technology-based businesses. Sandia donated refurbished laptop computers and other equipment, and Laboratories scientists are working with teachers on curriculum. "People from the Labs will come to the classrooms and partner with us," Chavez says. "We'll also collaborate with businesses in the park. The students have walking access to companies that are doing scientific work."



KATIE WIECK'S FIRST-TRIMESTER PROJECT at Technology Leadership High led to a student-developed video game. "We're learning how technology has real-life applications," Katie says. "It helps us think about careers."

The students recently visited TEAM Technologies, Air Products & Chemicals, and the QC Group on Manufacturing Day sponsored by the New Mexico Manufacturing Extension Partnership in conjunction with the SS&TP program office.

> *"We take a different approach to education than traditional schools."*
>
> **—Velina Chavez, director of community engagement at Technology Leadership High**

Chavez says the students will intern at park companies their junior and senior years. "We're exposing our students to experiences they wouldn't get in traditional schools," she says. "They see different career options up close."

Every Thursday the students go to places like the La Luz Early Childhood Center, New Mexico School for the Blind and Visually Impaired — also in the Sandia tech park — Manzano Mesa Elementary, and the Manzano Mesa Multigenerational Center to provide help and support. Chavez says the goal is to teach the kids to interact in the community and in professional settings. "Students can develop the soft skills they need to be successful going into the workforce," she says.

The school has drawn most of its students from the Southeast Heights and International District. "Our focus is to engage students who have been disengaged, students who might fall through the cracks at traditional schools," Chavez says. "We know students can succeed, and it's great to see that happen."

As the school moves into its second year next fall, Katie says she'll be there. "I enjoy the activities and helping people in the community," she says. "There is so much I want to explore."

A MATH PROJECT at the tech high school included cake baking. The approach to education is interdisciplinary, pulling subjects like algebra, physics, and language arts into a single, hands-on assignment.

STUDENTS AT TECHNOLOGY LEADERSHIP HIGH work on laptop computers donated by Sandia. "We've had a successful launch and solid start," says Velina Chavez, the school's director of community engagement. "It has to do with the students who are here. They are dedicated. We know we're doing good when they show up every day and work hard." The school is one of three in the Leadership Network, along with Health Leadership and Architecture, Construction and Engineering, or ACE.

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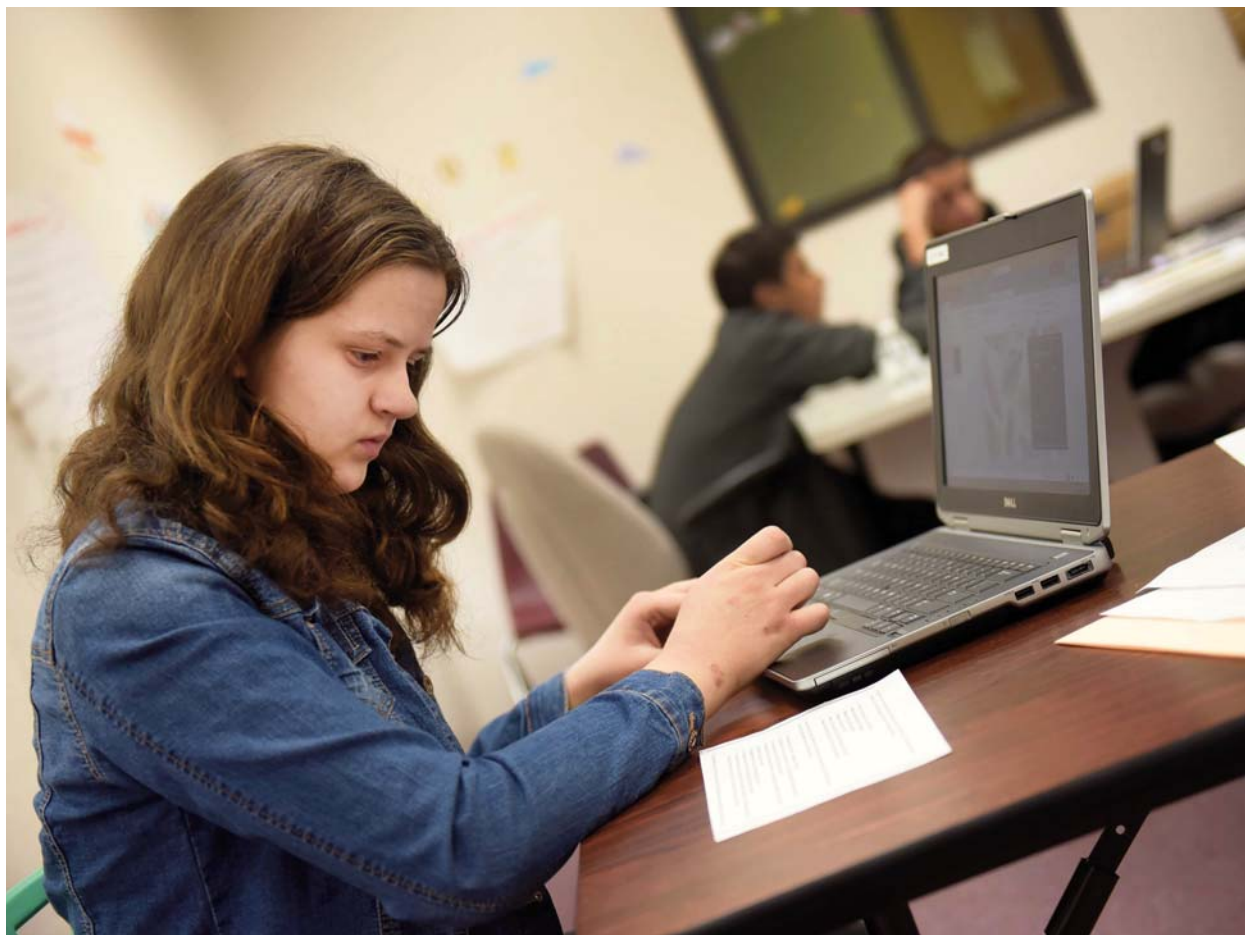

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