Sandia engineers world's most wear-resistant metal alloy

By Troy Rummler

If you're ever unlucky enough to have a car with metal tires, you might consider a set made from a new alloy engineered at Sandia. You could skid — not drive, skid — around the Earth's equator 500 times before wearing out the tread.

Sandia's materials science team has engineered a platinum-gold alloy believed to be the most wear-resistant metal in the world. It's 100 times more durable than high-strength steel, making it the first alloy, or combination of metals, in the same class as diamond and sapphire, nature's most wear-resistant materials.

Sandia's team recently reported its findings in Advanced Materials. "We showed there's a fundamental change you can make to some alloys that will impart this tremendous increase in performance over a broad range of real, practical metals," said materials scientist Nic Argibay, an author on the paper.

Although metals are typically thought of as strong, when they repeatedly rub against other metals, like in an engine, they wear down, deform and corrode unless they have a protective barrier, like additives in motor oil.

Costly coating burnout

In electronics, moving metal-to-metal contacts receive similar protections with outer layers of gold or other precious metal alloys. But these coatings are expensive. And eventually they wear out, too, as connections wear and slide against each other day after day, year after year, sometimes millions, even billions of times. These effects are exacerbated the smaller the connections are, because the less material you start with, the less wear and tear a connection can endure before it no longer works.

With Sandia's platinum-gold coating, only a single layer of atoms would be lost after a mile of skidding on the hypothetical tires. The ultradurable coating could save the electronics industry more than $100 million a year in materials alone, Nic says, and make electronics of all sizes and across many industries more cost-effective.

(Continued on page 3)
By Manette Newbold Fisher

The Sandia Science & Technology Park, home to 26 buildings, 47 companies and organizations and more than 2,000 jobs, celebrated its 20th anniversary last week and highlighted the park’s economic impact through 2017.

Sandia Director Steve Younger joined Albuquerque Mayor Tim Keller at SolAero Technologies Corp. to release findings of a new report by the Mid-Region Council of Governments.

The SS&TP, a 300-plus acre master-planned park located outside Sandia Labs and Kirtland Air Force Base, has generated $3.1 billion in economic activity since it was established in 1998, the report concluded. Called taxable personal consumption in the report, economic activity refers to spending on goods and services, government expenditures and private investments.

During the same period, the park also produced more than $123.4 million in tax revenue for the state of New Mexico and $22.5 million for the City of Albuquerque.

Steve congratulated the park on 20 years of success. He said the Labs benefit from the SS&TP, enabling Sandia researchers with increased access to partners.

Sandia committed to park partnership

“The Sandia Science & Technology Park is a successful public-private partnership that has had a positive impact on the community,” Steve said. “Sandia is committed to continuing to grow the park through collaboration, bringing long-term, high-quality jobs and economic prosperity to the county, state and city.”

Keller said the city is proud to be active in the park, which generated tremendous economic impact for Albuquerque and surrounding communities.

“The Science & Technology Park has spurred growth in the Southeast Heights while providing a gateway to science and technology for our community,” Keller said.

“This park is an example of a project that hits the mark on placemaking and ensures we’re creating areas that will make our city succeed.

From groundbreaking to growth

Celebrating at SolAero was significant because the SS&TP broke ground there in May 1998, said Jackie Kerby Moore, Sandia’s manager of Technology and Economic Development. The site initially housed EMORE, the first park business. EMORE transitioned to SolAero through an acquisition in 2014.

Sherman McCorkle, chairman of the board of the SS&TP Development Corp., said, “From a recovered brownfield to the premier science and technology park with more than $3 billion in economic impact in less than 20 years is a feat every state will envy. Our success comes from the outstanding collaboration from the many partners who make up the park.”

Along with celebrating the 20th anniversary and announcing the park’s economic impact, SS&TP recently received a Star of the Southwest Award at the Southwest Economic Development Association’s Conference in July. The award recognized the park for its economic impact success and for playing a meaningful role in Albuquerque’s future.

Jobs, wages and widespread investment

Jobs associated with the research park, which houses private companies and some Sandia National Laboratories sites in a collaborative environment, have paid out more than $3 billion in wages from 1998-2017, contributing significantly to the local economy, according to the report.

The report found that salaries for full-time employees of companies and organizations in the SS&TP last year averaged $58,000. The average salary for full-time employees in the Albuquerque metro area is $46,000.

“High-paying jobs have a benefit for the city of Albuquerque and for the region as a whole,” said Dewey Cave, executive director for the Mid-Region Council of Governments. “The park continues to bolster the economy by providing competitive salaries, long-term employment and first-rate jobs.”

In 2016 and 2017, the park’s economic impact was $388.7 million in taxable personal consumption, and it produced $15.4 million in tax revenue for the state and $6.6 million for the city. Wages in the two-year period totaled $747.7 million, according to the report.

Investments in the park since 1998 total more than $384.8 million, with $295.8 million coming from private sources and $89 million coming from public investment.

The park is a partnership of Albuquerque Public Schools, Bernalillo County, City of Albuquerque, Mid-Region Council of Governments, New Mexico Congressional Delegation, New Mexico State Land Office, Public Service Company of New Mexico, Sandia National Laboratories, Sandia Science & Technology Park Development Corp., State of New Mexico, Union Development Corp., U.S. Department of Energy/National Nuclear Security Administration and U.S. Economic Development Administration.

Ray Thomas led work at Sandia accelerators, CERN experiments

Ray Thomas, a Sandia manager, passed away last month.

Ray led the organization that provides telemetry and advanced electronic services and support to Nuclear Deterrence and National Security Programs mission areas.

Previously, he was the department manager for the accelerator operations organization responsible for HERMES III, SATURN and SPHINX.

“Ray was a kind person, always willing to go above and beyond to help his colleagues,” said senior manager Tom Trodden. “He was a voracious learner, and the organization leaned on him as an SME in many technical and safety areas for advice and guidance.”

Ray began his career at Sandia in 2004 working on the Z machine.

He earned his master’s and bachelor’s degrees in physics from Texas Tech University.

“Of all his achievements, Ray was most proud of his service to his country as a member of the United States Marine Corps,” Tom said.

Tom said Ray was a member of the team that worked on the Compact Muon Solenoid experiment at the Large Hadron Collider at the European Organization for Nuclear Research, or CERN.

Ray is survived by his wife, Dawn Thomas of Sandia’s transportation analysis department, and a son, Dillon Thomas.
Making it easier to get work done

By Janeen Miller

H ow do I report a lost Sandia badge? How do I order a new chemical for my lab? Can I accept payment for jury duty? What is the process for hiring a new employee? Can business and personal travel be combined?

And, finally, where would a member of the Sandia workforce find the answers to these and other commonly asked questions?

The new Laboratory Policy System

Making its debut last week, the Laboratory Policy System (LPS) represents almost four years of work to simplify and streamline Sandia’s policies and processes, with the goal of making it easier for the workforce to find the information they need to get work done.

Project beginnings

In August 2014, Sandia began a project that aimed to address workforce complaints about the complexity of Sandia’s Corporate Policy System, or CPS. Matt Schwartz, a policies and procedures analyst and manager in Policy Management, joined with Juanita Evans, Jeff Gilligan and Meredith Jones for a thorough review of the current system, and the policies, processes and procedures it contained. The team examined how policy leads processed changes. Then they researched policy systems at other large companies, including Honeywell, Boeing and Pacific Northwest National Laboratory, to benchmark best practices.

“We found at Sandia was a tangle of policies, managed by an extremely manual and cumbersome documentation system, located on an outdated information technology platform,” Matt said. “But we also found a starting point. The outstanding policy systems we reviewed were based on the needs of the customer. From that point on, our project team focused on how to make it easy for the workforce to find, understand and apply the appropriate policies and processes.”

In November 2014, the project team began working with Information Technology Services to track CPS user information. With several months of data, the team identified the Top 30: those policies and processes most requested by the workforce. Juanita Evans worked with the functional area leads to create succinct answers to frequently asked questions about those policies, which then were posted on a separate page on the CPS site.

“The creation of the FAQs page was just scratching the surface,” said Juanita. “We knew that we needed to make a more long-term plan for improvements — what we called the Corporate Policy System of the Future.”

The team began gradual improvements by identifying policy leads for each functional area, migrating content to a new technology platform, and reviewing and consolidating the policies and processes. The team’s approach is a modern one that depended on computational tools. Nic and Michael’s theory arose from simulations that calculated how individual atoms were affecting the large-scale properties of a material, a connection that’s rarely obvious from observations alone. Researchers in many scientific fields use computational tools to take much of the guesswork out of research and development.

“We’re getting down to fundamental atomic mechanisms and microstructure, and tying all these things together to understand why you get good performance or why you get bad performance, and then engineering an alloy that gives you good performance,” Michael said.

A slick surprise

Still, there will always be surprises in science. In a separate paper published in Carbon, the Sandia team describes the results of a remarkable accident. One day, while measuring wear on their platinum-gold, an unprecedented black film started forming on top. They recognized that black color, one of the world’s best man-made coatings, slick as graphite and hard as diamond. Their creation was making its own lubricant, and a good one at that.

Diamond-like carbon usually requires special conditions to manufacture, and yet the alloy synthesized it spontaneously.

“We believe the stability and inherent resistance to wear allows carbon-containing molecules from the environment to stick and degrade during sliding to ultimately form diamond-like carbon,” John said. “Industry has other methods of doing this, but they typically involve vacuum chambers with high temperature plasmas of carbon species. It can get very expensive.”

The phenomenon could be harnessed to further enhance the already impressive performance of the metal, and it could also potentially lead to a simple, cost-effective way to mass-produce premium lubricant.

Borobudur and Pacific Northwest National Laboratory, to benchmark best practices.

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FIGHTING FRICTION — Researchers Michael Chandross (left) and Nic Legby show a computer simulation used to predict the unprecedented wear resistance of their platinum-gold alloy and an environmental tribometer used to demonstrate it. (Photo by Randy Montoya)
Calling ‘Space Blimp’ mission control
Intern coding challenge takes to the air

By Mallie Rame
Photos by Norm Johnson

The Space Blimp coding challenge was on in full swing at Sandia National Laboratories in Albuquerque, New Mexico, on August 25, 2018. The challenge, which was sponsored by the Sandia National Laboratories’ System Mission Engineering (SME) team, was held at the SME lab in the middle of the day to allow participants to take a break from their work and engage in a fun and challenging activity.

The challenge brought together students from various universities, including the University of New Mexico, the University of Southern California, and Cornell University, to collaborate and develop code for a fictional space blimp. The goal of the challenge was to write code that would help the space blimp manage traffic and deal with various challenges that it might encounter.

The challenge was open to all谁 were interested in participating, and the competition was fierce. The students worked in teams of two or three, and they had to submit their code by a certain deadline.

The challenge was a great opportunity for the students to apply their coding skills and work on a real-world problem. It was also a chance for them to network with other students and professionals in the field.

The Space Blimp coding challenge was a success, and the students were proud of their achievements. They were excited to see the results of their hard work and to see how their code would be used in the future.

The students were also encouraged to continue participating in similar challenges and to keep improving their coding skills. They were given feedback on their code and were provided with resources to help them learn and grow.

Overall, the Space Blimp coding challenge was a great success and a great way for the students to apply their coding skills in a fun and challenging environment.

Sanding for certification again for ‘gold’ environmental standard

By Manette Neuchaud

Sandia Labs recently received its seventh consecutive “Gold” award for its environmental performance, recognizing the laboratory’s commitment to sustainability. The award is given by the American Society for Quality (ASQ) and the Environmental Performance Improvement Council (EPIC).

The award is based on a rigorous assessment of Sandia’s environmental performance, including its greenhouse gas emissions, water use, and waste management. Sandia has reduced its greenhouse gas emissions by 21 percent since 2005, and it has reduced its water use by 43 percent.

Sandia Labs has been working to improve its environmental performance for over two decades. The laboratory has invested in energy-efficient technologies and has implemented a number of best practices to reduce its environmental impact.

The “Gold” award is the highest level of recognition that Sandia Labs can receive, and it is a testament to the laboratory’s commitment to sustainability. Sandia Labs will continue to work towards even greater reductions in its environmental impact and will strive to achieve the “Platinum” level of recognition in the future.

Staying certified

Sandia Labs is one of the only organizations in the world to hold both ISO 14001 and ISO 50001 certifications. These certifications are a testament to the laboratory’s commitment to sustainability and its dedication to reducing its environmental impact.

The ISO 14001 certification is a standard that sets requirements for environmental management systems. The ISO 50001 certification is a standard that sets requirements for energy management systems.

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Sandia communicators excel in national APEX contest

by Neal Singer

Sandia communicators have garnered five awards in the APEX 2018 contest, the 30th annual national competition recognizing outstanding work by professional communicators, sponsored by Communication Concepts. More than 1,400 entries were received for this year’s competition.

Sandia winners of APEX awards for publication excellence were as follows:

Grand award
Social media
Darrick Hurst and Valerie Larkin, “Sandia’s Social Media.”

Only six other national social media programs or campaigns were recognized with the APEX grand award — the highest honor — including the Facebook site for NASA’s Armstrong Flight Research Center and the National Association of Realtors. This is the third time the Sandia social media team has won the grand award in recognition of their strategy and implementation.

The judges wrote: “Over 230,000 total social media followers rely on Sandia to provide a wealth of information including everything from news releases and announcements, world-renowned photography and video to direct messaging, chats and contests. The extreme care and attention given to strategy and content planning is evident throughout each of the numerous social media platforms. Sandia clearly accomplishes the goals it has set with regard to using social media for PK, recruiting, crisis communications and thought leadership.”

Awards of excellence

Feature writing
Nancy Salem, “We remember Christopher: A tale of friendship, loss and love.” A Sandia veteran, John Bailon, recalled the story of one Marine’s death and the friend who carried his legacy through family.

Technical and technology writing
Jules Bernstein, “Testing for Zika virus: there’s an app for that.” Sandia has developed a smartphone-controlled, battery-operated diagnostic device that weighs under a pound, costs as little as $100 and can detect Zika, dengue and chikungunya within 30 minutes.

Neal Singer, “HADES creates alternate reality to mislead hackers.” Rather than simply blocking a discovered intruder, Sandia deploys a recently patented alternative reality… which feeds a hacker not what he needs to know, but what he wants to believe. “Deception is the future of cyber defense,” says researcher Vince Urias.

“Green” writing
Neal Singer, “The destructive effects of supercooled liquid water on airplane safety and climate models.”

Supercooled water sounds smooth enough to be served at espresso bars, but instead it hangs out in Earth’s atmosphere, unpredictably freezing on airplane wings and hampering the simulations of climate theorists.
Blast tube

How to submit classified ads

DEADLINE: Friday noon before publication unless changed by holiday.
Submit by one of these methods:
• Email: Michelle Reining (classads@sandia.gov)
• Fax: 505-459-0545
• Mail: MS 1468 (Dept. 3551)
• INTERNET WEB: From Techweb search for “Necessary” at the bottom of that page, choose to submit an ad, select an article, fill in your questions, call Michelle at 505-448-0012.

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 email address, it will be cut to two or three words, depending on length of the address.)
2. Include organization and full name with the ad submission.
3. Submit no more than five phones.
4. Type of ad and legible use of accepted abbreviations.

One ad per issue.

We will not run the same ad more than three times.
5. No “for rent” ads except for employees on temporary assignments.
6. No commercial ads.

For active Sandia members of the workforce, retired Sandians, and DOE employees.
7. Housing listed for sale is available without regard to race, creed, color, or national origin.
8. We reserve the right to publish any ad that may be considered offensive or in bad taste.

WANTED

SCOOTER, 50cc, running or minor tune-up would be great, reasonable price.
Valencia, 505-228-7307.


SUBCLASSIFIED, 1986, mel's, for high school junior, 1 hr. per week, 3 p.m., Tues. Wed. or Thursday.
Putelli, 505-328-3120.

BOOMRATe, share home, start- ing mid-June, reduce cost of living, save money.
Burgell, 505-203-5570.

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MISCELLANEOUS

ARMOIRE/ENTERTAINMENT UNIT, 47x7x3 “23D” x 62” H, solid wood, very good cond- ition, $130. Atencio, 505-249-8935.

BENCH GRINDER, 6-in., 2 wheels, 4-1/2 hp, portable cabinet, grinder, $25; laminated wood floored, 4’ x 7’ 20”, 85”, metal filing cabinet, 4 drawers, $65. Garcia, 505-334-2009.


SLEIGH BED, full size, memory foam mattress, Ashleigh Furni- ture, photos available, $130 OBO. North, 505-314-7878.


WASHER/DRYER, Whirlpool, elec- tric, large capacity, energy ef- ficient, programmable, steam refresh, moving sale, like new, $430. Ashton, 480-259-9446, used.

GE APPLIANCE SUITE, white, re- frigerator, gas stove, over- crown, dishwasher, all in great condition, $600. Garcia, 505-366-4322.

LEER 1000X SHELL, white, 65 sq. ft. - 15714 Tacoma, older win- dows, dense light, factory roof raks, 1$10.00. Holt, 505-270-2792.

BASKETBALL HOOP, outdoor full-size, great condition, $20, tether ball polio, homemade, $10. Martinez, 505-792-3648.

FABRIC STEAMER/WINNALEE RE- MOVER, Norco Nail Free Care T160, boxed, w/pouch & instruc- tions, excellent condition, $22. Wagner, 505-386-2768.

TREADWELL, Landice L7, rarely used, like new, original price $3,000, asking $1,100 OBO.

LEER 720, 175,167.


TUBE SHOXX — Sandia researchers use wavefront imaging taken at 35,000 frames per second to analyze blast wave dynamics invisible to the eye and determine how well nuclear weapons couldcause a shock wave. (Photo courtesy of Sandia National Laboratories)

Blast tube

(continued from page 1)

Analysts process experimental data using embedded information, and use signal processing methods identical to the experimental and analyses to data compare and responses and assess the credibility of the model.

The objective is to develop validated analytic models for predicting response and trends with a high degree of confidence," Wil said. Researchers can use the validated model to help qualify a weapon to hostile blast environments that cannot be directly simu- lated with ground-based blast tube tests.

Planning takes much longer than test itself

Instrumentation is critical. Tests that last more milliseconds require months of planning.

“Communication and technical excellence are crucial to success,” and there’s only one chance to get things right. “It is crucial to maintain an environment of a blast, said John Griffin of Measurement Science and Engineering. “Simplicity in the design, protection of the hardware, redundancy of critical elements and thorough verification of connections are key to ensuring that we get the data in that one opportunity.”

Over the past three years, Sandia developed a new mobile instrumentation unit, a large-data acqui- sition system designed to self-check the accuracy and “health” of connections before and after testing. A hardened trailer encloses the system so it can be placed rear a blast test. The system can store up to 16 million samples per channel and record about one gigabyte per second at the maximum sample rate. For comparison, he said, this equates to more than 70 hours of digital music, or about 1,100 songs.

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Fuller, 505-401-7289.

505-730-4201.

505-220-6783.

505-220-6675.

505-220-6783.

505-309-4130.

505-401-7289.

505-573-4201.

505-385-3190.

505-579-0751.

505-699-6844.

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Shocking experiences bring intern back for more

A civil engineering student returns to Sandia each summer for love of community, mountains and explosions

By Troy Rummler

If you didn’t know better, you’d think Rebecca Nylen had a terrible start to her summer internship. She didn’t understand the work her group did. She had to be escorted everywhere because she worked in a tech area without a clearance. She tried picking up trail running, but fire restrictions closed the trails. When she joined a group of interns on a mountain climbing trip to Colorado, she tripped and broke her ankle. But none of that mattered, she said. At least not compared to what she loved about the Labs — supportive people, world-class technology, Southwest sunsets. As she completes her second summer internship, she has every intention of returning to Albuquerque in 2019.

“I mean, it’s Sandia,” she said, surveying a bulging, six-foot-tall steel cylinder deformed from explosives. Rebecca and her team sacrifice cylinders and other objects to refine the accuracy of computer simulations of damaging blasts, part of a field known as computational shock physics. But as a doctoral candidate in civil engineering at Georgia Tech, she’s more of an experimentalist, pummeling materials like reinforced concrete with high-powered actuators to study how the materials deteriorate and how to improve their post-impact strength.

It took about a month, she said, to feel comfortable with the entirely new skills and computational techniques, but her teammates throughout the computational structural mechanics organization played a key role aiding her ascent along a steep learning curve.

“I have a lot of confidence in the work I’m doing,” Rebecca said. “Russ Teezer, Rebecca’s Ph.D. adviser, has tremendous computational abilities for civil engineering structures.”

And that’s exactly what Rebecca plans to do. Civil engineering, she says, is largely driven by observation, but that makes certain scenarios hard to plan for. If you want to study a structure in an earthquake, you have to wait for an earthquake, and for obvious safety reasons, you can’t intentionally build a bridge that will fall apart to study its weak points, or violate building codes to experiment with new materials or techniques.

But a computer model can reveal ways to improve roads, bridges and other infrastructure in ways that are otherwise difficult to observe. Rebecca aims to combine her experimental and computational perspectives to propel her field. “I’d like to advance the state of computational abilities for civil engineering structures.”

Rebecca’s ankle has long since healed. In fact, she used it to reach the summit of nine Rocky Mountain peaks this summer. Next year, she wants revenge on Mt. Elbert, the expedition on which she broke her ankle. She’s also found it handy for escorting new, uncleared interns. Her advice to them: “Show interest in a subject, and there will be experts who will help you learn it.”

If you’re here next summer, Rebecca may be that expert.

Visitors study physics of Earth, exoplanet minerals under pressure

By Neal Singer

A hand of physicists and students from universities and national labs visited Sandia’s DICE and Z facilities in mid-August to improve their understanding of the composition of exoplanets and the Earth’s deep interior. DICE is the Dynamic Isentropic Compression Experiments facility. Z is the most powerful instantaneous X-ray source on Earth.

The visitors sought some idea of how the tremendous heat and pressure that Sandia’s huge machines bring to bear on materials might provide data for otherwise inaccessible theoretically calculations of the composition and evolution of Earth’s interior and of exoplanets over geologic time periods.

The visit capped a four-day physics conference, the Consortium for Materials Properties Research in Earth Sciences, held at the Santa Ana Pueblo, with about 100 researchers attending. Sandia researcher Seth Root, a keynote presenter, spoke on “Using Sandia’s Z machine and density functional theory simulations to understand planetary materials.”

Says Seth, “One problem in which people are often interested is Earth’s core composition. We know the core is mostly iron, but sound-speed measurements show it cannot be pure iron. So people try to understand different iron mixtures — iron with oxygen or sulfur or nickel, etc. — under high pressures and temperatures to explain the difference in sound speed from pure iron.”

ICE GIANT — Planets like Neptune, seen here in a composite image constructed from two photos taken by the narrow-angle camera on NASA’s Voyager 2, may have more water than previously thought. (Image courtesy of NASA)

CURRENT EVENT — Sandia researcher Randy Hickman points to the target chamber on the Velose (“swift” in French) mini-pulser machine. Velose uses electrical current to generate a sudden pressure wave that propagates through a material sample of interest. The machine can create an electrical current of about 2.2 megaAmpere, about one tenth of the current generated by Sandia’s Z machine. (Photo by Randy Montoya)