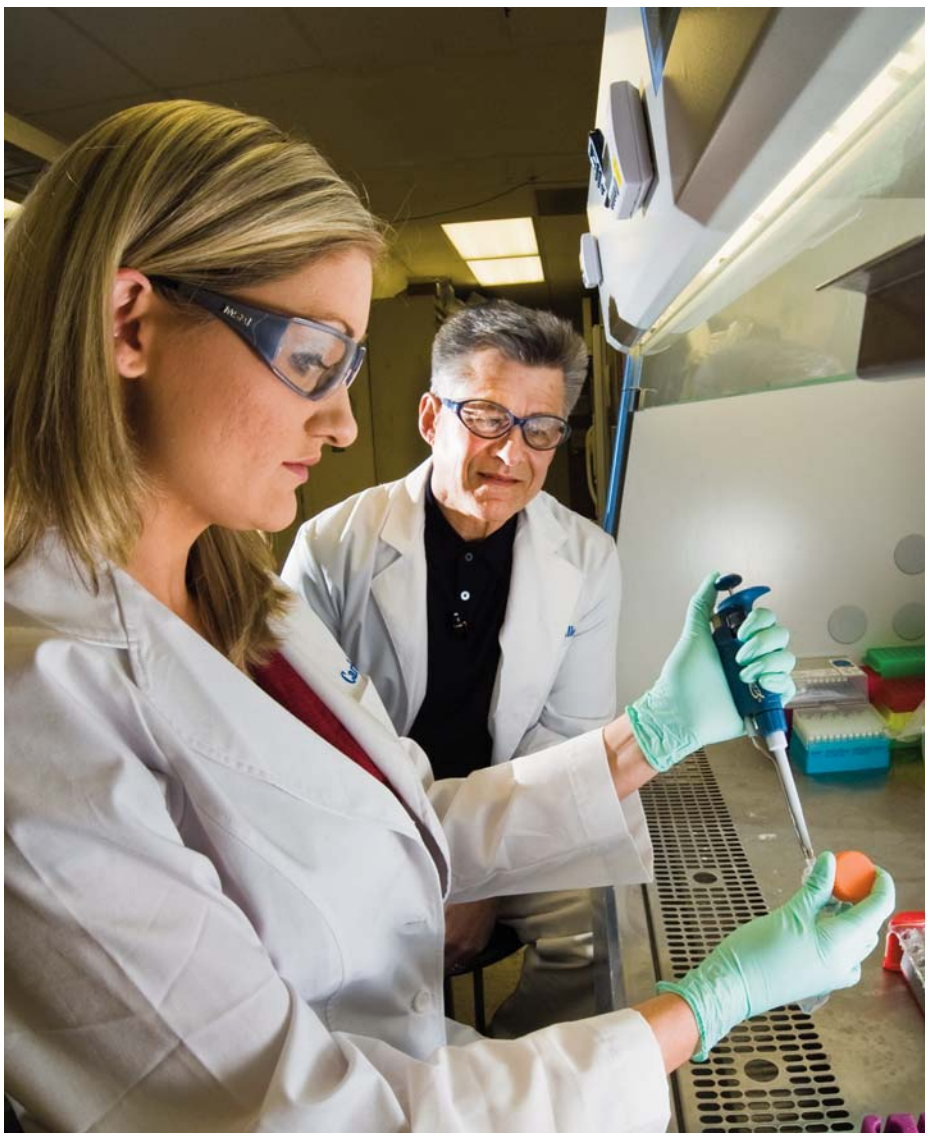
Sandia and UNM lead impressive effort to destroy cancers



Boosting medicine with nanotechnology strengthens lethal drug cocktail

By Neal Singer

Melding nanotechnology and medicine, research led by Sandia, the University of New Mexico, and the UNM Cancer Research and Treatment Center has produced an effective strategy to target a cancerous cell using nanoparticles that deliver a mélange of killer drugs into it.

A paper, selected as the cover article of the May issue of *Nature Materials* and available online April 17, describes silica nanoparticles about 150 nanometers in diameter as honeycombed with cavities that can store large amounts and varieties of drugs.

> *"Protocells modified with a targeting peptide that binds to a particular type of cancer exhibit a 10,000-fold greater affinity for that cancer than for noncancerous cells."*
>
> **— Sandia researcher Jeff Brinker**

"The enormous capacity of the nanoporous core, with its high surface area, combined with the improved targeting of an encapsulating lipid bilayer [called a liposome], permit a single 'protocell' loaded with a drug cocktail to kill a drug-resistant cancer cell," says Sandia researcher and UNM professor Jeff Brinker, prin-

(Continued on page 7)

SANDIA HARRY S. TRUMAN post-doctoral fellow Carlee Ashley introduces a buffer into a protocell solution to dilute it as Sandia researcher and University of New Mexico professor Jeff Brinker watches. (Photo by Randy Montoya)

Sandia LabNews

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Sandia National Laboratories

New Div. 5000 VP

Jeffrey Isaacson of the RAND Corp. and formerly an executive with Lockheed Martin, is joining Sandia as VP for Defense Systems and Assessments Div. 5000 effective May 2. See story on page 2.

Second Z plutonium shot safely tests materials

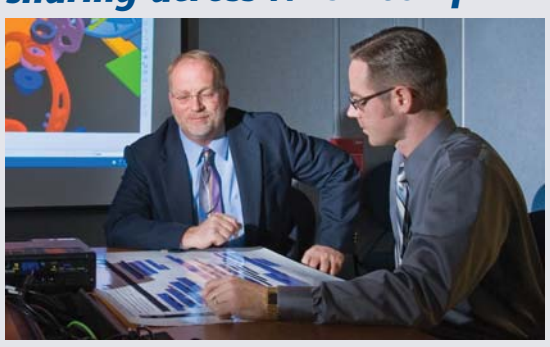
On March 31, researchers from Sandia and Los Alamos national laboratories completed their second experiment in the last six months at Sandia's Z machine to explore the properties of plutonium materials. The Z machine is the Earth's most powerful and efficient laboratory radiation source.

The experiment is a continuation of studies performed at Sandia prior to the major refurbishment of the Z machine, made to increase its output of electrical energy.

"The ultrafast closure valve and containment chamber performed as expected, isolating the plutonium

(Continued on page 4)

Improving workflow, data sharing across NNSA complex



PRIDE spurs collaboration throughout product life cycle. See story on **page 6.**

LDRD transparency markedly improved by VP Steve Rottler

Researchers interested in increasing their probability of winning one of

Feedback provided for funded and nonfunded projects

By Neal Singer

Researchers interested in increasing their probability of winning one of Sandia's vaunted Laboratory Directed Research and Development awards may wish they had attended a town hall meeting led by Steve Rottler (VP of S&T & Research Foundations Div. 1000) last month at the Steve Schiff Auditorium.

The meeting, simulcast to California, offered five-minute presentations from the leaders of each investment area of the LDRD program, detailing precisely what they look for in an idea submission. Steve himself then described changes to the review and selection process that are expected to significantly improve employee perceptions of the process.

"There's been a certain lack of transparency perceived by Sandia researchers as to who got funded and why in the LDRD process," Steve told the live and online audience. "One change is to start talking more broadly, in meetings like this, as to what's going on."

Changes were instituted in response to input from two sources. One was a Labs-wide "Principal Investigator and Project Manager" self-assessment survey put out months ago by the LDRD office, said LDRD program manager Hank Westrich (1911). The second was the LDRD feedback provided in a Division 1000 focus group on Sandia's ST&E research environment that Steve attended.

"Our survey asked whether there was anything we could do to improve LDRD in general," Hank said. "Staff responses gravitated naturally toward process improvements. Steve was intrigued by the broad

(Continued on page 4)

Inside . . .

The Habitat habit

Groundbreaking for Sandia/Lockheed Martin's 11th Habitat for Humanity house was held April 9. The house will be built by more than 250 Sandia employees, contractors, family members, and retirees. See story and photos on **page 12.**

That's that

Marking a couple of 50th anniversaries this month. In April 1961, the Soviet Union launched Yuri Gagarin into orbit. The tiny young Soviet pilot — the 27-year-old son of peasants was just over five feet tall — became a giant in the world's eyes. As the first human in space, he was feted around the globe and was put forward as the face of a triumphant Soviet communism.

Gagarin's flight was a shock to the US, of course, all the more so because, while the US space program was conducted largely in the open, the Soviet program was — as the saying goes — shrouded in secrecy. I was a little kid when Gagarin completed his one-orbit flight (one that came much closer to ending in disaster than the Soviets ever let on) but even as an 11-year-old, I understood that the US had suffered a defeat. It was a defeat that didn't sit well with the American people — or with our political leadership. Barely had America's first astronaut, Alan Shepherd, climbed from the Mercury capsule after a 15-minute suborbital flight than President John F. Kennedy announced the US would go to the moon "before this decade is out." And we did.

Set aside for a moment the ideological/political forces that drove the space race of the 1960s and consider this: There were plenty of places where the US and the Soviet Union could have competed for hearts and minds. The fact that space was a mutually agreed upon theater in the Cold War is telling. Both the Soviets and the US understood that "the conquest of space" captured the imagination like nothing else. As humankind's first spacefarer, Gagarin represented something high, aspiring and, yes, noble: a quintessential human desire to explore the unknown — "to boldly go where no man has gone before" — if I may borrow the world's most famous split infinitive to make my point.

* * *

As we reflect on 50 years of human accomplishment in spaceflight, though, we must always keep close to our heart the awareness of a dark potential in our kind. Fifty years ago this month, the Israelis put on trial Adolph Eichmann, the so-called "transportation administrator" for the Nazi death camp machine. In Eichmann, we see a man who was a respected member of his community, a citizen of arguably the most cultured and accomplished society in the world, an ordinary (by no means an extraordinary) man. And yet, this technocrat, this father, husband, neighbor, was deeply complicit in the murder of millions of people. It is precisely his ordinariness, his embodiment of the "banality of evil," to use the term political theorist Hannah Arendt applied to Eichmann, that is disturbing. Were he a towering psychopath, Eichmann's crimes could be seen as an aberration, a freak of nature. But no one, at his trial or elsewhere, argued that he was insane. He was just . . . a careerist, determined to do a good job and get ahead.

The juxtaposition of these two anniversaries calls to mind a passage from the movie *Gettysburg*, based on a historical novel by Michael Shaara. In the scene, Col. Joshua Chamberlain and grizzled old Irish Sgt. Buster Kilrain are engaged in deep philosophical conversation. Chamberlain — the idealist — quotes Hamlet: "What a piece of work is man . . . . how express and admirable. In action, how like an angel." To which Kilrain — the cynic — replies, "Well, if he's an angel, all right then, but he damn well must be a killer angel."

* * *

Just came back from a nice vacation where I was lucky enough to visit several Caribbean islands. While being driven around the various islands by local cab drivers, each one made a point of taking us by their new state-of-the-art cricket stadium. And each driver, too, made a point of noting that the Chinese built the stadium for them. After the first island, I didn't think anything of it other than, that's nice. By the time the scene had repeated itself — in almost identical fashion — on the third island, I really got interested. On doing a bit of research when I got home, I found that the Chinese government built or significantly upgraded five cricket stadiums in the Caribbean in advance of the 2007 World Cup cricket championships, held that year among eight island nations. Analysts noted that the Chinese were investing heavily in these good-will projects in the Caribbean as a way to outflank and marginalize Taiwan, which has had traditional trade ties and enjoyed cordial relations with a number of these island nations for decades. Maybe it's just me, but I think Taiwan isn't the only nation being outflanked here.

See you next time.

— Bill Murphy (505-845-0845, MS0165, wtmurph@sandia.gov)

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Bill Murphy, Editor **505/845-0845**
Randy Montoya, Photographer **505/844-5605**
Mike Janes, California site contact **925/294-2447**
Michael Lanigan, Production **505/844-2297**
Contributors: Neal Singer (845-7078), Iris Aboytes (844-2282), Patti Koning (925-294-4911), Stephanie Holinka (284-9227), Karyn Scott (284-8432), Darrick Hurst (844-8009), Stephanie Hobby (844-0948), Heather Clark (844-3511), Tara Camacho-Lopez (284-8894), Renee Deger (284-8997), Michelle Fleming (Ads, Milepost photos, 844-4902), Jim Danneskiold, manager (844-0587)
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RAND Corp. executive Jeff Isaacson will head Labs' Defense Systems and Assessments SMU

JEFF ISAACSON, newly appointed VP of Defense Systems & Assessments SMU. (Photo courtesy of RAND Corp.)

Jeffrey Isaacson of the RAND Corp. and formerly an executive with Lockheed Martin, is joining Sandia as VP for Defense Systems & Assessments Div. 5000 effective May 2.

"Sandia will benefit greatly from Jeff's leadership, innovation, and experience as he takes over our vital work of developing and integrating advanced science and technology into state-of-the-art systems for the DoD and other national security agencies," says Sandia President and Labs Director Paul Hommert. "We are looking forward to the contributions he will make to Sandia's heritage of exceptional service in the national interest."

> *"I am very pleased to join an organization that does such outstanding work for our nation and contributes to such a broad range of national security missions."*
>
> **— New Div. 5000 VP Jeff Isaacson**

Jeff will lead the Defense Systems and Assessment Strategic Management Unit, one of four major management units at Sandia. The DSA unit is responsible for work in such areas as global and conventional strike; information and cyber operations; intelligence, surveillance, and reconnaissance; missile defense; counter-proliferation and nonproliferation technologies; and DoD transformation initiatives.

Jeff is vice president and director of the RAND Corp.'s Army Research Division in Washington, D.C., a job he has held since 2007. His duties include leading the Arroyo Center, the US Army's federally funded research and development center for studies and analysis. He also has led RAND's National Defense Research Institute, which directly supports the secretary of defense, the Joint Chiefs of Staff, the combatant commands, and the defense agencies.

From 2004 to 2007, Jeff directed and was chief system engineer for the Space Based Infrared System program with Lockheed Martin Corp. Space Systems Co. The multibillion-dollar satellite program is developing the nation's next-generation missile warning capability.

Jeff is a US Navy veteran who served as a mobilized reservist in Operation Enduring Freedom in Afghanistan in 2009-2010. He holds a doctorate in physics from the Massachusetts Institute of Technology, a master's degree in chemical engineering from Princeton University, and a bachelor's in nuclear engineering from Columbia University.

"I have admired the expertise and reputation of Sandia for years, and I am very pleased to join an organization that does such outstanding work for our nation and contributes to such a broad range of national security missions," Jeff says. "I am eager to join the team and get to work."

Paul thanked Mike Vahle for serving with distinction as acting VP for Div. 5000 for the past several months.

Technology aims to rapidly identify and characterize unknown pathogens

At the heart of RapTOR a microfluidic 'Grand Central Station'

Story by Patti Koning • Photos by Dino Vournas

TINY BUT GRAND — Ken Patel works on the digital microfluidic hub, the "Grand Central Station" of RapTOR that manages and routes samples. He won the Society for Laboratory Automation and Screening's $10,000 Innovation Award for this work.

More often than not, you can't put a price tag on the rewards of scientific research — satisfaction at solving a tough problem, the respect of peers, knowing your work will have a larger impact on the world. But sometimes you can: just ask Kamlesh (Ken) Patel (8621). He recently won the Society for Laboratory Automation and Screening (SLAS) $10,000 Innovation Award for his outstanding podium presentation, "Preparation of Nucleic Acid Libraries for Ultra-High-Throughput Sequencing with a Digital Microfluidic Hub."

"The SLAS Innovation Award was created specifically to recognize cutting-edge research and the individual behind the work, and Kamlesh's exploration into nucleic acid libraries for ultra-high-throughput sequencing with a digital microfluidic hub will impact the scientific community for years to come," says SLAS Innovation Award Committee Chair Jörg Kutter.

Sandia CaliforniaNews

While Ken's name is on the award, he's quick to point out that his work is part of a much larger effort with contributions from a multidisciplinary team. Led by principal investigator Todd Lane (8623), the RapTOR (Rapid Threat Organism Recognition) Grand Challenge, part of the International, Homeland and Nuclear Security strategic management unit, has the ambitious goal of rapidly identifying and characterizing unknown pathogens. (*Lab News*, Aug. 26, 2010). In an outbreak scenario, whether the result of bioterrorism or a fast-moving, deadly virus like Ebola, RapTOR could greatly accelerate the response. Until you know what's making people sick, treatment is like throwing darts.

Leveraging DNA sequencing technology

Using the latest in DNA sequencing technology, RapTOR aims to transform slow, labor-intensive benchtop sample preparation methods to an automated microfluidic platform to create a fast, efficient, and flexible tool. "We're taking advantage of DNA sequencing technology," Ken says. "Reading the genetic code, the original building blocks, allows you to begin characterizing a pathogen at the most basic level."

But getting at those building blocks is not easy — clinical samples are packed with information, most of which is not of use in characterizing an unknown pathogen. For example, more than 99 percent of the DNA in a blood sample is the human genome. DNA in a nasal swab is 90 percent human-derived and much of the rest is garden-variety bacteria. Suppressing all that background DNA is essential to get at the unknown pathogen.

DNA sequencing technology has evolved at a tremendous pace, even surpassing Moore's Law, the 45-year-old prediction that computer processing power would double every two years. The pre-sequencing steps, however, have hardly changed since the bacteriophage genome was first sequenced in the mid-1970s.

Ken leads the Automated Molecular Biology (AMB) research to both scale down and automate traditional sample preparation methods such as normalization, ligation, digestion, and size-based separation — methods that traditionally require a skilled scientist and take days or even weeks. A critical component of RapTOR is bringing together the different sample prep steps to create a "one-stop shop" that connects to a DNA sequencer. Key to this is the digital microfluidic hub.

The hub is a Grand Central Station for samples, routing them from one step to the next with the flexibility to skip or repeat steps on the fly. But imagine a train station in which some trains are orders of magnitude larger than the others, and some travel at the speed of light and others at 60 mph. The digital microfluidic hub is designed to negotiate these differences, functioning like a train station that can shrink and enlarge trains as necessary and manipulate their speeds.

Instead of trains, droplets are the mode of transportation in this station and voltage serves as the engine. The sample is cargoed within a microliter-scale droplet that is spatially moved across the Teflon-coated surface of the hub when electrostatic forces are appropriately applied. The hub also manages the size of the sample, extracting the right amount for each process.

Reagents dispensed as needed

Size is only one variable that the microfluidic hub manages. Reagents and enzymes necessary for different manipulations are stored in reservoirs connected to the hub and dispensed as needed. "If we need to do a reaction at a set temperature, we can move the sample through a connector tube off the hub into a heated microreactor, perform the reaction at temperature with appropriate reagents, and then redispense the sample back onto the hub for the next processing step," Ken says. "This is where AMB becomes very powerful — it allows you to connect multiple, different components together through a common flexible interface. All of the microreactors are replaceable, so contamination is not an issue."

KEN PATEL and Numrin Thaitrong (8621) examine the digital microfluidic hub.

At the start of the Grand Challenge, the AMB team wasn't sure how efficiently they could repeatedly move droplets on and off the hub. Turns out, the ability to move the droplets is one of the most powerful features of the device.

"We've concluded that this is one of the main contributions we've made to the field," Ken says. "Interfacing to a droplet and other microfluidic chips is not just possible, it's quite effective and a good path forward for processing samples."

As the AMB team continues to refine the digital microfluidic hub, they are also working on a parallel project to culture cells within the droplets. "There are several exciting advantages to this approach — we can work with different microcultures of cells independently on the device. It is possible to study infections at the cellular level, working with small amounts of cells — thousands at best, not millions — in a hermitically sealed, safe environment," Ken says. "The end goal is a device that could be used in Biosafety Level-3 containment, enabling safe diagnosis and research of infectious agents."

Expanding the role of this technology, Ken was recently awarded additional funding from the US Army Criminal Investigations Laboratory to develop a microfluidic-based approach for genotyping in the field. Such a device would allow law enforcement to rapidly process forensic evidence at the crime scene for matching DNA, rather than sending a sample to the lab and waiting days for confirmation, generating immediate intelligence that can then be applied to the unfolding situation.

HANYOUP KIM (8621) checks out the Rapid Threat Organism Recognition (RapTOR) device prototype. The digital microfluidic hub, visible inside the case, serves as the "Grand Central Station" of the device, routing and managing samples for speedy identification and characterization.

The digital microfluidic hub could have a wide range of applications — from crime scene investigators to first responders to a general practitioner's office.

"An eventual goal might be to develop an all-in-one portable device, a sequencer with a sample prep front end. We have portable sensors, so why do not DNA sequencing in the field?" says Ken.

"Going to the DNA level gives you so much definitive information, amazing characterization capabilities that we just don't have today. It's the new revolution, a really interesting and exciting way of doing research and solving clinical problems. It just makes sense for Sandia to be on that leading edge, applying this research to our national security missions in biodefense."

Boosting LDRD transparency

"The point isn't whether you like the answer. It's that you understand the decision and why it was made the way it was. . . .we're obligated to give every employee the explanation of our thinking so they know why they were funded or not funded."

(Continued from page 1)

swath of concerns, and a focus group took him further. There, Steve heard that passion live. It's a wakeup call when you experience something like that. He heard the staff and came to a realization that changes should be made as soon as possible."

These include removing principle investigators' names and organization numbers from their idea submissions. This would make possible so-called "blind reviews" uninfluenced by the status of the individual submitting the idea. Upon conclusion of the proposal evaluation process, substantive feedback will be provided to each applicant to explain why the proposal was accepted or rejected. In addition, each project's proposal, the names of its proposers, and its review scores will be listed on the LDRD website. So will the names of reviewers, though without being associated to particular projects.

"The point isn't whether you like the answer," Steve told his audience. "It's that you understand the decision and why it was made the way it was.

"Usually, out of 50 applications, any of 40 could be funded. But we can only choose 10," he said. "So there are many good proposals that won't be funded. But we're obligated to give every employee the explanation of our thinking so they know why they were funded or not funded."

Speakers describing what they looked for in the investment areas of the LDRD program included Mike Knoll (5300), Defense Systems and Assessments; Charles Barbour (1100), Energy, Climate, and Infrastructure Security; Peter Davies (8100), International, Homeland and Nuclear Security; Bruce Walker (200), Nuclear Weapons; John Porter (1670), Science of Extreme Environments; Bruce Hendrickson (1440), Enable Predictive Simulations; Jerry Simmons (1120), Nanoscience to Microsystems; and Jim Woodard (1900), Cyber Security and New Directions.

In the interests of increased openness, the slides that accompanied each investment-area speaker, detailing their outlooks on important aspects of proposals, should soon be available at the LDRD website for review by potential applicants, Hank said. The funding available for new-start LDRD projects in each investment area will also be posted soon to the LDRD website.

In the draft FY12 budget presented by Steve, $52 million will be slated for mission technologies: defense systems and assessments; energy, climate, and infrastructure security; international, homeland, nuclear, and security efforts; and nuclear weapons.

Grand Challenges are allotted $21 million; cyber security $6.5 million; ST&E foundations about $52 million; and total strategic partnerships and early career R&D, $43 million. Corporate reserves and program management will receive $3 million.

The meeting was held to explain the call for proposals, Steve said. On Aug. 23, another town hall meeting will be held to explain the LDRD investment area funding decisions. "A third town hall meeting will be held in the fall in advance of next year's call, when we can talk more about strategies for the upcoming year," he said.

Though the audience was sparse, questions were not.

One researcher mentioned that he was told that if a researcher already holds an LDRD grant and the same name comes up again, it could be effectively grounds for disqualification. Steve responded, "There are no criteria that prevent a proposal from being funded in such a situation, and it would be inappropriate if such criteria were used." However, he qualified, dual LDRD projects would be an issue if it was clear there was not enough work time in the day for the researcher to credibly pursue both projects.

Another individual wanted to move proposal submission and review time to fall, rather than spring, to improve people and project management. Steve responded that that had been considered but because the federal budget for the next year was typically very uncertain in the fall, it was impractical to make this change.

Another question was whether the blind review was imperiled if a researcher discussed his idea with LDRD review team members to better frame a proposal.

"That would be your choice," Steve said. "It is not my intent to prevent or discourage individuals from talking with those who participate in the idea selection process and can provide good advice on how to improve the quality of an idea."

Another questioner asked if it was within the realm of LDRD guidelines to give preference to new employees as part of the inducement for coming to Sandia. The response was that LDRD criteria do not change for early career employees, but because new employees may come on board after the normal application period ended, it was important to maintain some money for worthy possible projects. An important side benefit of LDRD is that is an important factor in attracting good people to Sandia, Steve said.

Laboratory Directed Research and Development gives the Labs director the ability to direct up to 8 percent of Labs costs, or $166 million this year and $177 million projected for next year, for imaginative employee-generated research projects that have a significant chance to improve US science and technology in areas important to national security. Last year LDRD research produced 20 percent of Labs' refereed publications. Overall, LDRD projects have produced roughly 40 percent of Labs patents and, from 2006-2010, 50 percent of the Labs' R&D 100 awards.

"There's been a certain lack of transparency perceived by Sandia researchers as to who got funded and why in the LDRD process. One change is to start talking more broadly, in meetings like this, as to what's going on."

Z shot successful

(Continued from page 1)

within the primary containment system," says Mike Lopez (1679), Z Operations manager, after the event.

"My personal congratulations go to the Sandia and Los Alamos team on the safe achievement of their second plutonium experiment in the past year. I, like many others, look forward to seeing the data!" emailed Don Cook, NNSA deputy administrator for Defense Programs (NA-10).

"Once again I am very proud of the Z team," says Keith Matzen, director of Sandia's Pulsed Power program (1600). "By applying lessons learned from the first plutonium experiment on the refurbished Z facility last November, they significantly improved the operational efficiency for this second experiment and safely provided high-quality, mission-critical data."

Said Don Brunell, a senior technical safety adviser at DOE's Sandia site office, "Congratulations to Sandia scientists and engineers for not only getting the job done but doing it to the best standards of science and safety." Brunell, an expert on plutonium and Z, recently assisted Sandia researchers in interactions with the Defense Nuclear Facility Safety Board over technical safety issues.

"What we did was work as an integrated team with the line to accomplish the mission safely and efficiently while protecting the environment," said Sid Gutierrez (4100), Sandia's chief safety officer. "Departments from ES&H that were particularly involved included Rad Protection, Industrial Hygiene, and Safety Basis."

Depending on experimental complexity, the Z machine is capable of performing 200 shots every year. The machine uses electrical currents of about 26 million amps to reach peak X-ray emissions of 350 terawatts, an X-ray output of 2.7 megajoules, and pressures greater than those at the center of the Earth.

The Z machine is part of Sandia's Pulsed Power program. Pulsed power is a technology that concentrates electrical energy and turns it into short pulses of enormous power, which are then used to generate X-rays. Produced in the laboratory, this controlled radiation or magnetic pressure can create conditions on a small scale similar to those caused by the detonation of nuclear weapons, which is why from its earliest days one of the features of pulsed power has been used to study weapons effects. — *Neal Singer*

CENTER 1600 DIRECTOR Keith Matzen, left, explains to Brig. Gen. Sandra Finan, right, some of the operational capabilities of Sandia's Z machine. Also looking on is NNSA Sandia Site Office Manager Patty Wagner, center. Finan, NNSA's principal assistant deputy administrator for Military Applications, Office of Defense Programs, toured the Labs recently to receive briefings on Sandia's DP-related capabilities. Last month the Z machine completed the second in a new series of experiments to study the properties of plutonium. (Photo by Randy Montoya)

Recipe for radioactive compounds aids study of nuclear waste and fuel storage pools

By Neal Singer

Easy-to-follow recipes for radioactive compounds like those found in nuclear fuel storage pools, liquid waste containment areas, and other contaminated aqueous environments have been developed by Sandia researchers.

"The need to understand the chemistry of these compounds has never been more urgent, and these recipes facilitate their study," principal investigator May Nyman (6915) says of her group's success in creating a method to self-assemble significant amounts of relevant compounds.

The trick to the recipes is choosing the right templates. These are atoms or molecules that direct growth much the way islands act as templates for coral reefs.

The synthesized materials are stable, pure, and can be studied in solution or as solids, making it easier to investigate their chemistry, transport properties, and related phases.

The compounds are bright yellow, soluble peroxides of uranium called uranyl peroxide. These and related compounds may be present in any liquid medium used in the nuclear fuel cycle. They also appear in the environment from natural or human causes.

Made with relatively inexpensive and safe depleted uranium, the recipes may be adapted to include more radioactive metals such as neptunium, whose effects are even more important to study, May says.

Cesium — an element of particular concern in its radioactive form — proved to be, chemically, an especially favored template for the compounds to self-assemble.

The work was done as part of the Actinide Materials Department of Energy (DOE) Energy Frontiers Research Center (EFRC) led by professor Peter Burns at Notre Dame University. Using the new method, researchers at the University of California-Davis are studying how materials behave in water and in different thermal environments, while researchers at DOE's Savannah River Site study the analogous behavior of neptunium.

SANDIA RESEARCHER May Nyman investigates radioactive materials in a beaker of dissolved uranium and templates, from which crystals will grow. Her gloves, taped to her lab coat, effectively prevent any contact from possible spillage of the 'hot' materials. The radioactivity of this particular mix is fairly low, on par with thorium lantern mantles sold in camping equipment shops. (Photo by Randy Montoya)

The research will be the cover article of the May 3 online *European Journal of Inorganic Chemistry*, to be published in print May 13. It currently is highlighted in preview in the online *ChemViews Magazine*.

FACT site attracts international attention

By Stephanie Holinka

It's been an exciting year so far for the Facility for Acceptance, Calibration, and Testing (FACT), but you'd never know it if you ventured all the way out to the site.

The FACT site lies far southeast of Sandia's tech areas in one of the loneliest outreaches of Sandia's footprint on Kirtland Air Force Base. But the silence and solitude belie the activity and excitement that this year has brought to the extremely quiet site.

Researchers at the facility develop and test sensor systems used in the Comprehensive Nuclear Test Ban Treaty (CTBT) detection systems at International Monitoring System (IMS) sites.

These sensors allow detection of underground or near-surface nuclear explosions since signals from these large events can travel thousands of miles through the earth or the atmosphere until they are picked up by a monitoring station.

"The sensors for the monitoring mission include seismic, infrasound, hydroacoustic, and radionuclide," says Darren Hart (5736), primary technical researcher at the FACT site.

"We focus on seismic and infrasound, evaluating sensors and waveform recorders to ensure they meet the monitoring mission requirements," Darren says. "These requirements, as set forth in the treaty, include sensitivity, dynamic range, and maximum internal noise levels."

DARREN HART, left, and Kyle Jones check out a sensor system configuration at Sandia's Facility for Acceptance, Calibration, and Testing. The hoses spidering out from the yellow bucket-like container are soaker hoses intended to keep down dust levels around the sensor system. (Photo by Randy Montoya)

Nations that participate in the CTBT need to know if anyone attempts any nuclear explosive testing. Sensor systems such as those evaluated at Sandia assure CTBT participants that unannounced tests could be detected and analyzed. Currently the FACT site is working to expand its mission to provide its capabilities to a broader international community.

"Other countries might be developing different monitoring quality sensors," Darren says. We'd like to evaluate [non-US] sensors to see how their characteristics compare to the US equipment."

But going international isn't easy; the rules for working with organizations outside the US are often strict.

"With non-US businesses we can usually provide only evaluation information," Darren says. "We must obtain export control approval before we can make specific suggestions for improvement."

Still, international plans are moving forward. In May of last year Sandia researchers visited the European Geoscience Union (EGU) conference in Vienna and visited with Patrick Grenard, chief of engineering and development for the Comprehensive Nuclear Test Ban Treaty Organization-International Monitoring System (CTBTO-IMS).

"We explained the work we do for the US and explained how we could support hardware evaluations so they won't have to duplicate efforts," Darren says.

The results of that visit include an introductory "ice-breaker project." The team is doing some initial evaluation work and navigating the preliminary logistics of working with CTBTO, in the hopes that it will lead to greater cooperation with that organization.

Officials from the CTBTO-IMS toured the FACT site in early April. NNSA's Randy Bell (director of the Office of Nuclear Detonation Detection) and Gil Sateia (deputy director of Warhead Dismantlement Transparency, Office of Nuclear Verification, Department of State) hosted the CTBTO-IMS delegation, which included executive secretary ambassador Tibor Tóth; chief of engineering and development Grenard; director of the international data center division Lassina Zerbo; and chief of external relations, protocol, and international cooperation Jean P. du Preez. Visitors toured the site and discussed the challenges of monitoring in a dynamic environment as well as the intricacies of setting up new capabilities for treaty nations.

Field test engineer Kyle Jones (5736) showed the visitors around the instrumentation and data collection center for FACT, and explained how large-scale world events such as the recent earthquake and tsunami in Japan are used by researchers to validate the data analysis on the types of sensor systems used to monitor all kinds of activity including nuclear detonations.

"Work on sensors doesn't occur in a vacuum," Kyle says. "Data analysts work with other sensor researchers worldwide to understand what large-scale events have to say about the validation of their instruments and systems."

The visit went well, Darren says, and the visitors voiced interest in the Sandia team participating in the next CTBTO infrasound calibration experiment.

In addition to the CTBTO visit, the FACT team is expecting final approvals from the US Air Force and NNSA's Sandia Site Office to expand its monitoring footprint on Kirtland Air Force Base, allowing it to expand its sensor footprint from the initial 45 acres to additional sites within a 400-acre boundary. This additional space will allow the team to set up larger sensor arrays with greater station spacing; arrays that would compare to systems that will be deployed in support of both US and other CTBT monitoring.

PRIDE spurs collaboration throughout product life cycle — Integrating CAD models with workflow across complex

"This system is the most ambitious and transformational engineering information system to be deployed at Sandia and across the Nuclear Security Enterprise, because it offers integration and real collaboration, with enhanced security when sharing ideas."

— Rick Harris

TAKING PRIDE IN THEIR WORK — Rick Harris (left) and Abe Sego discuss the status of NNSA'S PRIDE initiative, in which Sandia has played a key enabling role. PRIDE's aim is to ensure that product realization is managed as an integrated enterprise across the complex. In the background is a sample illustration demonstrating the 3-D capabilities of ProE software. (Photo by Randy Montoya)

Story by Jonathan Price

Sandians have launched a significant new engineering information system for storing, sharing, and securing the models and drawings needed to bring a product from conception to release, in both nuclear weapons and work for others.

Now in use, the software allows designers, engineers, and manufacturing teams to effectively manage product data and collaborate quickly, efficiently, and securely across the enterprise.

The initial push for the Product Realization Integrated Digital Enterprise (PRIDE) program began five years ago, when NNSA came to realize that the Nuclear Security Enterprise (NSE) was having difficulty managing product realization as an integrated enterprise. Each NNSA site had its own functions and therefore its own way of creating and storing its engineering records.

In some cases there were formal mechanisms for sharing information; in other situations, sharing was informal and slow. Generally, engineering drawings were managed well, but important supporting documents were not. Weak configuration management often led to tedious detective work, mistakes, and costly errors.

So in June 2006, NNSA launched a campaign to enhance information management across the enterprise, to offer secure, authoritative sources of information, allowing better collaboration during the entire process of product realization. Sandia played a central role in the campaign. In addition to serving as the PRIDE program manager for Sandia, Rick Harris (2990) has been the chair of the PRIDE initiative across NNSA.

Realizing the PRIDE vision

For the PRIDE vision of enterprise-wide sharing and collaboration to be fully realized, designers, engineers, and manufacturing teams required a tool that could provide file handling and workflow for ProEngineer, the standard mechanical computer-aided design (CAD) tool across the enterprise. That tool was PDMLink, a product data management application.

Abe Sego (2997) says, "We chose this system to bring consistency and configuration management for CAD models and other product documents, so we can effectively share and collaborate."

In a project funded by NNSA's PRIDE program and the corporate Product Lifecycle Management (PLM) program, Timothy Meeks (2994) led the software development team, while Abe handled the configuration and deployment of the software. But they had to solve a number of interrelated problems.

The problems

For years, designers and engineers at one site could not get direct access to various engineering files at another site, so they had to ask for help from someone at the site, and that person had to put together the files, and put them on a drop zone, or transmit them — a secure method, but one that raised havoc with configuration management.

And even when a team received a document, they often could not answer questions such as: Is this the latest revision? What assemblies does this part go into? Where are the relevant test specs?

Struggling to answer questions like these, the teams often wasted time and wandered off-track, because there was no standard way to locate all the design information, no central location for the files, and no agreed-upon metadata about each document.

Also, there was no easy way to identify all the documents related to one product, assembly, or piece part, or to identify the sequence of revisions, and other changes.

Plus, each site had its own myriad methods for storing drawings securely, so the actual files were often duplicated in many different locations, including archival systems such as the Image Management System.

Addressing all these tangles meant that the move to the new system was a huge undertaking. But in 18 months, the Sandia teams set up and configured the system, built product structures to organize the files, and brought together most vital records for nuclear weapons, and for other projects such as Satellites. The teams also built workflow to automate the movement of documents, reviews, and approvals, from initial concept to product acceptance.

The Sandia team started moving all models and drawings for currently active nuclear weapon projects from the legacy repository, the Design Definition Manager, known informally as "Matrix," into the new system, so the records would be easier to find, manipulate, and share.

This migration took a lot of work because Sandia has so many product records, some that belong on the SRN and others on the SCN. And each assembly has a hierarchical relationship with piece parts below, and products above — and any one part may have several different iterations, revisions, and changes of status. Those relationships and versions had to come over intact.

As Jack Martinez (2992) recalls, the team asked itself, "What are we going to bring over? Every version of everything throughout time? Or will we intelligently prioritize?

"We decided to leave some records behind. We'd take only the latest released version, as the starting point, and then all subsequent versions, released or not."

The team also persuaded individuals to bring in records that had been stored on personal hard drives, shared drives, and local servers. In this way, the team built one common repository for all current ProE CAD data, for both NW and non-NW programs such as Satellites.

For Satellites, Rick Chavez-Hatton (2996) set up the product structure — the hierarchical tree showing how each part folds into a subassembly, and that goes into the next assembly, and so on up the chain.

That framework ties a part to all its drawings, models, material specs, test results, and other documents going back in time, so a designer can see how a particular part is used, as it flows into an assembly. And if a team hits a wall, the designers can go back to an earlier version of the drawings, and begin again from there. James Thompson (5212) says, "In Satellites, we have used this new system to capture, structure, and link our build records to Product Structure, with the goal of providing a Record of Assembly to support customer acceptance and downstream operations and maintenance."

As Abe Sego says, "Now we know the latest version of an item, and we know what has changed with it, and we can be sure that we are working on the right data. So we waste less time searching around, checking that this is the right one, which we had to do quite often in the past, because of the problems of managing a definition on a computer where you could have multiple copies of the same thing."

Collaboration becomes faster and easier. Because you have to check out a document before making any changes, only one designer can work on the model or drawing at any time — no accidental duplications or diverging specs. But the designer who is using ProE to work on the drawing can also show those edits to other team members, even if they are at another site, and they can all discuss the changes in real time. And the software automates workflow, taking the designer through the process of getting peer reviews and electronic signoffs, then making the models and drawings available to manufacturing.

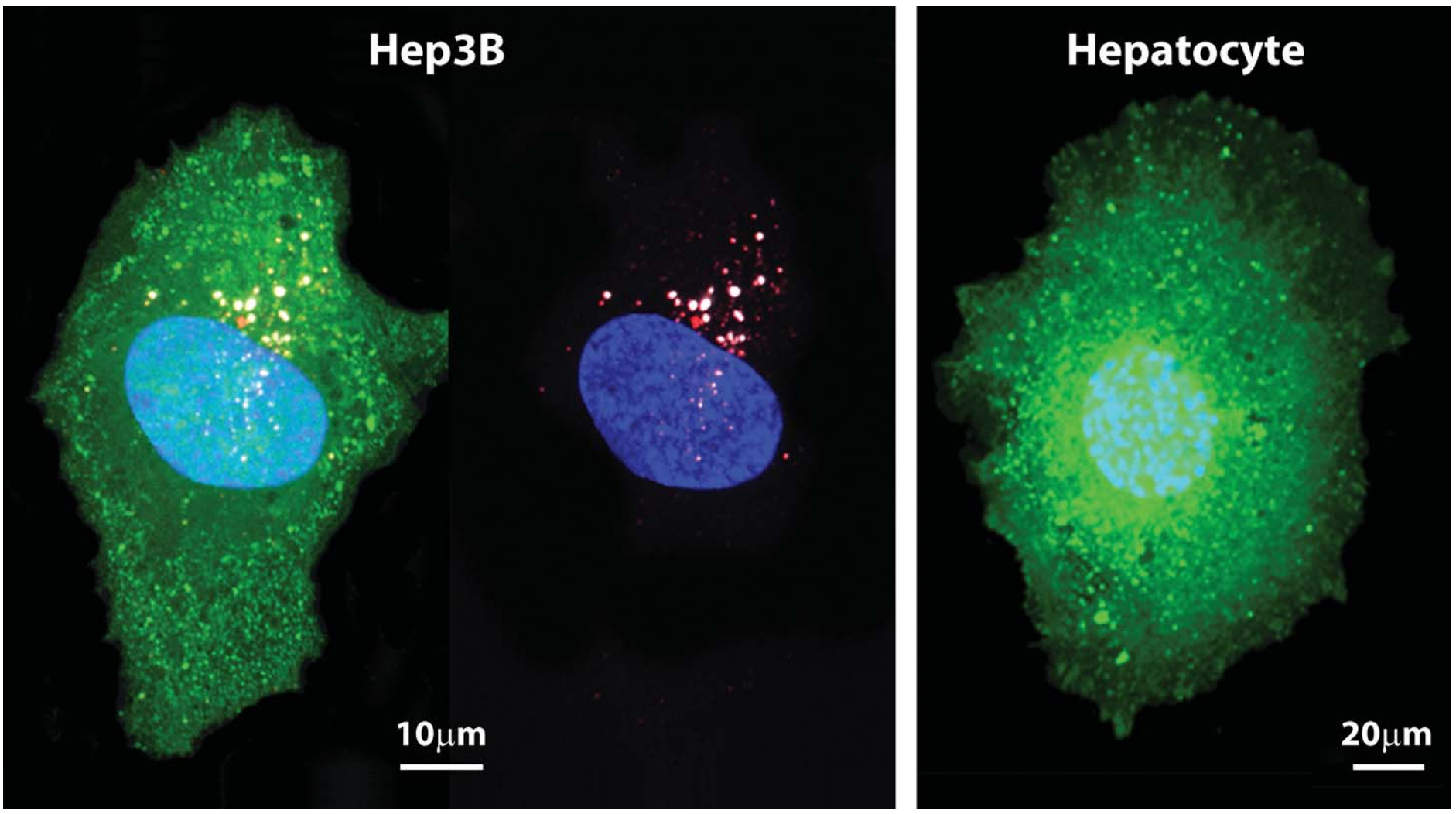
More groups within Sandia are benefiting, including B61 LEP, Missile Defense, Satellite Systems, and all WR Production Systems. Chris Russell (2997) is helping other groups at Sandia tie into the system, providing training and service-level agreements as more teams decide that the new system is a way "to help the line avoid wasting an exorbitant amount of time just reconciling drawings."

The enterprise is coming online, too. For example, Los Alamos can pull information for mechanical envelopes from Sandia, or insert a model into a weapon system assembly at Sandia, having that design fully integrated into the system.

Results

As Rick says, "This system is the most ambitious and transformational engineering information system to be deployed at Sandia and across the Nuclear Security Enterprise, because it offers integration and real collaboration, with enhanced security when sharing ideas. This solution has proven to reduce design cycle time, allowing more design options to be considered. With this system the NSE will be able to move more quickly, and work together more efficiently, to create the innovations that our country needs in science and technology."

A new approach to beating cancer



DEEP IMPACT — The figure on the left (Hep3B) shows a greenly fluoresced cancerous liver cell penetrated by protocells. The small red dots are lipid bilayer wrappings. Their cargo — drug-filled nanoparticles, their pores here filled with white fluorescent dyes for imaging purposes — penetrate the cancerous cell. (Penetration is more clearly seen in the second image, where the green fluorescence has been removed.) The normal cell on the right (hepatocyte) shows no penetration.

(Images, courtesy Carlee Ashlee, were taken with a confocal microscope at the University of New Mexico cancer center's Fluorescence Microscopy Facility.

(Continued from page 1)

cipal investigator on the research. "That's a million-fold increase in efficiency over comparable methods employing liposomes alone — without nanoparticles — as drug carriers."

The nanoparticles, surrounded by cell-like membranes formed from liposomes, together become the combination referred to as a protocell: the membrane seals in the cargo and is modified with molecules (peptides) that bind specifically to receptors overexpressed on the cancer cell surface. The nanoparticles provide stability to the supported membrane and contain and release the therapeutic cargo within the cell.

A current Food and Drug Administration-approved nanoparticle delivery strategy is to use liposomes themselves to contain and deliver the cargo. In a head-to-head comparison of targeted liposomes and protocells with identical membrane and peptide compositions, the paper reports that the greater cargo capacity, stability, and targeting efficacy of protocells leads to orders-of-magnitude greater cytotoxicity directed specifically to human liver cancer cells.

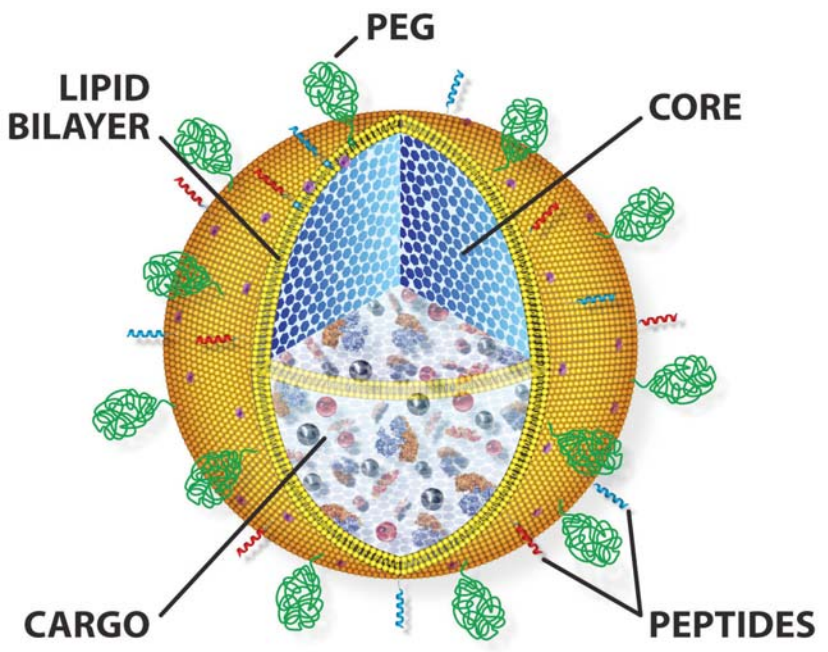
Specialized loading strategies

Another advantage to protocells over liposomes alone, says lead author Carlee Ashley (8621), a Harry S. Truman Fellow at Sandia/California, is that liposomes require specialized loading strategies. "We've demonstrated we can simply soak nanoparticles to load them with unique drug combinations needed for personalized medicine. Protocells can also effectively encapsulate potent protein-based toxins, carrying them as well as siRNAs that silence expression of proteins that cancer cells need to survive."

RNA, the biological messenger that tells cells which proteins to manufacture, is, in this case, used to silence the cellular factory, a way of causing apoptosis or cell death. "Si" is short for "silenced interfering."

The lipids also serve as a shield that prevents toxic chemotherapy drugs from leaking from the nanoparticle until the protocell binds to and becomes internalized within the cancer cell. This means that few poisons leak into the system of the human host, should a malignant cell not be located. This cloaking mitigates toxic side effects usually expected from more conventional chemotherapy.

Instead, the particles — crafted small enough to float under the radar of the liver and other cleansing organs — can circulate harmlessly for days or weeks, depending on their engineered size, seeking their prey.



ANTI-CANCER DEATH STAR: The cutaway shows the nanoparticle's extreme porosity in blue (CORE). The (so to speak) nanovehicle is loaded with an assortment of chemicals (CARGO) tailored to destroy a specific cancer and is enshrouded in a protective (LIPID BILAYER) cover for travel in the bloodstream. Specific surface agents (PEPTIDES) are intended to dock the particle at the targeted cancer and in effect board it, allowing the therapeutic cargo to empty into the cell. The polyethylene glycol (PEG) prevents unwanted interactions with noncancerous cells. (Illustration by Mona Aragon)

A library of phages — viruses that attack bacteria — was created at UNM's cancer center by collaborator David Peabody. This permitted researchers to expose the phages to a group of cancerous cells and normal cells, allowing identification of peptides that bind specifically to cancer cells but not normal cells.

"Protocells modified with a targeting peptide that binds to a particular type of cancer exhibit a 10,000-fold greater affinity for that cancer than for non-cancerous cells," says Carlee.

Jeff adds, "A key feature of our protocell is that the fluid stable supported bilayer allows high-affinity binding with just a few of these peptides overall. This reduces nonspecific binding and immune response."

The method is being tested on human cancer cells in culture and will shortly be tested in mice at UNM's nationally accredited cancer center.

Preselecting particles for size

Work still ongoing includes engineering the size of the porous silica particle, which is formed by aerosolizing a precursor solution. The porous nanoparticle fabrication process — called evaporation-induced self-assembly and pioneered in the Brinker lab — produces particles from 50 nanometers to several micrometers in diameter. Particle sizes between 50 and 150 nanometers in diameter are ideal for maximizing circulation and uptake into cancer, so the particles are preselected for size before their formation into protocells.

"Their overall dimensions determine how widely they'll be distributed in the bloodstream," says Jeff. "We're altering our synthesis to favor the smaller sizes."

Also of importance to the circulation time of the particle are its electrical charge and hydrophobicity, which can improve or detract from its ability to remain free of unwanted molecular or energetic entanglements.

Protocells may be ready for testing in humans in as few as five years, researchers estimate.

Jeff is a Sandia Fellow and UNM Regent's and Distinguished Professor of Chemical and Nuclear Engineering and member of the UNM cancer center.

Other institutions involved in the research include the University of California, Davis, and, in Canada, the University of Waterloo.

Funding was provided by the National Cancer Institute, the National Science Foundation, DOE's Basic Energy Sciences program, the Air Force Office of Scientific Research, and Sandia LDRD.

Scientists' ideas, businesses' know-how spark innovation through New Mexico Small Business Assistance Program

BUILDING A BETTER BALER — Rod Dakan and his wife, Marilyn, asked the New Mexico Small Business Assistance Program for help to design a baler capable of economically bringing alpaca fleece to their processing facility, Royal Fiber Spinnery, in Ruidoso, N.M.

Story by Heather Clark

Rod Dakan, owner of Royal Fiber Spinnery in Ruidoso, N.M., wanted to figure out how to economically bale fleece from small, scattered alpaca herds for transport to the mills, so he turned to the New Mexico Small Business Assistance (NMSBA) Program for help.

Royal Fiber was one of 339 small businesses in 27 counties that participated in 2010 in the NMSBA Program, a public-private partnership between Sandia, Los Alamos National Laboratory, and the state of New Mexico that connects small business owners with scientists and engineers who provide assistance to their companies. The program provided $4.6 million worth of technical assistance to small businesses last year.

Ten projects that achieved outstanding innovations through the NMSBA Program in 2010 were honored at a 10 Years of Innovation Celebration on April 7 in Albuquerque. The program also marked its 10th anniversary by including small business owners it has helped since its inception.

"The NMSBA Program has been bringing together small-business owners with world-class scientists, engineers, and other experts at Sandia and Los Alamos national laboratories and other partner organizations for more than 10 years. These partnerships have not only resulted in the successful innovations we've celebrated over the past decade, but also have brought jobs and economic growth to our state," says Jackie Kerby Moore, manager of Sandia's Technology & Economic Development Dept. 1933.

Royal Fiber, the largest alpaca fiber processor in the country, spins on average 12,000 pounds of fleece into yarn every year, Dakan says. Yet, because alpacas are raised in scattered herds of 20 animals or fewer, traditional 700-pound wool and cotton balers aren't an effective way to package and ship the fiber to processors like Royal Fiber.

Through the NMSBA Program, Dakan met Bob Winters, who retired last year from the Organic Materials Department's Manufacturing Science and Technology Group (2453) at Sandia. They discussed how to design a baler that could pack 50 to 70 pounds of fleece into a 1.5-foot square box suitable for shipping.

Bob, who has provided his design expertise to several successful NMSBA projects, says he tried a manual press to bale the fleece, but it broke the box the fiber was to be shipped in, so he switched to a hydraulic press. He also used a machine in the lab that applied 5,000 pounds of force to compress small amounts of alpaca fleece to prove that his concept worked.

In an animation of the design, the shipping box is inserted under a chute. The alpaca fiber comes down the chute, is compressed into the box, and a fork holds it in place as the ram retracts. If more fiber is added, the fork retracts as the fiber is being compressed.

> *"Their attitude is, 'Tell us what the problem is and let's see if we can fix it.' That's the kind of thing that made this country great in the first place."*
>
> **— Rod Dakan, Royal Fiber Spinnery**

Bob provided Dakan with a detailed design, a 3-D model, and specifications for parts, materials, and welding instructions, which Dakan can use to have a prototype built, a project Dakan says he's pursuing.

Dakan says he wants to expand his business to include selling balers to alpaca farmers. He also hopes the baler can one day increase the domestic market for alpaca fleece, which wicks 80 percent better than wool and is three times warmer.

Small business owners have big ideas, but often are short on money to pursue them, so they need programs custom-designed for them, Dakan says. "This program in that regard is awesome," he says. "Their attitude is, 'Tell us what the problem is and let's see if we can fix it.' That's the kind of thing that made this country great in the first place."

Here is a selection of additional projects that Sandia's researchers worked on that were recognized earlier this month:

• **Pesticide Application Technologies'** research director Ellis Huddleston, an emeritus professor at New Mexico State University, wanted to design a pesticide sprayer that could decrease the number of disease-carrying mosquitoes in the developing world. Huddleston found current equipment was ineffective, so he sought help from two researchers with Sandia's Fire & Aerosol Sciences group, John Brockmann and Daniel Lucero (both 1532). Now, Huddleston has a blueprint for a small, handheld pesticide sprayer and data to prove the concept, which will enable him to get the technology to where it's needed.

• **Santa Cruz reservoir** supplies water to about 1,600 farms in the Espanola Valley, but sediment reduced the reservoir's capacity by 36 percent, hurting small businesses like **Kenny Salazar Orchards**, which irrigates with reservoir water. Sandia and Los Alamos researchers uncovered the sources of the sediment and recommended solutions. Sandians included Jessie Roberts and Rich Jepsen (both 6122), Michael Chapin (6212), and Geoff Klise (6926). Their findings saved the Santa Cruz Irrigation District from building an expensive sediment trap in the wrong location and showed them where to place lower-cost sediment traps.

• Albuquerque companies **Vibrant Corp., Mechtronic Solutions Inc., Fiore Industries Inc., and ZTEC Instruments Inc.** asked the NMSBA Program to help evaluate Process Compensated Resonance Testing (PCRT) of aviation components. Sandia's Airworthiness Assurance Non-Destructive Inspection Validation Center used good and bad airplane engine turbine blades to compare standard structural testing methods to PCRT, a nondestructive technology that provides cost-effective and fast reporting on the structural integrity of components. Since working with Sandia, Vibrant has earned Federal Aviation Administration approval to use PCRT, which increased business opportunities and contacts for the other partner companies, as well as substantial cost savings for the aviation industry. Kirk Rackow and Mike Bode (both 6624) and Justin Newcomer (415) assisted the companies with this project.

Since it was created about a decade ago, NMSBA has provided 1,736 small businesses with $25.2 million worth of research hours and materials. The program has helped create and retain nearly 1,550 New Mexico jobs at an average salary of about $38,000, increase small companies' revenues by $82 million, and decrease their operating costs by $45 million. These companies have invested $19 million in other New Mexico goods and services.

Gen. Barry McCaffrey describes unexpected national security challenges during Sandia talk

By Stephanie Hobby

Future threats to national security will stem from myriad challenges, but they will be different from those making headlines today, according to retired US Army Gen. Barry McCaffrey. Although many are watching the Middle East with trepidation, McCaffrey said during a talk at Sandia that some of the greatest challenges are very close to home.

"STRATEGIC International Security Challenges Facing the United States" was presented to Sandians by retired Gen. Barry McCaffrey as part of the National Security Speaker Series. (Photo by Randy Montoya)

Most of the dialogue among national security experts is focused on international terrorism with roots in Islamic extremism, but McCaffrey, a well-known military analyst and former director of the White House Office of National Drug Control Policy, said he is far more concerned about the convergence of international crime, especially the multibillion dollar drug trade, and criminal conduct by those in power.

"It's unlike anything the global community has ever seen," McCaffrey said.

McCaffrey, who was at Sandia as part of the National Security Speaker Series, described the cocaine industry in Colombia as netting the cartels more than $1 billion a year, and the opium trade in Afghanistan as a $4 billion-a-year industry, more than one-third of the nation's gross domestic product.

"When you see funding of that magnitude, the law enforcement challenges are not just buying a judge or corrupt police officer, but bloc voting behavior in national legislatures," he said.

He contrasted that with US support to Mexico, which he called "anemic" at $1.3 billion promised over three years. With more than 35,000 of its citizens murdered, Mexico's problem is not a war over drugs, he said, but over establishing the rule of law and ensuring that its institutions are not weak or corrupt. Canada and Mexico are America's top two trade partners, so supporting those nations is vital to US national interests, he said.

Cuba is another neighbor to watch, according to McCaffrey. When Fidel Castro dies or loses power, McCaffrey predicted that close to 1 million people will flee the island nation, seeking not only economic opportunity, but freedom.

McCaffrey is adamant that the US needs to finish strong in Afghanistan. Despite polls indicating that two-thirds of Americans believe the US military should pull out of that country, he said it would be disastrous to do so. He said that building an honest and legitimate government with security, law enforcement, and infrastructure takes a generation or more. With Afghanistan's booming drug industry, much remains to be done.

McCaffrey pointed to other challenges ahead, including Russia's turn to a more authoritarian regime, China's continued economic strength, and the need for continued support of Pakistan to assist US efforts in Afghanistan. He said that Iran will likely have a dozen nuclear weapons within the next five years, which will increase tension in the Middle East. The challenge for US policymakers will be to engage other nations to prevent a preemptive nuclear strike on US armed forces or allies.

Protecting assets at home is another critical factor. The United States is made up of 87,000 communities, 2,800 power plants, 5,000 airports, 120,000 miles of railroads, and 2 million miles of pipeline, and much of it is completely unprotected. McCaffrey said that 85 percent of the nation's infrastructure is held by private companies, with no central security. Critical infrastructure protection must be a public-private enterprise, he said. Although it's impossible to defend against every conceivable threat, he said the nation needs to move beyond gates, guards, and guns to develop new technology that can protect against potentially high-casualty targets.

The national labs will continue to play a vital role in securing infrastructure and similar interests, McCaffrey said, adding that the technologies needed to manage the nation's electrical grid are among critical contributions to national security from the labs. "These institutions are absolute national treasures. I think they're doing a substantial amount of genuine pure science research in our country, and that without them, we would be in peril," he said. "It's astonishing what you're doing for the country."

The National Security Speaker Series brings senior policy officials and former officials to Sandia to share their thoughts and interact with Sandians on security issues important to the nation. The goal of the series is to increase understanding of the unique role and contribution of the national laboratories to national security strategy in the post-Cold War environment.

McCaffrey's seven principal challenges to global security:

- **The proliferation of nuclear, biological, and chemical weapons**
- **Regional war among nation states**
- **Civil war and failed states**
- **International terrorism**
- **Global recession and poverty**
- **International crime and drug cartels**
- **Humanitarian crises and refugees.**

If you would like to view the whole talk, it is available online on Sandia's internal web at: https://sharepoint.sandia.gov/sites/NSSS/April12.aspx

RETIRED GEN. BARRY McCAFFREY speaks with Labs Director Paul Hommert, right, and Deputy Labs Director Jerry McDowell before his presentation to Sandia in the Bldg. 810 auditorium. (Photo by Randy Montoya)

Dr. Damron says 'Live the dash'

By Iris Aboytes

United Way of Central New Mexico recently announced Sandia's contributions to the community through Sandia's ECP campaign as $4.3 million. On the heels of that record-setting number, Community Involvement (3652) at a celebration breakfast announced Community Service Award and President's Volunteer Service Award winners.

The President's Council on Service and Civic Participation created the President's Volunteer Service Award program as a way to thank and honor Americans who engage in volunteer service. The award recognizes individuals, families, and groups who have volunteered more than 100 hours.

Sandia had 287 employees who volunteered more than 100 hours and received this year's award.

The Community Service Award program was developed by Sandia to provide financial support for nonprofit agencies where employees volunteer. Volunteers donating 100, 250, or 500 hours to a single agency in a calendar year are eligible. After appropriate paperwork is completed, an award of $100, $250, or $500 is given to each agency. This year Sandia gave a total of $20,600. Not only were the agencies helped by the volunteers, but Sandia also donated money.

Employees, retirees, and contractors log their volunteer hours in the Sandia Serves Volunteer Tracking Database. For calendar year 2010, 881 Sandians logged in 121,213 hours.

"I love my job," says Patty Zamora (3652), volunteer program coordinator. "I take pride in knowing that I work with people who care so deeply and know the importance of giving back to their community."

Dr. Barbara Damron, associate professor at the University of New Mexico Cancer Center and College of Nursing, was the featured speaker at the breakfast. She has been active in the field of oncology for more than 30 years.

Damron talked about volunteers being the face of Sandia. "Volunteers speak to the goodness and wonderful reputation of Sandia," she said. "I tell people they have to — live the dash. When you die, your headstone has the date you were born, a dash, and the day you die. It is the dash that is filled with your life. It is that part that we have to make count. It covers all things in your life. That is where volunteering belongs."

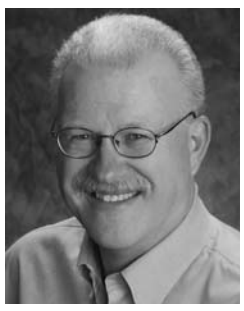
She talked about how the best way to meet the needs in the community is through volunteerism. "As volunteers, you truly make where you live and work better," Damron said.

"Lockheed Martin has been impressed with Sandia's program and is using our example to encourage volunteering in their other companies," says Community Involvement Manager Amy Tapia (3652).

DR. BARBARA DAMRON, guest speaker at Sandia's annual volunteer breakfast, offers words of inspiration and motivation.

Mileposts

New Mexico *photos by Michelle Fleming*
California *photos by Randy Wong*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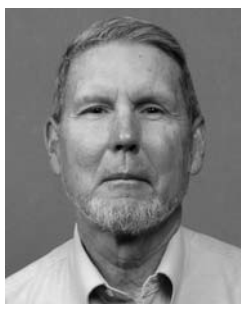
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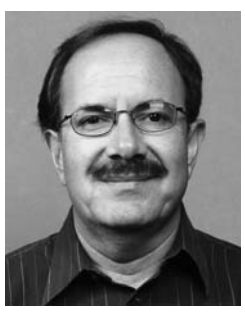
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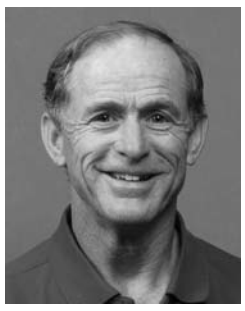
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Daniel Urenda
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Nisa Brown
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Bion Merchant
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Alan Williams
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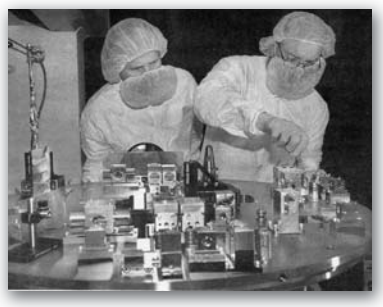
SEVERAL SANDIANS inspect a sled following its run on the six-mile Holloman sled track.

50 years ago . . . Last month a Sandia designed and developed **rocket sled made two successful runs on the Holloman six-mile track.** These firings were the first under a new AEC-ARDC (Air Research and Development Command) contract. A total of 18 components being tested for effects of high initial acceleration, were carried by the sled in the two firings.

30 years ago . . . At a brief ceremony, **ground was broken for construction of a new PBFA-II laboratory.** The new building, east of PBFA-I, will be both a high bay and light lab structure similar to Bldg. 981, which houses PBFA-I. "Theoretically," said Gerry Yonas, Director of Pulsed Power Programs 4200, "PBFA-II would produce 100 terawatts, four megavolts at 25 mega-amps in a 40-nanosecond pulse with an output of 3.5 megajoules at the target center."

20 years ago . . . Sandia, Livermore celebrated its 35th anniversary. Sandia researchers developed new solid-state radioluminescent (RL) lights, a Sandia technology that may improve on the safety, reliability, and lifetime of existing RL lighting systems. The new lights might be useful for optical computing and photonics, as instrumentation lights on a space station, or as long-life power sources in weapons or deep space probes.

10 years ago . . . Some years ago, Sandia/California showed that extreme ultraviolet light (EUVL) could be used to break "the visible light barrier" and produce integrated circuit features that were smaller than previously possible. **Today EUVL is a reality.** The prototype, known as the Engineering Test Stand, is producing wafers successfully at its Sandia/California home. Next-generation EUVL technology will reduce still further the size of transistors, resistors, and other chip components.


SANDIA RESEARCHERS make fine adjustments to the Extreme Ultraviolet Lithography (EUVL) test stand. EUVL technology allows microelectronic feature sizes in the nanometer range. (Photo by Randy Montoya)

LM Voice is open

LM Voice
Powered by employees

Want to influence leadership's decisions?

All you need is 20 minutes and an Internet connection

LM Voice, Sandia's new and improved employee survey, is now open through April 29. Don't miss this quick, confidential opportunity to let leaders know what you think.

LM Voice is a way to share your thoughts about important aspects of your experience at Sandia, such as diversity, ethics, career development, leadership, job satisfaction, and other topics.

You should have already received an email invitation with your personal, confidential password and instructions on how to participate. You can charge your primary project and task to take this survey since the time is considered incidental. Should you have any questions about which project and task to use, contact your manager.

Your leaders will carefully consider your feedback to understand what's going well and what could be better. Survey results will be shared with all employees, and executives at director level and above will be responsible for implementing action plans to address the feedback received. Make sure to add your voice so your leader can make the best decisions for your team.

Alternative Fuels Challenge

29 teams of middle school students from around New Mexico competed in the fifth annual Alternative Fuels Challenge on April 16. The event is sponsored by Sandia, Albuquerque Public Schools, PNM, and Los Alamos National Laboratory. Student teams designed a car powered by a hydrogen fuel cell. The competition includes racing, design, oral presentation, and a written essay. This competition gives students a chance to explore engineering and scientific principles in a real-life application. Teams from Kennedy Middle School took first and third overall honors and a team from Alta Vista Middle School in Carlsbad placed second.


THE RACE IS ON — *Two students prepare to race their vehicles during the annual Alternative Fuels Challenge.*

Sandia breaks ground on 11th Habitat for Humanity house for the Peña family

Story by Iris Aboytes • Photos by Patty Zamora

RAISING WALLS — Sandia volunteers begin to make the Peña home a reality.

CANDY AND ALBERT are all smiles as their home takes shape.

"Oh, my God. I am blessed, blessed, blessed. I can't believe I am going to have my own home. Now I don't have to worry who is going to take care of my son, Albert."

— Susana (Candy) Peña

Groundbreaking for Sandia/Lockheed Martin's 11th Habitat for Humanity house was held April 9. Plans are for the house to be completed by the end of July. The house will be built for Susana (Candy) Peña by more than 250 Sandia employees, contractors, family members, and retirees. Once again, Sandia's retirees have stepped to the plate, contributing financially to the building of the home. Sandia retiree Bob Reiden is job captain for the build.

Peña says she applied for a Habitat home three years ago. "I can't believe it is finally going to happen," she says. "When I was 40 years old, I was blessed by having Albert. Now I will be blessed again by having my own home."

As a school bus driver for special needs children for 14 years, Peña was able to take her son with her. "I always had a car seat in the bus," she says. "My life revolves around my son. Albert loves to read, but is not so crazy about math. I make sure he does all his homework. Since he loves basketball, I already enrolled him in a summer league.

"I have been a smoker since I was 15, but 2 months, 3 days ago, Albert asked me to stop smoking and I did — cold turkey. People ask me how I did it. I did it for Albert."

Peña currently lives in a mobile home that is breaking down. Her mother, Magdalena (Maggie), lives next door. Maggie is the attendant in the bus that Peña drives.

"My mom has been an attendant for 25 years, but she recently injured her knee, so it is hard for her to work," Peña says. "I would like for her to retire and stay home. I am trying to persuade her to come and stay with me so I can keep a closer eye on her. I have four brothers but no sisters, so it is up to me to care for her.

"I love to cook and many weekends have a big dinner for all my family. My brothers love my meatloaf."

Peña is responsible for 500 hours of sweat equity, so she will be on the building site most days her house is being built. Once the house is finished, Peña will buy the home from Habitat for no profit, with a 0-percent-interest loan.

"I am the happiest mom in the world," says Peña. "I have a son, a wonderful family, and now I am getting my own home built by wonderful and caring people."

To volunteer, see the attached schedule below. Retirees are welcome to volunteer and join the build of this home.

AN OVERWHELMED Candy thanks the volunteers.

Build Schedule for Habitat home at 6443 Trujillo Road SW

Work Period *	Division and contact	Date	Task	Number of Vol.
1st	9000 Stan Hall	Friday, April 8	Assemble Walls	15
		Saturday, April 9	Groundbreaking/Wall Raising	20
2nd	4000 Robert Otero	Friday, April 15	Finish Walls – Sheathing	10
		Saturday, April 16	Set Trusses – Sheathing	20
NO WORK		**4/22 – 4/23**	**EASTER WEEKEND**	**0**
3rd	1000 T.J. Mannos	Friday, April 29	Sub Facial-Start Deck – Misc.	10
		Saturday, April 30	Deck & Underlay(roof), Drywall, Frame	20
4th	5000 Darick Lewis	Friday, May 6	Start Shingles	10
		Saturday, May 7	Finish Shingles – Sheathing - Windows	15
5th	2000 Fran Current	Friday, May 13	Soffits – Sheathing	10
		Saturday, May 14	Finish Frame – Shingle – Misc.	15
6th	9000 Stan Hall	Friday, May 20	Hang Ceiling Rock	20
		Saturday, May 21	Finish Hanging Rock	20
NO WORK		**5/27 – 5/28**	**MEMORIAL WEEKEND**	**0**
7th	10000 Lynne Adams	Friday, June 3	Paint Wall & Ceiling	15
		Saturday, June 4	Hang Doors – Trim – Fence	15
8th	3000 Kayleen Vahle	Friday, June 10	Finish Interior Paint	15
		Saturday, June 11	Underlayment – Landscaping	15
9th	11000 Brianne Tafoya & Lynda Sue Walker	Friday, June 17	Cabinets/Flooring	10
		Saturday, June 18	Detail & Punch	10
10th		TBD	TBD	
11th		TBD	TBD	
12th		TBD	Dedication	

*This Build Schedule is only **TENTATIVE** because of such factors as weather, waiting for subcontractors and inspections, etc.