By Neal Singer

Sandia researchers have created “zombie” mammalian cells that may function better after they die. The simple technique uses a silica solution to coat a cell’s insides to form a near-perfect replica of its internal structure. The process opens the door to simplifying a wide variety of commercial fabrication processes from the nano- to macroscale. The work, reported in a fall issue of the Proceedings of the National Academy of Sciences (PNAS), uses the nanoscopic organelles and other tiny components of mammalian cells as fragile templates on which to deposit silica. The researchers then heat the cell to burn off its protein. The resultant hardened silica structures are faithful to the exterior and interior features of the formerly living cell, can survive greater pressures and temperatures than flesh ever could, and will function better for some uses than when they were alive, says lead researcher Bryan Kaehr (1815).

Letting nature do the work

“It’s very challenging for researchers to build structures at the nanometer scale,” says Bryan, who came to Sandia as a Truman Fellow. “We can make particles and wires, but 3-D arbitrary structures haven’t been achieved yet. With this technique, we don’t need to build those structures — nature does it for us. We only need to find cells that possess the machinery we want and copy it using our technique. And, using chemistry or surface patterning, we can program a group of cells to form whatever shape seems desirable.”

Says University of New Mexico professor and Sandia Fellow Jeff Brinker (1802), “The process faithfully replicates features from the nanoscale to macroscale in a robust, three-dimensionally stable form that resists shrinkage even upon heating to over 500°C. The refractoriness of these delicate structures is amazing.”

Because a cell is populated by a vast range of proteins, lipids, and scaffolding, says Bryan, its interior is ready-made to serve as models for catalysts, funnels, absorbers, and other useful nanomachinery. For example, he says, “Catalysts that evolve in cells are large molecules (enzymes) that have to be in the right shape for their chemistry to work. Because structure is important to their function, if we can stabilize a catalyst in the shape it evolved, that’s extremely valuable. Imagine stabilizing a genetically

(Continued on page 4)

By Nancy Salem

The human body has a pretty standard response to a slippery surface. It falls. But muscles have memory and can be trained to keep a person upright when the going gets slick.

“It’s called kinetic learning, or learning by doing,” says Andy Zeitler (4122), an occupational safety engineer. “The body learns very quickly and it will impact you a lifetime.”

Andy is among a group of Sandians who worked nine months to bring an apparatus to the Labs to help train people to walk in slippery conditions without falling down. The Slip Simulator is a 10½-foot-high steel frame suspended over a polished, 20-foot-long tile runway. The trainee wears a harness attached to the top of the frame and walks down the four-foot-wide path in a special shoe with furniture-moving sliders attached to the bottom.

“You’re going to slip no matter who you are,” says Andy Zeitler.

(Continued on page 4)
That’s that

Welcome back. Last year didn’t end on a bad note, did it? The world didn’t end on Dec. 21, we didn’t go over that dreaded fiscal cliff, and the Redskins beat the Cowboys. So that’s always a good thing, right? So we have all been given dispensation to carry on for another year, to keep calm and carry on.

Have you seen those posters, by the way: the ones that say “Keep Calm and Carry On”? I’ve been seeing them up and down the hallways for days, or at least I think I have. I’ve suddenly become very aware of them. They’re striking in their simplicity: a stylized crown at the top, with bold lettering and a bright red background. They’re everywhere. As sauces as they look, the posters aren’t exactly new. They originated in late 1939 when the British government’s Ministry of Information printed some 2.5 million copies as part of a rally cry against the enemy. Only a relative few were actually distributed at that time. Other posters – notably, one that read “Your Courage, Your Cheerfulness, Your Resolution Will Bring Us Victory” – were far more popular. A bookstore in the UK “rediscovered” the Keep Calm poster in 2000, and since the crown copyright on it had expired, the design was in the public domain. The bookstore’s website started printing copies on demand and then in bulk as interest grew. By the end of the decade, the poster had attained that ultimate of 21st-century accolades – the parody. “Now Panic and Freak Out,” “Keep Calm and Fear Grant,” “Keep Calm and Rock On.” (depicted with a silhouette of crossed electric guitars in place of the stylized crown), and even a parody of a parody, “Keep Calm and Rock On,” with a silhouette of a child’s rocking horse instead of guitars.

Some cultural observers think the new popularity of this 70-something-year-old propaganda poster is based on simple nostalgia for a lost “Britishness.” Some think the message resonates with the current state of the economy: Times are tough, but hang in there and things will get better. There’s probably something to both of those perspectives but I think, too, the poster succeeds mainly because people recognize the fundamental wisdom of the message. Panic never does no good. As the based-on-real-life surfing guru Frosty Hesson says to his young protégé in the movie Mavericks, fear is healthy, it keeps you alert and ready for action, but panic will kill you.

I did New Year’s resolutions. “Keep Calm and Carry On” would be about as good a goal as anything else I might choose. I like the pluck, the stiff-upper-lip Britishness. I’ve learned something at all over the years, that problems and challenges are almost always better addressed calmly, deliberately, forthrightly.

... Had a nice interlude right before Christmas when I read that researchers have found that brown fat in the body actually accelerates the burning of white fat. The kind sort of us would like to get rid of a greater or lesser extent. With an apparent thumbs-up from the scientific community, I set about ingesting all the brown fat I could get my hands on: fudge, brownies, cakes, those marvelous concoctions called truffles, turtles, kisses ... I know, I know – I sound like Bubba, the chunky Texas-based-on-real-life surfing guru Frosty Hesson says to his young protégé in the movie Mavericks, fear is healthy, it keeps you alert and ready for action, but panic will kill you. But that’s that。“

John Duran (4847) recalls that “James was a man of few words, but when he spoke, the words were always meaningful. I went to his funeral service and it was very evident to me that he lived a lot of lives and helped out so many with just his words.”

James was a “good friend; I would call him a ‘bro,’” says Stephanie Holinka, Media Relations and Communications Specialist. “He seemed to be a very kind man with a kind heart. James loved his Harley. But those who worked with James knew better. He was a very thoughtful, giving person and a good listener. He was more for the little things in life. I will truly miss the many good times we shared.”

Employee death

A man of few words but a kind and gentle heart, James Martinez will be missed

See you next time.

Bill Murphy (505-845-8845, mfm168, wtmurphy@sandia.gov)
Steve Rottler to head California laboratory as VP of Div. 8000, head of Energy, Climate, and Infrastructure Security SMU

Julia Phillips, Duane Dimos will assume acting roles as Chief Technology Officer and Div. 1000 VP, respectively

Chief Technology Officer Steve Rottler will become VP of Sandia’s California laboratory, Div. 8000, effective Feb. 1.

In his new position, Steve will lead the Energy, Climate, and Infrastructure Security Strategic Management Unit.

In announcing Steve’s new role, Labs Director Paul Hommert said, “This management change will maintain continuity and operational stability during the pending contract competition and help ensure a leadership team that supports the workforce as we continue to deliver on our commitments.”

Steve has held a number of increasingly important leadership roles since he joined Sandia as a member of the technical staff in 1985, including VP of Weapons Engineering and Product Realization and chief engineer for nuclear weapons. He also led nuclear warhead system engineering, the integration and development of high-performance electronic systems, and organizations and programs responsible for the research, development, and application of advanced computational and experimental techniques in the engineering sciences.

Steve received his bachelor’s, master’s, and doctorate, all in nuclear engineering, from Texas A&M University.

“Everyone at Sandia owes a tremendous debt of gratitude and appreciation to Rick Stulen for his significant contributions to the Laboratories and the nation,” Paul said. “I wish him the very best in his retirement.”

Steve’s current responsibilities as VP for Div. 1000 and CTO will be split between Julia Phillips, currently director of Research Strategy and Partnerships Center 1900, and Duane Dimos, currently director of Engineering Sciences Center 1500. Julia will be the acting VP and Chief Technology Officer, and Dimos will serve as acting VP of Div. 1000, both effective Feb. 1.

Julia will lead Sandia’s Research Foundations and take responsibility for the Laboratory Directed Research and Development Program and research strategy development and implementation. She will also lead Sandia’s technology transfer efforts and the Labs’ research relationships with universities, industry, and the state of New Mexico.

Steve’s management experience is deep, having led Sandia’s National Nuclear Security Administration programs, the Laboratory Directed Research and Development Program, and Sandia’s cyber security initiatives. He has also served as the DoD representative for the National Nuclear Security Administration and the Department of Energy’s Information Technology Laboratory.

Julia has been a leader at Sandia for more than 25 years, serving in roles of increasing responsibility in the areas of technology development, R&D proposals, and collaboration with industry. She has a strong track record of delivering results and is well respected by her colleagues for her leadership skills and technical expertise.

“Julia Phillips is a leader of rare talent and experience,” said Steve. “She is an excellent choice to lead Sandia’s Energy, Climate, and Infrastructure Security initiatives.”

2012 ECP giving shatters all records

The 2012 ECP campaign set goals to raise $5 million, increase participation in every division from the 2011 baseline, and engage newer employees in the Labs culture of giving. Sandia’s overall participation rose to 73.6 percent from 71.8 percent the previous year, and more than 90 percent of divisions raised their participation. New employees showed a participation increase of 5.6 percent.

Of Sandia’s total giving, $3,489,990 was designated to the Community Fund, up $63,753 from the previous year. The fund supports a range of programs that address families, education, health, hunger, family violence, senior citizens, the homeless, and the disabled in Alamogordo, Sandia, Torrance, and Valencia counties.

Deputy Laboratory Director and Executive VP for Mission Support Kim Sawyer, chair of UWCNM’s 2012-13 $28.15 million campaign, says the response from Sandians and retirees this year was “absolutely fantastic.”

“It continues to demonstrate our strong culture of giving,” she says. “Other companies admire the generosity of Sandians and our retirees and are envious of what we have accomplished for the good of the community year after year.”

Due to the UWCNM’s Corporate Cornerstone program, 100 percent of money donated by individuals goes directly to help people in need. Companies can choose to donate to Corporate Cornerstone, which pays all the organization’s administrative expenses. Lockheed Martin/Sandia donates $100,000 annually as one of more than 70 Corporate Cornerstone companies.

Ed Rivera, UWCNM’s president and CEO, says Sandia’s generosity is “huge,” and an inspiration to the entire community. Rivera says Sandia’s per capita giving ranks in the top among companies of its size nationwide. “We thank you for that from the bottom of our hearts and from all those who benefit from what you do,” he says. “You will change lives.”

“Everyone at Sandia Labs should be extremely proud of what we accomplished together. This donation will make our community a better place and help our most vulnerable neighbors.”

— 2012 ECP Campaign Chair Anthony Thornton

(Continued from page 1)

“The results from the campaign are truly astounding,” says Anthony Thornton, the 2012 Employee Caring Program campaign chair and deputy to the VP of Defense Systems and Assessments Dept. 5220. “Everyone at Sandia Labs should be extremely proud of what we accomplished together. This donation will make our community a better place and help our most vulnerable neighbors.”

“Everyone at Sandia owes a tremendous debt of gratitude and appreciation to Rick Stulen for his significant contributions to the Laboratories and the nation,” Paul said. “I wish him the very best in his retirement.”

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Julia will lead Sandia’s Research Foundations and take responsibility for the Laboratory Directed Research and Development Program and research strategy development and implementation. She will also lead Sandia’s technology transfer efforts and the Labs’ research relationships with universities, industry, and the state of New Mexico. Julia is a Fellow of the Materials Research Society, American Association for the Advancement of Science, and the American Physical Society. She received her doctorate in applied physics from Yale University.

As acting VP for Div. 1000, Duane will be responsible for delivering a full spectrum of differentiating research and development capabilities to support Sandia’s mission needs — from fundamental scientific discoveries to system-level engineering solutions. He is chair of the Materials Research Society’s Government Affairs Committee, is a fellow of the American Ceramic Society (ACerS), and is a past chair of the Basic Science Division of the ACerS. Duane received his doctorate in materials science and engineering from Cornell University.
Slip simulator  
(Continued from page 1)

Andy says, “Every single person who steps out there slips a little. The body tells you this thin is slick and says, ‘I have to change direction,'” he says. 

As the walker toils down the path the harness prevents a fall. “It trains you to position your body so you don’t fall,” Andy says. “The walker instinctively learns to straighten up, shift the center of gravity underneath the body, and take smaller steps.” 

The next time the person is on a slippery surface the kinetic learning should kick in automatically. “It’s like riding a bike,” Andy says. “There’s muscle memory so you catch yourself. It’s in your body and always with you. You don’t have to think about it.” 

Slip simulator  
(Continued from page 1)

The Slip Simulator got a lot of visibility after United Parcel Service started using one. The average UPS driver makes more than 100 deliveries a day in sometimes wet and/or snowy weather or on slippery floors. Training on the simulator resulted in a significant drop in on-the-job falls.

Sid Gutierrez, director of Radiation Protection, Waste Management, and ES&H Center 4100, heard that Los Alamos National Laboratory had a Slip Simulator. He sent a team to LANL to check it out. “Everybody fell in love with it,” Andy says. “The Slip Simulator has the potential to greatly improve the safety culture at Sandia while teaching folks to walk safely on slippery surfaces.” 

LANL sent design drawings and specs, ES&H ordered materials and a team from Facilities built the simulator in the unused Disassembly and Sanitation Operation (DSO) facility in Tech Area 2. 

It was unveiled in mid-December and one of the first volunteers was Deputy Laboratories Director and Executive VP for Mission Support Kim Sawyer. “I thought it was a breeze to cross through,” Kim says. “I quickly discovered that the surface was almost like glass. The first time across was a piece of cake. I was then challenged to perform every everyday thing — holding a phone, a package, wearing a backpack. Clearly, this made it more difficult.” 

Kim’s muscle memory kicked in and she took small steps and focused on the path. “It was challenging but fun at the same time,” she says.

Starting in February, Sandians will be able to sign up for a simulator session on a special website. Andy says humans can, in principle, do this many times. Each individual session runs about 10 minutes. He says people should aim to use it once a year to continue to improve their slip-prevention skills.

“It’s just phenomenal that Sandia has something as awesome as this,” Andy says.

“I strongly recommend that all Sandians try the Slip Simulator,” she says. “It would provide a great experience for groups who want to emphasize safety and team building, and want to laugh a little.”

Zombie cells  
(Continued from page 1)

designed biocatalyst at its most optimal shape and then using it in a 200 degree Celsius reaction in which it otherwise would have no chance of surviving.” The hardened silica would stabilize and protect the still-present protein as it did its work.

In its simplest, most immediate use, says UNM post-doctoral student Jason Townson, silicification may be the simplest, best method of preserving the structure of organic materials for imaging. “Formerly, for internal preservation and subsequent imaging, a cell would be fixed in formaldehyde or some other preservative. But many of these methods are labor-intensive. This method is simple. The preserved cells will never get sloppy in decay. And when we cracked open the resulting structure, we were blown away by how well the cell was preserved, down to the minute grove of the cell’s DNA.”

Like a Madame Tussauds wax portrait

Heating the cell to still higher temperatures, greater than 400 C, evaporates the organic material of the cell—its protein—and leaves the silica in a kind of three-dimensional Madame Tussauds wax portrait of a formerly living being. The difference is that instead of modeling the face, say, of a famous criminal, the hard-en ed silica-based cells display internal mineralized structures with intricate features ranging from nano- to millimeter-length scales.

Construction occurs like this: Take some free-float ing mammalian cells, put them in a Petri dish, and add silicic acid. Through the action of methanol, a byproduct of the acid, the cell’s lipid layers — the protective casings that keep the cell intact — are softened and made porous enough for the silica to flow in at the temperature of the human body.

The silicic acid, for reasons still partially obscure, enters the cell’s electrical resistance by approximately 20 percent. Dissolution of the underlying silica support decreased the cell’s electrical resistance by approximately 20 percent. That such extraordinary results can be achieved by silicifying cells indicates, according to the technical paper, that many soft cellular architectures could be “feedback for most materials processing procedures, including those requiring high temperatures and pressures.”

Other porous material structures, relying on titanium instead of silica, have been formed using the organic template technique. Other metal oxides, says Bryan, are a possibility. These would have advanced structural functions or could serve as catalysts.

The work follows the efforts of a number of scientific groups, including Bryan’s, that have built gel-like structures, copied them with silica, and then burnt off the gel to create, in effect, large sponges.

“Now we can change the biological shape and cal ci fy (heat it), so for the first time we get new irregular structures,” Bryan says.

In the PNAS paper, Bryan’s team used disassociated cell culture from various human, chicken, and mouse organs as starter material. Grown in flasks, these are soft, delicate objects that normally would eventually exist in a multicellular structure like a person (or a chicken’s egg).

“Since then we have found that the procedure can slicify an entire organism — in this case, a chicken embryo — which is somehow creepy,” says Bryan. “But it proves that larger-order animal forms (that is, humans) can, in principle, be glassified just like single cells using this technique.”

The work was supported by DOE’s Office of Science. Other authors of the technical paper are Jeff Brinker (1002 and UNM), Brian Swartzentruber (1131 and the Center for Integrated Nanotechnologies), Robin Kalinich (2501), and Darren Dunphy and student Yasmine Awad of the University of New Mexico.

NOT SO FAST — Kim Sawyer, Deputy Laboratories Director and Executive VP for Mission Support, navigates a super-slick surface and an obstacle as she tries out Sandia’s new Slip Simulator. “It was challenging but fun at the same time,” says Kim, who wore a safety harness to prevent a fall. Individuals and groups are encouraged to use the simulator to train their bodies not to fall on slippery surfaces.

(Photos by Tom Wubbels)
Identifying malicious intent

Cybersecurity's Roger Suppona (9317) says the ability to identify the possible intent to send malicious content might enable security experts to raise a potential threat's awareness. "More importantly, we might be able to provide sufficient specifics that would be far more helpful in elevating awareness than would a generic admonition to be suspicious of incoming email or other messages," he says.

Jeremy, in the final stretch of a two-year Early Career Laboratory Directed Research and Development grant, presented his work last year at a Sandia poster session. He has been looking into behaviors of web crawlers from people using browsers, and he has been able to split those groups. He believes the work to date will help security because it allows analysts to look at groups separately.

Distinguishing malicious intent

Cybersecurity’s Roger Suppona (9317) says the ability to identify the possible intent to send malicious content might enable security experts to raise a potential threat’s awareness. “More importantly, we might be able to provide sufficient specifics that would be far more helpful in elevating awareness than would a generic admonition to be suspicious of incoming email or other messages,” he says.

Jeremy wants to distinguish bots from browsers without having to trust who they are who they say they are. He expects some are lying, so he looked for ways to measure behavior. The first measurement deals with the fact bots try to index a website. When you type in search words, the web crawler looks for pages associated with those words, disregarding how they’re arranged on a page. That means a bot pulls down HTML files far more often than other things. Jeremy pays attention to HTML downloads. Bots should have a high percentage. Browsers pull down smaller percentages.

More than 90 percent of the nulls pulled down nothing but HTML — typical bot behavior.

A single measurement wasn’t enough, so Jeremy devised a second based on another marker of bot behavior: politeness.

Bots could suck down webpages from a server so fast it would shut down the server to anyone else. Jeremy says that might prompt bots to take turns. “They say, ‘Hey, give me a page,’ then they may crawl a thousand different sites taking one page from each,” Jeremy says. “Or they might just sit there spinning their wheels for a second, waiting, and then they’ll say, ‘Hey, give me another page.’”

Bots go after only one page but want all images, code, and layout files for it instantly. “I call that a burst,” Jeremy says. “A browser is bursty, a crawler is not bursty.”

Bursts equal a certain number of visits within a certain number of seconds.

What ‘bursty’ behavior indicates

Ninety percent of declared bots had no bursts and none had a high burst ratio. Sixty percent of nulls also had no bursts, lending credence to Jeremy’s belief they’re bots.

But 40 percent showed some bursty behavior, making them hard to separate from browsers. However, normal browsers behave unpredictably because it allows combined, both metrics, nulis fall outside those parameters.

That left browsers who behaved like bots. “Now, are all these people lying to me? No. There could be a reason people who wouldn’t fall into this category and still be a browser,” Jeremy says. “But it distinctly increases suspicions.”

Jeremy also looked at IP addresses. Unlike physical addresses, IP addresses can change. Say you plug your laptop into the Internet at a coffee shop, which assigns you an IP address. After you leave, someone else shows up and gets the same IP address. So an IP address alone doesn’t necessarily distinguish users.

There’s another identifier: a particular browser on a particular operating system, which leads to what’s called a user agent string. There are thousands of distinct strings.

IP addresses and user agent strings can collide, but Jeremy says odds are dramatically lower that two people will collide on the same IP address and user agent string within a short period such as a day. That tells him they’re probably different people.

Now he needs to bridge the gap between splitting groups and identifying targets of ill-intentioned emails. He has submitted proposals to further his research after the current funding ends this spring.
High-stakes countdown:
Kauai Test Facility launches target missile to help assure national defense

Story by Heather Clark

In the Pacific Ocean, some sailors will be tested. A target missile launched from Sandia’s Kauai Test Facility (KTF) will fly across the sky and, if all goes according to plan, the Navy’s newest interceptor missile, the Standard Missile-3 Block IB, will shoot it down in an operation similar to defending the US from an offensive missile attack.

Past test operations have been described as hitting a bullet with a bullet. Most people think of countdowns as television voiceovers: “10, 9, 8, 7…” but they are much more.

Days and weeks before the launch, Sandia employees arrive at KTF, a 132-acre launch site at the Pacific Missile Range Facility (PMRF) on the western tip of the Hawaiian island of Kauai, to support the test of the US Missile Defense Agency’s Aegis Ballistic Missile Defense Program. At the PMRF gate, drivers are told to go “right at the stop sign and all the way down.” The remote spot is no accident. It has little interference from the radio frequencies found on the East and West coasts; there’s an expanse of ocean to work in and it’s near the Pacific Fleet, says Vince Salazar, senior manager of Sandia Missile & Air Defense (5410).

Test targets arrive at the Missile Assembly Building, which contains a 30-foot-high bay with 10- and 20-ton cranes and office space, where the targets are assembled and tested, manager Steve Lautenschleger (5419) says.

Nearby, two white canvas “clamshells” on wheels protect two large rail launchers, which are used to launch both guided and ballistic missiles, from the weather, Steve says. Nearby are a vertical launch tower, which will be used for this missile, and a universal rail launcher.

Across from the vertical launcher is the bunker-like Launch Operations Building (or LOB, pronounced el-oh-bee), the site’s communications hub, topped by 15- and 20-foot white dish antennas that will receive telemetry from the missile.

Reuben Martinez (5419), the test director for this mission, first came to KTF as the “computer guy.” He explains that thousands of data points will be analyzed and turned into graphic displays that help controllers quickly determine whether the test missile is flying along its intended flight path. They use that information in real time to make recommendations about whether to continue the mission. It’s also used after the flight for further analysis or making changes when things don’t go the way they should, he says.

Sandia employees and contractors begin their three practice countdowns with the arrival of Uncle Tom Taka- bee (5410), the site’s communications hub, topped by 15- and 20-foot white dish antennas that will receive telemetry from the missile.

On launch day, a large digital clock with red numbers ticks away the hours at the left-hand side of the room.

T minus 06:00:00

“T minus six hours,” an automated voice says. This is the countdown’s unceremonious start. The KTF team must complete more than 300 steps to launch the 42-foot-tall single-stage guided missile. Each step is listed on a spreadsheet that Reuben has tweaked to perfection in the late night hours during the three practice countdowns.

If the on-screen boxes containing each step turn yellow, Reuben and Margaret state the task hasn’t been completed within one minute of its scheduled time. After 60 seconds, the print turns red and remains so until the task is completed and checked.

T minus 05:33:03

One of the first major steps is to verify the launch pad and missile are ready for a launch. The latter involves turning on and verifying you can receive telemetry from the equipment, and confirming that the systems are working.

After Margaret receives a series of numbers from PMRF, an expert in the field radios to say several numbers are unusually low.

Reuben considers the problem, leaning forward in his chair and then pacing. He asks whether one of the doors on the vertical launch tower hadn’t been opened properly and saturated the radio signal, but the response from the field was that the door was fine.

The wheels turn in his head as he kicks off what could be causing the odd readings: Are the PMRF antennas turned in the correct direction, he asks. Sure enough they were pointed the wrong way. Problem solved.

“You need to have situational awareness,” Reuben says. “When something doesn’t look good, you have to figure it out on the fly.”

T minus 05:00:00

“T minus five hours,” drowns the automated voice.

Reuben’s and Margaret’s jobs are stressful and involve major multitasking. Imagine monitoring 15 communications networks, or loops, chattering all at once, having to problem-solve within seconds or risk delaying a launch, and working and communicating with multiple agencies to make the launches happen.

“It’s a stressful job, but it’s exciting,” says Reuben, who has been test director for five launches and recently also became KTF’s site manager. “Margaret and I are a good team. We’ll get in a groove, and I know what she’s going to do and she knows what I’m going to do.”

A large digital clock with red numbers ticks away the hours at the left-hand side of the room.

At the LOB, Manager Steve Lautenschleger (5419) explains the layout of KTF from the rooftop of the LOB. (Photo by Michael Bejarano)
As they work, many times a single utterance or a nod indicates who’s going to handle which task and they often cover for each other like clockwork. Employees then verify that the Flight Termination System (FTS) works. This missile contains an FTS, which could be critical in preventing the company from losing the vehicle if it flies off course before it hits something it shouldn’t, Steve says.

A large white weather balloon is tethered to the 80-foot tall launch tower to provide a PMFR team a visual on the vehicle pad location. This gives the PMFR team a line of sight to verify how the rocket leaves the launch pad in the brief period before it’s high enough to be detected by radar, Margaret says.

The balloon is the same as the ones carrying balloons Sandia contractors at KTF launch to 100,000 feet to test the impact of various altitude weather conditions, such as the jet stream, say mechanic Charlie Vega and groundskeeper Michael Mier (both S419-1).

“In the beginning, we didn’t get involved with the launches. Now we’ve gotten involved with pretty much everything they do,” Charlie says.

Ken Dama (S419-1) agrees that the local contractor who started out as a part of KTF, in day-to-day operations and mission support.

Today, the weather balloons that release plug and piggyback accidently gets wrapped around a lightning tower and ultimately falls. Steve is concerned that the balloon could interfere with the launch tower being pulled away from the missile.

“Steve was the kind of unplanned event,” Reuben says. During a practice countdown, four chickens scurried across the launch pad and pigs once ran across the launch pad during an actual countdown.

Steve decides the balloon must be cut down, and covers with Wayne Irokanu (S419), who is responsible for the weather balloon launches and data acquisition.

“I like these types of crises better than when a target misses its window,” Reuben says. “This is not so bad.”

Safety risk analysis

Terry Jordan-Culler (S422), an aerospace engineer, calls from Sandia/New Mexico to give a real-time flight safety risk analysis during weather balloon data collection.

Should the report be negative, the launch could be scrapped, Reuben says.

While the report comes from Sandia, it’s just one example, Vince says Sandia’s involvement in KTF pre- and post-launch and during the mission operations is key to KTF’s success, particularly when Sandia-developed rockets and payloads are launched.

“Sandia is what makes KTF unique. It is Sandia doing the technical work, developing the target missile systems and also having major responsibility for the payloads that we’re putting up,” Vince says. “You get to see the countdown and liftoff of these experiments. It is sealing the deal.”

Suddenly, 13 steps on Reuben’s and Margaret’s screens turn red. Employees are on the launch pad aiming the missiles, but another group needs to start its work.

Calls are coming in from the ROCC asking when the next task will start, as the entire screen goes red. The tension in the room rises slightly, as Steve and Margaret discuss how to keep the launch moving forward, but about an hour later PMFR puts a planned two-hour hold into effect, KTF suddenly takes up, faces and show relief all around.

With the missile now prepared for launch, all non-essential personnel are cleared out of KTF, in case of an accident, to watch the launch from a nearby hill. The engines take the arm plug, a red canister about the size of an egg, and remove the green safe plug to make the connections on the launch pad necessary for the launch, a task simulated during the practice runs.

The plugs are kept safely in a locker behind the central operations desk.

There are about 22,000 pounds of explosives on the target missile, so safety is paramount, Steve says.

T minus 00:15:00

With about 15 minutes to go, Steve and Reuben say the LOB becomes very still as everyone focuses on their jobs.

“No one’s talking about their weekend or cracking jokes,” Reuben says. “We’ve got to go. The 10-minute mark, you think. ‘This is serious. We’re probably going to go. We’re not turning back now.’

T minus 00:05:00

“Three-word-hold is in effect,” comes over the radio.

Steve explains that anyone who sees any reason to hold the launch can say “hold, hold, hold” into the radio and everything is halted. During the dress rehearsal, two holds were called outside KTF as last-minute checks were made, but so far the real launch has had none.

A set of keys used to initiate the launch were handed around a lightning tower and ultimately falls. Steve is concerned that the balloon could interfere with the launch tower being pulled away from the missile.

“‘No one’s talking about their weekend or cracking jokes,’” Reuben says. “‘We’ve got to go. The 10-minute mark, you think. ‘This is serious. We’re probably going to go. We’re not turning back now.’

T minus 00:00:50

“The three-word-hold is in effect,” comes over the radio.

Steve looks happy and relaxed. The launch was “smooth … very smooth” and no holds were called in the final minutes.

“I really like this job. You really feel like you’re doing something important,” Reuben says. “I bet the president knew we did this tonight.”

Margaret adds: “You feel instantly excited that it’s over. Then you can breathe. Then you start thinking about starting work on the next one.”

Lift off!

And with an orange blaze the target missile moves slowly off the launch stool and into the night sky.

In a field about two miles away, a crowd of Sandia employees and contractors, Orbital Sciences staff (Orbital Sciences supplied the missile), and the military waits in the LOB.

From behind a line of trees a whistling-orange glow lights up a half circle of the dark sky. Silently a bright white glowing orange oval rises slowly above the trees. Then the sound hits, first a rumble, followed by a metallic roar that lasts for nearly a minute as the oval becomes smaller and smaller, until it is a tiny orange ember among the stars.

A small cheer and a sense of relief washes over the LOB.

The target missile transmits telemetry to KTF, where Ed Mader (S419) is splitting his time between operating the tracking antennas and monitoring the control room with Steve Sanchez (S419). Wes Crownover (S419), who records all data, but uses Best Source Selector equipment to determine the transmission and routes it to Sandia and Orbital Sciences.

Across the LOB, Larry Young (S422) generates displays on computer that translate telemetry within milliseconds into graphs on 17 monitors that show whether the target missile is flying along its intended path, viewed as a green line within an orange corridor. Larry says the green missile should fly along the green line. Should the missile move outside the orange corridor, the Navy would abort its launch to avoid wasting a missile.

Sitting yards away from Larry is Tom Johnson of the Johns Hopkins University/Applied Physics Laboratory, who studies the graphs to tell PMFR whether it’s a good target.

On this test, Johnson has a 15-second window to make the call, which he says is a “fairly narrow,” compared to as little as 5 seconds sometimes he has on other flights.

Today, the rocket flies straight.

The voice of Eric Hedlund, test director of the US Missile Defense Agency’s Aegis Ballistic Missile Defense (BM) Program, is heard from the ROCC. “Good target, good target.”

“Confirm,” comes the answer, which means the Navy can try to intercept the incoming missile.

“Eagle away!” The Navy is ready to launch its interceptors. All eyes are on the front video screen, watching as two yellow lines grow longer and longer and intercept at a yellow dot.

In the field, the missile-sparks orange as the interceptor flying from the Navy ship in the Pacific Ocean hits it. An excited voice says “Mark Indial” on the radio.

“Whoosh, how about that through the dark,” congratulates!

Back in the LOB, the control desk is quiet because it’s unclear whether the interceptor hit its target, Steve says.

But Wes, the telemetry expert, sees his data go dark, so he unsure whether the interceptor hit its target, Steve says.

Another contractor exits the LOB with a huge smile across his face.

Steve looks happy and relaxed. The launch was "smooth … very smooth" and no holds were called in the final minutes.

“I really like this job. You really feel like you’re doing something important,” Reuben says. “I bet the president knew we did this tonight.”

Margaret adds: “You feel instantly excited that it’s over. Then you can breathe. Then you start thinking about starting work on the next one.”
Two years ago Sandia introduced Sandia Total Health, a consumer-directed health plan that encourages healthcare consumerism while improving overall health through an integrated approach to health and wellness. This includes a focus on prevention and healthy lifestyle factors, the management of chronic conditions, and behavior modification aimed at changing risk factors. Sandia is pleased to introduce another tool in your toolkit to help you be a better healthcare consumer, thus maximizing your Sandia Total Health benefits.

**Healthcare Consumerism website**

The Sandia Healthcare Consumerism website features a bevy of tools and resources to help you become a savvy healthcare consumer. You can get to the site by going to hbe.sandia.gov and clicking on the Your Healthcare Consumer Toolkit logo (pictured here).

- **Know Quality Health care** — Some doctors have higher quality standards than others. Finding quality health care can help you recover quickly from illness and stay healthy.
- **Take Care of Yourself** — Your doctor is a partner in helping you stay healthy. As a partner, you too should be involved in making decisions that affect you. The more you know about your condition, the more confident you can be in discussing treatments with your doctor.
- **Watch Your Dollars** — Spending your dollars on quality care can save you and Sandia money. With your doctor's help, you can identify medical issues early and potentially avoid costly treatment later.
- **Use Resources You Can Trust** — Certain websites can offer accurate health information, backed by medical research. There are a number of things to look for to make sure a site is reliable.
- **Choose Health Services Onsite** — As a Sandia employee, you have access to certified medical professionals, right here at work, through HBE’s Health Services Onsite, all at no cost to you.
- **Compare the Plans** — Any time you make a significant investment, like buying a home or automobile, there are steps you take before you decide. You should also be a smart consumer when deciding which administrator to choose for your Sandia Total Health plan: Blue Cross Blue Shield of New Mexico, UnitedHealthcare, or Kaiser in California.
- **Focus on Health & Benefits** — Updated monthly with news and information about particular elements of Sandia Total Health and how you can maximize the benefits of your plan.
- **Article Library** — Visit this area to peruse previous HBE articles written about your health benefits, Sandia Total Health, and the Sandia Health Partner Network.

To learn more and see the full website, visit hbe.sandia.gov and click on the Your Healthcare Consumer Toolkit logo.

All Sandia Total Health Blue Cross Blue Shield of New Mexico and UnitedHealthcare (UHC) members should have received new Express Scripts ID cards. This new Express Scripts ID must be shown to pharmacies when you are filling your first prescriptions of 2013. If you have not yet received your Express Scripts ID card or if you have any other questions about your prescription drug benefits, contact Express Scripts at 877-817-1440 or visit www.express-scripts.com.

Additionally, all Sandia Total Health UHC members should have received new UHC medical ID cards. UHC has issued new cards because they changed the name of the network from UnitedHealthcare Options PPO to UnitedHealthcare Choice Plus. The providers in the network are not changing; only the name is changing. When you first visit a medical provider in 2013, you must indicate your insurance has changed and show the provider your new ID card. If you have not yet received your UHC ID card, or have any other questions about your medical benefits, contact UHC at 877-835-9855 or visit myuhc.com.
Comet explosions did not terminate ancient Clovis culture

By Nancy Salem

The company worked with Sandia through a cooperative research and development agreement (CRADA) to produce a commercial-scale manufacturing procedure for the technology.

CSTS's were being honored by the Sandia National Laboratories (SNL). The company had developed a method for removing cesium from contaminated water. It had already successfully treated more than 40 million gallons of contaminated water at Fukushima.

Mark Boslough, coauthors find fault with theory

By Neal Singer

Sandia and UOP, a Honeywell Company, are being honored by the Federal Laboratory Consortium (FLC) for their work to transform an innovative technology to the private sector.

The FLC awards program annually recognizes federal laboratories and their innovations that are commercially available or in the marketplace. The FLC is a nationwide network of more than 300 members that provides the infrastructure and support to employees of federal laboratories and non-laboratory Federal Laboratory Consortia (FLC) member laboratories that do intellectual property.

On the one hand, it was a chance to check the new Pangaea's logic against real events, a shake-down national security test. On the other, it was a hold-your-breath prediction, a kind of Babe Ruth moment when the Babe is reputed to have pointed to the spot in the bleachers he intended to hit the next ball. No other scientists were willing to point the same way, partly due to previous failures in predicting the behavior of comets. Kohoutek and Halley, and partly because most astronomers believed the plumes would be hidden behind Jupiter's bulk.

The plumes indeed proved visible started Mark on his rise to international celebrity. He had the skills to turn a media touchstone for things asteroidal and meteoritic.

Indian Jones and Tom Sawyer

It didn’t hurt that when he stood before television cameras to discuss celestial impacts, he had the skill to use metaphor, expressive gestures, and extraterrestrial subject matter made him seem a combination of Carl Sagan and Luke Skywalker, or perhaps Tom Sawyer and Indiana Jones.

Standing in jeans, work shirt, and hiking boots for the Discovery Channel at the site in Siberia where a mysterious explosion occurred 100 years ago, or discussing it at Sandia with his supercomputer simulations sliding in bold colors on a big screen behind him, the rangy, 6-foot-3 Sandian vividly explained why the mysterious explosion at Tunguska that decimated hundreds of square miles of forest and whose ejected debris was sent as far away as London most probably was caused neither by flying saucers drunkenly ramming into the side of a mountain nor by an asteroid striking Earth’s surface, but rather by the fireball of an asteroid about three kilometers in diameter that exploded high above ground, like a nuclear bomb, expanded to implosion as it plummed deeper into Earth’s thickening, increasingly resis- 

The tests found the alleged 12,900-year-old carbon to be of very recent formation. The procedures included busi- 

researcher Jim Krumholand (retired) and manager Mark Riggio.

"We are extremely proud when Sandia’s technology transfer initiatives have a major impact. In this case, it’s international," says Jackie Kerby Moore, Program Manager of Technology and Economic Development Dept. 1931 and Sandia’s representative to the FLC.

The FLC is a nationwide network of more than 300 members that provides the forum to develop strategies and opportunities for linking laboratory mission technologies and expertise with the marketplace.

The FLC Awards Program annually recognizes federal laboratories and their industry partners for outstanding technology transfer efforts. Since its establishment in 1984, the FLC has presented award to 37 federal laboratories, becoming one of the most prestigious honors in technology transfer.
On warm and dry Fridays that he's in the office, Dennis Beyer (8537) rides a vintage 1954 Harley Davidson Panhead Bobber motorcycle to work. Sure, it's a beautiful bike, but this Bobber is also a piece of living history, part of the Beyer family legacy.

Dennis was about 16 years old the first time he laid eyes on this motorcycle. "My brother Dave brought it home one day, much to the chagrin of our parents. I thought it was pretty cool," he recalls. "He then sold it to me when he was shipped off to Vietnam a few years later."

As a mechanical engineering student and self-described tinkerer, Dennis started working on the bike. "It was a passion for a number of years," he says. He put the Panhead through a series of chopper versions with modifications to the frame and gas tank, switching up the seat, fender, sissy bar, and paint job along the way.

The Panhead moved with Dennis from Michigan to California in 1976 when he graduated from the University of Michigan and began working at Sandia. Then he put the bike aside in 1981 as work and family began to fill up more of his time. For the next 20 years, the bike was relegated to the back of the garage. "I kept seeing it there and began to wonder if I could get it running again," Dennis says. "I always enjoyed working on the bike — it exercises my hands and it's both fun and challenging to see if you get and keep a machine that's nearly as old as me running. But it's also a huge time sink."

A family tradition

The bike turned out to be in relatively good mechanical shape, so in 2003 Dennis decided to restore it. "Before, budget had always been a constraint and I bought the parts I could afford," he says. "This time, I was determined not to let cost be a factor and create the bike it could have been when I stopped working on it, a period Bobber."

Sourcing parts was the easy part. Dennis eventually had to completely rebuild the engine to address several mechanical issues. "I'm pretty proud of how it turned out," he says. "This is the only bike I've ever owned."

Vintage motorcycles are a family tradition for Dennis and his two brothers. After Dave sold the Panhead to Dennis, he bought a 1970 XLCH Sportster for himself that was featured in a 1976 issue of Easyriders magazine. Eventually, Dave dismantled that bike and repurposed many of the parts, but kept the frame hanging in the back of his garage. Don, the youngest of the three brothers, later bought that frame from Dave and with a basket case Sportster, painstakingly restored it as a 1963 Street Tracker. Dave is now busy working on a 1952 Harley K Model. The Beyer brothers and their bikes were featured in the December 2012 issue of IronWorks magazine (see magazine cover at right).

By Patti Koning

On warm and dry Fridays that he's in the office, Dennis Beyer (8537) rides a vintage 1954 Harley Davidson Panhead Bobber. The bike has gone through a lot of iterations since it came into the family. This is the Panhead in 1976 (left photo courtesy of Dennis Beyer). Dennis Beyer and his baby, the 1954 Harley Davidson Panhead Bobber, in 1972 and today. The bike has been restored several times. (Right photo by Dino Vournas; left photo courtesy of Dennis Beyer)

More than meets the eye: A family legacy on two wheels

Rep. Swalwell visits California lab

Rep. Eric Swalwell, D-Calif., newly elected to California’s 15th district and a member of the House Homeland Security and Science committees, visited the site on Jan. 11 and toured various labs. Here, he talks with Tom Kroeger (right, 8960) and Bob Hutchinson (left, 8965) about Sandia’s cybersecurity efforts. (Photo by Dino Vournas)