Each year, Sandia assesses the safety, reliability, and performance of the nation’s nuclear weapons stockpile. Through a series of presentations and discussions, all stockpile weapon systems and relevant component engineering and science and technology organizations report on the safety, reliability, and performance status of each weapon type in the stockpile in the absence of nuclear testing.

As required by law, the Laboratories director sends an annual report of this assessment and related issues to the Secretary of Energy, Secretary of Defense, and the Chairman of the Nuclear Weapons Council.

The directors of Los Alamos and Lawrence Livermore national laboratories and the commander of the United States Strategic Command complete similar reports based on their assessments. The secretaries, in turn, attach each assessment without change and submit a letter to the President under their signatures summarizing their comments, conclusions, and other appropriate information regarding the state of the nation's nuclear deterrent.

* * *

After signing the 2016 assessment report, Jill shared the following thoughts:

As I sign this year’s annual assessment report addressing the status of the nation’s nuclear weapon stockpile, I take pride in the extraordinary commitment, skill, and focus Sandia brings to this important responsibility. Although the report itself is a snapshot in time, it comes as the culmination of a complex year-long effort involving teams from across Sandia.

The conclusions expressed in the report reflect the most important role of the Laboratories, offering the nation’s leadership and policymakers an unbiased and informed judgment about the safety, security, reliability, and performance of the nuclear weapon stockpile.

The nation places great trust in Sandia, a trust we’ve earned in the course of serving the nation for more than 65 years. We are proud of the confidence our nation places in us, and we come to work every day determined to live up to that trust.

— President and Laboratories Director Jill Hruby

Photo by Stephanie Blackwell

Exceptional service in the national interest

Sandia Lab News

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Defence Secretary Ashton Carter visits Labs

‘Nuclear mission the bedrock of American security’

Photos by Norm Johnson

Defense Secretary Ashton Carter and President and Lab Director Jill Hruby pause in front of a bronze statue of the late physicist Willis Whitfield, who invented the modern laminar-flow cleanroom at the Labs in 1962. During a Sept. 27 visit, Carter toured a nuclear weapons display area and the Microsystems & Engineering Sciences Applications (MESA) complex and received briefings about Sandia’s mission. Earlier in the day, speaking to Air Force personnel at KAFB, Carter said the “nuclear mission is the bedrock of American security.” He also praised Energy Secretary Ernest Moniz and Deputy Energy Secretary Elizabeth Sherwood-Randall for being “spectacular leaders” and added that the nuclear enterprise needs DoD and DOE to continue to “run just like this, these two departments doing our two parts.”

US DEFENSE SECRETARY Ashton Carter, left, is joined by Sandia President and Director Jill Hruby and Executive VP Steve Rottler during a tour of the Labs.
That's that

"E pur si muove — And yet, it moves." That's the phrase attributed to Galileo Galilei — the father of modern physics — after being forced by the powers that be to recant his claims that the Earth moves around the Sun rather than the other way around.

One imagines Galileo muttering the phrase, knowing full well that he was right, and knowing, I suspect, that history and science, being the quest for truth, would vindicate him.

I got to thinking about Galileo because of the annual rite of fall, the Major League Baseball playoffs, which are upon us. The National Pastime, more than any other sport, has in the past appealed to the numbers nerd, the stats freak, in all of us.

Now those old-school baseball statistics — batting average, runs batted in, earned run average? They're all so very passé these days in the stratospheric heights of baseball nerd-dom. Now the hard-core stats nuts get into #zetas for the wins and losses and I'm talking to you, into some outright fictitious over which stat is more important, the Value Over Replacement Player number or the Wins Above Replacement rating.

And the debates haven't been limited to the relative merits of increasingly arcane statistics.

For the better part of the 20th century one of the most contentious issues in baseball was whether the curve ball actually, you know, curve. Waring camps staked out their positions, with some arguing the pitch was a mere optical illusion. Others, trusting the evidence of their own eyes, were convinced the phenomenon was real and argued accordingly. A compelling piece of evidence was that many a young prospect, a high school hotspot with his future all ahead of him, was flailed at the Big League level because he couldn't hit this "optical illusion."

Granted, the fight over the real or perceived trajectory of the curve ball isn't as monumental as Galileo's fight to establish a fundamental astronomical truth, but it did heat up the blood of lots of otherwise mild-mannered Rotarians.

The matter seemed to be resolved with some finality when LIFE magazine, famed for its photojournalism, published a "proof" that the curve was in fact, an illusion. To which Galileo, were he a switch-hitting shortstop facing the pitcher Bob Feller, might well have said: "And awed and missed the right-handed man's curve ball. And, yet, it moves!

Curve-ball and American original Dizzy Dean was having none of what LIFE espoused. "Stand behind a tree 60 feet away, and it'll whomp you with an optical illusion?" he said at the time through a mouthful of Beech-Nut chew.

LIFE's exposé didn't settle the matter. Several years later, archival LOOK magazine published its own proof, this time demonstrating graphically that the ball did, and curve, not to be left out, got into the act. Ralph Lightfoot, an aeronautical engineer with Sikorsky Aircraft, ran wind tunnel tests that seemingly closed the book on the matter. Under rigorous control and scrutiny, the ball was shown to actually curve, just as befuddled batters had been awering since the days of Abner Doubleday. So the issue was done and dusted, right? Not quite.

"There's the finality: It now seems that both sides were correct. The ball does curve, but an optical phenomenon associated with the pitch makes it very difficult for batters to predict where the ball will be when it crosses the plate of the plane. And that wind pitch — the real part and the illusory part — is still the bane of plenty of young prospects caught flawing away at empty air where the ball should have been.

"More baseball history if the curveball has the nomenclature of batteries for decades, the knucklerball has been like Russia’s pre-World War II intentions as described by Winston Churchill: A riddle, wrapped in a mystery, inside an enigma. It's a classic win-win."

We're right in the middle of our annual ECP campaign to raise funds for those who've been knocked down, it's not always easy to get back on your feet without a helping hand. And that's what we're about here: Making a difference — for the nation and for our community.

See you next time.

— Bill Murphy (MS 1446, 505-845-0845, wtmurph@sandia.gov)

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By Patti Koning

Early two years ago, Sandia researchers Joe Pratt (8366) and Lennie Klebanoff (8367) set out to answer one not-so-simple question: Is it feasible to build and operate a high-speed passenger ferry solely powered by hydrogen fuel cells? The answer is yes.


The study found that it is technically possible to build a high-speed, zero-emission hydrogen-powered ferry. We also believe this can be done with full regulatory acceptance,” says Joe.

In the course of the study, we examined more than 10 major issues where feasibility was initially unknown. SF-BREEZE sailed through them all,” adds Lennie.

Tom Fischer, president of San Francisco’s Red and White Fleet, first conceived of the project when he asked if it was possible to do away with emissions altogether on one of his ferries. “This is a game changer. We can eliminate environmental pollution from ships,” he says. “This could have a major impact on every ship in the U.S.”

Supported by the Department of Transportation’s Maritime Administration and led by Sandia, the feasibility studies brought together the American Bureau of Shipping (ABS), the US Coast Guard, naval architect Elliott Bay Design Group, the Port of San Francisco, and dozens of other contributors.

“Not long ago, the prospect of pollution-free transportation seemed like science fiction,” says Maritime Administration Administrator Paul “Chip” Jaenichen. “Today, through public-private collaboration on projects like SF-BREEZE, we are making progress to turn it into a reality.”

Novel boat design

Hydrogen-powered ferries do exist, but most are smaller, slower vessels used for tours on lakes and rivers. The SF-BREEZE study set out to discover whether it is technically feasible to build a large, fast vessel; it could meet maritime regulations; and it could be economically competitive with modes of transportation already available in the San Francisco Bay area.

The group set up conceptual specifications: a 150-passenger commuter ferry that would travel four 50-mile round-trip routes each day at a top speed of 35 knots (roughly 19 miles per hour) about 60 percent of the time. The ferry could refuel midday, between the morning and afternoon commutes.

“Historic boat designs have never been built before,” says mechanical engineer Curt Leffers, the project manager for Elliott Bay Design Group. “Hydrogen fuel cells are heavier than diesel engines for a given power output, so achieving the right power-to-weight ratio for the vessel was tricky.”

The need for speed drove the design to a slightly longer catamaran. The engineers were able to save weight by consolidating the support equipment for the fuel cells.

“First-of-its-kind vessel can achieve speed with zero emissions”

To achieve the necessary safety standoff distances from the fuel cells, the designers placed fuel cells on the main deck of the vessel in a separate compartment. Leffers adds that this provides physical separation between the fuel cells and passengers.

The project supports Elliott Bay’s commitment to the environment. “I’m a big believer in developing environmentally friendly designs,” Leffers adds. “This project has been terrific because it’s something I really believe in. I think that this proof-of-concept — this boat — is built, it’s very important for future projects.”

Regulations and economics

ABS issued a conditional Approval in Principle to verify that the conceptual design would comply with applicable regulations and rules and to identify any potential gaps in compliance. Combining their assessment with feedback from the Coast Guard, Sandia found no regulatory showstoppers and concluded that the vessel will be acceptable from a regulatory perspective once a more detailed “ready-to-build” design is generated.

“ABS is proud to have participated in the SF-BREEZE feasibility study and advance the research on unique challenges of designing a high-speed passenger ferry powered solely by hydrogen fuel cells,” says ABS Chief Technology Officer Howard Fireman. “The collaboration with Sandia and the project team extends our knowledge base and the potential technology transfer to address the challenge of reducing the environmental footprint.”

The hydrogen ferry would cost about twice as much as a comparable diesel ferry, says Joe. “But this is a question we need to explore further. Is economic parity necessary from the outset? Lessons from the automotive market tell us maybe not.”

Vehicle manufacturers have successfully brought hydrogen-refueling stations to California for a hardware update. HySTEP, which recently won an Outstanding Partnership Award from the Federal Laboratory Consortium, was developed by Sandia and the National Renewable Energy Laboratory. DOE’s Office of Energy Efficiency and Renewable Energy’s Fuel Cell Technologies Office funded HySTEP as part of the Hydrogen Fueling Infrastructure Research and Station Technology (HyFIRST) project. After a few days of maintenance and calibration in Sacramento, HySTEP stopped in Livermore before heading to Redwood City, California, to commission a new hydrogen refueling station.

Previously, HySTEP was testing hydrogen refueling stations in Los Angeles and surrounding areas. Joe Pratt (8366), left in photo at lower left; and Terry Johnson (8255), at right in the same photo) shown here, are Sandia’s HyFIRST project leads.

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Computing is stuck in a rut. The integrated circuits that powered the past 50 years of technological revolu-
tion are reaching their physical limits. This is opening the door for new ideas—new devices built using novel physics, new ways of organizing units within computers, and even algorithms that use new or existing systems more efficiently. To help coordinate his new ideas, Sandia has assisted organizing the Institute of Electrical and Electronics Engineers (IEEE) International Conference on Rebooting Computing held Oct. 17 in San Diego.

Researchers from Sandia’s Data-driven and Neural Computing Dept. 1462 will present three papers at the conference, highlighting the breadth of potentially tradi-
tional neural computing applications.

“We’re taking a stab at the scope of what neural algo-
rithms can do. We’re not trying to be exhaustive, but rather to bring to the forefront the potential of neural computing,” says Brad Aimone (1462), a computer scientist. “The brain is continually learning. ‘While we do learn in school, our learning doesn’t stop when school ends. Instead, our brains are continually adapting through processes such as synaptic modifications. However, most machine-learning algorithms learn once and are done,’” says Craig, a computer scientist.

Most so-called machine-learning algorithms have a learning phase and a separate testing and operation phase. This is really time-consuming. Ambitious — and challeng-
ing — attempts to develop algorithms that learn continu-
ously also run the risk of the algorithm “learning” some-
thing that’s wrong, Craig says.

His paper argues for continual learning and suggests decisions, such as when to take out the trash and when to hope
SIMULATING FRAGMENTATION — A computer model shows a simulation of explosively driven plate expansion and fragmentations at Sandia's knowledge how pipe bombs and other improvised explosive devices work and how much destruction they cause to learn how to mitigate that damage. (Illustration by Org. 1535)

Insights into what happens in explosions insight on how to make approximations to better mimic the fracture and fragmentation is important. How fast a fragment moves and whether it spins make a difference in the damage it inflicts. Simply assuming fragments are one size or behave one way skews the assessment of possible damage and ways to lessen it.

"If you think the average fragment is going to go a half mile, but you get one that's shaped just so and it flies 2 miles, then that's a problem, that begins to illustrate the behavior of fragments in flight, beginning while the fragments were inside the explosive fireball and continuing as the fragments began to rotate in flight.

Lead technologist Mike Bejarano (1535) helps ready everything from cameras to cables and works on post-explosion test data processing. The team is responsible for protecting the expensive tracking system and making sure it triggers when it should and that the delicate measuring system remains stable. "Moving even a tenth of a pixel introduces uncertainty and reduces the fidelity of the measurements," Mike says.

Digital image correlation

Researchers use a technique called digital image correlation to watch how a metal case around an explosive expands and ruptures. They coat the object with a speckled pattern and set high-speed, high-resolution cameras in pair for stereo photography. The cameras track how the pattern moves as the case expands, and the stereo pairs show how speckle shift, allowing researchers to measure 3-D displacement fields and see when strains are great enough for metal to fracture. X-rays penetrate the smoke, flame, and dust of the initial blast, capturing data cameras need.

The project uses image-processing algorithm techniques developed by Dan Guildenheicher (1521) to help eliminate noise that interferes with accurate measurements.

Noise is defined broadly. "You've got things like shock waves, you've got dust that's getting kicked up, you're operating cameras at very fast rates and so they're acquiring a lot of noise. As a result, you've got noise that comes in with lots of different false signals that could show up in your measurements. We have a lot of different noise, and we have to be able to figure out where we're measuring actual particles," Dan says.

Traditionally, explosive experiments placed layers of plywood or other material around a device to catch fragments — called soft catch — then removed the fragments for study. However, there was little or no diagnostics to evaluate fragments during flight. Researcher Jason Wilke (1626) says current experiments use high-speed photography and imaging techniques to determine fragment size and location during the explosion; researchers then dig the corresponding fragments from the soft catch for study.

Phillip added, "What are you validating [the model] against, fragments that run into something or fragments that are floating in the air before they run into something? We'd like them in the air before they run into something because that's how they'll be coming at the things we care about."

The team plans three to four test series a year, each with several explosions. "It's better to run some tests, think about what went right, what went wrong, what we need to change, then come back in a few months and set up another test," he says.
Our duty to help others

United Way Affinity Group members encourage Sanidans to help

By Manette Newbold Fisher

The way Angela Rivas (9531) feels about United Way is written all over her face and emails. She sends sentences with smiley face emoticons and, in person, she'll enthusiastically explain why she wants everyone to get involved.

It's no surprise that someone who volunteers for four affinity groups would want to spread the United Way Fever, and those who talk to Angela know that she might catch the bug, too.

Angela, a communication and project management specialist, volunteers with Women in Philanthropy (WIP), Young Leaders Society (YLS), Hispano Philanthropic Society (HPS), and Guys Give. On average, she meets with each group monthly and serves on the stewardship committees for WIP and YLS.

The United Way provides several ways for members of the community to get involved, whether it's donating money, organizing a workplace event, or volunteering. Affinity groups provide opportunities for networking, event planning, and fundraising; and grant allocation — all revolving around specific issues.

"I think what's unique about United Way is there are so many ways to give," Angela says. "Whether it's being in an affinity group or volunteering on the Community Fund allocation panel or a number of things. There are so many opportunities. Plus, they have the whole center for Non-Profit Excellence that gives you volunteer opportunities with all the different organizations. You can be as involved as you want to, but you should definitely get involved."

Angela grew up in Albuquerque and says her family and friends used some of the resources United Way provides. Knowing what it's like on the receiving end is one of the reasons she gives her time and resources now, she says.

"I'm in a position now where I can give. I can give my time and I can give my financial resources," she says, adding she recognizes that at any time she could need services again. "I think that's something people often forget ... You could lose your house in a fire or need emergency services and that counts, and that's under the umbrella."

Resonating issues

There are six local affinity groups associated with United Way of Central New Mexico, and each has a different purpose. For Senior Manager Jesus Ontiveros (10596), it was children and education that drew him to HPS.

He says the primary focus of the group is to contribute funds to organizations that support middle schools. STEM-related activities, mentoring, and awarding grants are main focuses of the group. Jesus and others in HPS are working with Polk Middle School students in the South Valley. Members of HPS offer brown bag lunches, speakers, field trips, and presentations to teenagers who may not see them.

"Knowing what it's like on the receiving end is one of the issues can be overwhelming, but Angela and Jesus both say "We really try to focus on making sure we're engaging them and not just putting them out there. It's really almost a concern," Jesus says. "One of the things that really helps us in that direction is having bilingual mentors. I think it makes a difference if you get to them young, and the volunteer lunch time session in Spanish or at least be able to speak to them in Spanish for a portion of the class."

Along with providing support to Vision's Polk Middle School program, also volunteers with YLS' mentoring program at Del Norte High School. She says many of the youth she works with don't see a clear path to their future, and they all have opportunities for service, opportunities for networking, and even opportunities for agency visits, she says.

Locally run, locally focused

Physicist Ben Yee (1178) became a YLS member when he moved to New Mexico from Michigan. He saw it as a way to network in an active group. He helped with an outdoor beautification project at Crossroads for Women's Hope House and mentored teenagers at Del Norte High School. He also participated in Gift of Giving, an event at Explora last week that enabled the public to learn about local philanthropy.

"What I really like about the United Way is it's locally run, locally organized, and it's locally focused," Ben says. "Even though it's a national group, it's sort of like a franchise. It's all local members. They are the ones who decide where the funding goes, what the funding priorities are, what kind of projects they want to support."

Instead of focusing on individual programs, United Way is more interested in what set of programs help a particular issue, Ben says.

United Way volunteers have the opportunity to read proposals and listen to presentations from various agencies seeking funding. For the last two years, Angela read several domestic violence proposals that receive grants through WIP, and Jesus, the council chair for HPS, read proposals that benefit students. Learning about Central New Mexico's issues can be overwhelming, but Angela and Jesus both say "We really try to focus on making sure we're engaging them and not just putting them out there. It's really almost a concern," Jesus says. "One of the things that really helps us in that direction is having bilingual mentors. I think it makes a difference if you get to them young, and the volunteer lunch time session in Spanish or at least be able to speak to them in Spanish for a portion of the class."

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The community at large needs a lot of help, and when you discover the needs you can almost overwhelm. But there are many different aspects of the community that individuals can get involved in, and many ways to give back. "I think most of us in HPS feel like we've been blessed with so much that it's our duty to help others have some of the same blessings that we had, and see themselves getting and leading successful lives here in Albuquerque, or wherever they might go.

For more information on United Way affinity groups, visit www.uwcmn.org/you-can-help/join-group.
Service and Suds

By Manette Newbold Fisher

I wasn’t technically happy hour, but it was that time of day, and as the sun streamed its late afternoon glow on Marble Brewery’s rooftop, a couple of dozen guys gathered for a pint and lively talk about philanthropy. And even if the beers weren’t the first on a two-hour special, it seemed like happy hour anyway.

The crowd has been meeting for several months at various breweries around town to network and discuss how to create positive change in Albuquerque. The group, officially called Guys Give, is one of United Way’s affinity groups that connect locals with opportunities to give their time and financial resources to the community.

A few of the men brought sporting goods equipment with them that night to support Guys Give’s first project for the Boys and Girls Clubs of Central New Mexico. Technical Security Systems Dept. 4226 Manager Greg Hughes brought kids’ golf clubs and says he’s been a big advocate of United Way and Sandia’s Employee Caring Program (ECP) for 31 years.

Guys Give’s first project for the Boys and Girls Clubs of Central New Mexico. Technical Security Systems Dept. 4226 Manager Greg Hughes brought kids’ golf clubs and says he’s been a big advocate of United Way and Sandia’s Employee Caring Program (ECP) for 31 years.

“The data has said for many, many years that women give because they’re involved. Men give, and this is a generalization, men give because … another man in their business community, Strickland says. To do that, they will work with United Way on issues that can be affected, and figure out ways to put impactful projects...

“Instead of saying ‘We want you to help out, we want you to give these tickets to the kids,’ they’ll say ‘We want you to help out by giving us these tickets, and then we’ll give away $10,000 to the kids that are the most needy…’

“Guys Give is about creating a way for men to be more intentional about giving to their community. The guys can actually, Strickland says, “do that. They have access to United Way on issues that can be affected, and figure out ways to put impactful projects into practice.”

“I just had a long discussion with a guy and he said in his family, women were the gen-

“The Payoff for Guys Give is seeing kids skipping with joy as a collection of sporting goods is delivered to a Boys and Girls Club facility.

(Photsy by Randy Montoya)

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“I just had a long discussion with a guy and he said in his family, women were the gen-

“The Payoff for Guys Give is seeing kids skipping with joy as a collection of sporting goods is delivered to a Boys and Girls Club facility.

(Photsy by Randy Montoya)

Service and Suds

By Manette Newbold Fisher

I wasn’t technically happy hour, but it was that time of day, and as the sun streamed its late afternoon glow on Marble Brewery’s rooftop, a couple of dozen guys gathered for a pint and lively talk about philanthropy. And even if the beers weren’t the first on a two-hour special, it seemed like happy hour anyway.

The crowd has been meeting for several months at various breweries around town to network and discuss how to create positive change in Albuquerque. The group, officially called Guys Give, is one of United Way’s affinity groups that connect locals with opportunities to give their time and financial resources to the community.

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One of the biggest untapped clean energy sources on the planet — wave energy — could one day power millions of homes across the US. But more than a century after the first tests of the power of ocean waves, it is still one of the hardest energy sources to capture.

Now, engineers at Sandia are conducting the largest model-scale wave energy testing of its kind to improve the performance of wave-energy converters (WECs). The project is taking place at the US Navy’s Maneuvering and Sea Keeping facility at the Carderock Division in Bethesda, Maryland, one of the largest wave tanks in the world at 360 feet long and 240 feet wide and able to hold 12 million gallons of water.

Sandia project leads Ryan Coe and Giorgio Bacelli (both 6122) spend long days in the dark wave tank, where minimal lighting reduces the growth of algae in the water. They are collecting data from their numerical modeling and experimental research to benefit wave energy technology with improved methodologies, strategic control systems design, and testing practices for wave energy converters.

Tackling challenges of harsh environments

“Our goal is to improve the economic viability of these devices,” says Ryan. “To do so, we are working out ways to control the WEC’s generator to increase the amount of power it absorbs. At the same time, we are looking at how to reduce the loads and stresses on these devices in harsh conditions to ultimately lengthen a WEC’s lifespan in the water.”

Ryan says numerous initial studies estimate that improving control of the WECs’ generators can dramatically increase energy absorption by as much as 300 percent. Transitioning these simplified studies to more realistic large-scale devices is the challenge at hand.

To control the dynamics for better, faster results in the wave tank, Ryan and Giorgio are using modeling and control methods that have been successful in other industries, such as in the aerospace industry.

More information in a fraction of the time

“The systems we used have been around for a while, but strangely enough they had never been applied to wave energy converters,” Giorgio says. “So far, we know the techniques we are using are more efficient and cost-effective than existing methods. We are getting more information in a fraction of the time.”

Now that Sandia has completed the first round of analyses in the water, Ryan says the goal is to process all the collected data to develop a new, enhanced model that will make sure the next test yields even more valuable results.

“Make no mistake, these are extremely complex machines,” Giorgio says. “They have to be fine-tuned continuously because ocean waves are constantly changing. With this setup at the Navy’s facility, we have a unique opportunity to study the problems and quantify the effects. We want to help the industry by offering solutions to the challenges the wave energy world is facing.”

Sandia’s continuing wave energy project, Advanced WEC Dynamics and Controls, kicked off in 2013 and is funded by DOE’s Office of Energy Efficiency and Renewable Energy. Innovations from Sandia’s Water Power Technologies Program advance the nation’s energy security by making renewable energy more economically feasible, says Ryan. Contributions include WEC-Sim, an open source code for modelling the performance of wave energy converters, extreme-conditions modeling, and tidal and turbine modeling. Sandia researchers serve as advisers and judges for DOE’s Wave Energy Prize competition.
Sandia tests nuclear battery safety for Mars 2020 mission

By Mollie Rappe

Mars is really cold; at night it can get down to -130° F. The rover for the Mars 2020 mission, like Curiosity and other Mars rovers before it, needs a way to stay warm and continue exploring the Red Planet, even without sunlight. Radioisotope thermoelectric generators, or RTGs, convert the heat produced by natural decay of radioactive materials such as plutonium-238 into electricity. The heat keeps the rover warm enough that its electronics and moving parts don’t freeze, and the electricity produced runs vital scientific instruments. RTGs have been used on space probes such as Pioneer 10 and 11, Voyager 1 and 2, Cassini, and New Horizons; the Apollo lunar experimental modules; and the Curiosity rover.

In the unlikely event of an accident during the launch of the Mars 2020 rover, the fuel from the RTG has the potential to break through multiple layers of containment and be released. That’s where Dan Clayton (6223), a chemical engineer at Sandia, and his team come in.

Working for DOE, they are assessing the potential risk of possible accidents for the Mars 2020 mission. Using state-of-the-art computer programs, they test what would happen to the RTG if the rocket were to explode on the ground or in mid-air.

Rugged protection put to the test

RTGs are designed to minimize any possible release of radioactivity. Modern RTGs use plutonium-238 in an insulubile, ceramic form. Each pellet of plutonium is encased in a lead, ceramic form. Each pellet of plutonium is encased in a

Labeled pull-apart view showing the major components of the Multi-Mission Radioisotope Thermoelectric Generator. (Image credit: NASA)

system to the test by running mechanistic-based computer models on advanced supercomputers, validated with experimental data.

"We try to validate every aspect of our models with the data we have. But it’s hard to convince anyone to blow up a rocket," says Dan. Even without blowing up an actual rocket costing upwards of $100 million, the team has access to large amounts of data from small-scale tests. Data from solid-propellant fire tests conducted at Sandia’s Thermal Test Complex and the Johns Hopkins University Applied Physics Laboratory (APL) are used to validate the computer models of extreme heat from burning rocket fuel.

The results from impact tests at Los Alamos National Laboratory (LANL) and early tests at Sandia’s Rocket Sled Track are compared to the damage the models predicted from the rocket plummeting to the ground.

The durability and ductility of the iodine metal that encases the plutonium is tested at Oak Ridge National Laboratory (ORNL) and Sandia’s Engineering Science Center.

Even data from accidents are put to good use

But not all of the data Dan’s team uses come from experiments. "We don’t plan on getting accident data, but when an accident happens, we use that to validate our damage models too," says Dan. For example, in 2014, an International Space Station-bound rocket exploded just seconds after liftoff at NASA’s Wallops Flight Facility. In the days after — while others were involved in mitigating the environmental impact and determining the cause of the accident — Dan and his team headed to launch site at Chincoteague Island, Virginia. They analyzed the damage and compared it to what they calculated for a similar event.

Specifically, they validated their fireball models and their smoke plume models. None of the data from the accident invalidated previous safety analyses, says Dan, and it reduced the overall uncertainty of their models.

"The durability and ductility of the iodine metal has been well-tested in experiments, and the heat generated by the rocket..." says Dan. "The results are a good indicator of how the rocket would perform in an accident."
Recent Retirees

David Bullington 40 2665
Jeff Romske 40 2666

Barry Hess 54 9520
Jerome Rejent 34 1811

Tania Carson 25 5151
Evan Ashcraft 10 10520

Lorraine Mendoza 30 10615
Carol Harrison 10 2223

Berta Montano 25 5554
Mary Alt 20 5812

Tania Carson 25 5151
Eric Schindewolf 80 5420

Larry Young 26 5422
Veronica Garcia 15 4853

Tom Schuberg 15 5522
Jose Sperd 15 1462

Mike Shuckland 15 5624
Michael Hapka 15 9534

Mary Abt 20 5012
Mary Abt 20 5012

Donna Young 10 2953
Michael Hapka 15 9534

2017 Open Enrollment coming soon
Open Enrollment is your annual opportunity to review and update your benefit elections.

- Active Employees: Oct. 31-Nov. 17
- PreMedicare Retirees: Oct. 15-Nov. 18
- Medicare Retirees: Oct. 15-Dec. 7

Find out more at hbe.sandia.gov.
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I chose a different path

By Becky Krauss, Director,
Communications Center 3600

I have an Invisible Chronic Illness. To an unknown observer, I appear healthy and, dare I use the word, “normal.” But on the inside, at any given time, I might be feeling numbness or tingling in my hands or feet, intense fatigue, diziness, or, my most common symptom, an intolerance of heat. To a hot, stuffy room, I can feel like my whole nervous system is shutting down.

In 1998, I was diagnosed with relapsing remitting multiple sclerosis. It was devastating and scary, especially when my first doctor recommended I quit my job. I chose a different path.

I was a Sandia lawyer, a wife, a mom. Why would I bench myself? Instead, I had to accept my new self and learn how to live with my new reality.

First, medication. While that involves injecting myself three nights a week (it’s better than it used to be — when it was by mouth), my medicine has significantly reduced symptoms. I now only experience symptoms every night!, my medicine has significantly reduced my symptoms.

Second, understand my new limitations. When I was first diagnosed, I took a class offered by the National Multiple Sclerosis Society to learn about MS, get tips, and develop coping strategies. One teacher gave an analogy that has stuck with me. Imagine you're suffering with chronic fatigue; he said having MS is like having one bus of matches per day. Each matchstick is a unit of energy. When you use up your matches, you can't replenish until the next day. People without MS can grab extra matchboxes each day — with a little rejuvenation, they can reenergize. But because people with MS can't do that, they really have to plan how they will use their matches during the day, how soon their matches will be empty, and what they will do when the matches are gone.

I have taken that advice to heart and try my best to prepare for every day. What will my schedule be? (will it be an exhausting day?); what will I wear? (can I wear my favorite pair of high heels or will that sap my energy?); what will I eat? (will I have an intolerance of heat?); what will I wear? (can I wear my family or friends to be on pins and needles waiting to see if one of my symptoms is going to flare up. Of course it is hard enough. Having the support of people who understand that even though you look fine you might not feel fine is a great source of strength.

I think I can speak for most people with MS that we don’t want people watching us, waiting to see some sign of how we are feeling so they can help. I may feel pins and needles in my hands or feet or something is going to flare up. Of course it is OK to ask me how I am feeling. That is a sign of caring, not overbearing. But on the whole, I know that it is up to me to take help.

Third, surround myself with support. I made the decision early on that while I would not publicize my illness, I would not keep it a secret. Did I worry whether telling people I have MS would hurt my career? Yes, but I decided it was a chance I had to take. Coping with invisible symptoms is hard enough. Having the support of people who understand that even though you look fine you might not feel fine is a great source of strength.

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I know that might sound contradictory, I know it might be difficult to understand how someone like me wants to be treated. My advice — ask. If someone you care about is willing to tell you she has an MS, then chances are good you can have a deeper conversation about how she wants to be supported.

I have never had cause to regret telling people. My family gives me comfort and support. My friends keep me optimist. My managers have accommodated me and never underestimated my abilities. My co-workers give me confidence that if I ever need help in a meeting, on a trip, even in the parking lot, I will get it.

Deciding whether to tell others about an Invisible Chronic Illness is a very personal decision. For me, having people know has an source of strength and comfort. I’m glad I am not alone, even when others are shivering in the cold next to me. Hot coffee is on me!

The road taken: Kirk Graham forges a new life after accident

By Stan Mathews

On Sept. 13, 2007, Kirk Graham’s life changed forever while riding his motorcycle on the curvy Highway 60 near Mountainair, New Mexico. His only memory is that the road turned and he didn’t.

As a result of the accident, Kirk spent several months in the hospital recuperating and getting used to a new normal: life in a wheelchair, paralyzed from the waist down. He worked each day to accomplish Sandia’s shared mission. Recognize the difficult challenges they face each day to accomplish Sandia’s shared mission. Recognize the difficult challenges they face.

Kirk’s newfound spirituality and this class changed his life, and he made a difficult decision: He could either start living and take control of his disability, or let it take control of him. Kirk chose to take control of his disability right from the start. He has praised Sandia for the extent to which it has made accommodations in the workplace to enable him to succeed.

Join the Sandia Disability Awareness Committee

For Disability Awareness Month, take a moment to expand your knowledge about the important events in disability employment history and to embrace the benefits diversity brings to your workplace.

Join the Sandia Disability Awareness Committee (DAC), or visit its SharePoint site at http://tiny.sandia.gov/qexn9 on Sandia’s internal Web. DAC is open to all on- and off-employees who share a common goal to increase disability awareness, educate, and provide helpful resources. There are employees with invisible and visible disabilities who work each day to accomplish Sandia’s shared mission. Recognize the difficult challenges they face each day to accomplish.

For a timeline on disability employment history visit: https://www.dol.gov/featured/adap/.

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