

Sandia aids cleanup of Iraqi nuclear facilities, rad waste

Labs' work focuses on tech transfer of knowledge

By Michael Padilla

Sandia scientists are helping train Iraqi scientists and technicians to clean up radioactively contaminated sites and safely dispose of the radioactive wastes as part of the Iraqi Nuclear Facility Dismantlement and Disposal Program.

The Sandia work is a technical transfer of skills and knowledge that the Labs use day to day, says principal investigator John Cochran (6765). As an example of this, Sandia has transferred its Rad Worker II training materials to the government of Iraq.

The Iraqi Nuclear Facility Dismantlement and Disposal Program (the Iraqi NDs Program) was initiated by the US Department of State to assist Iraq in eliminating the threats from poorly controlled radioactive materials, John says. The current activities build on two years of cooperative efforts coordinated by the International Atomic Energy Agency in Vienna with support by donor countries. The State Department is coordinating the US government assistance from Sandia, DOE, Texas Tech University, the Environmental Protection Agency, the Nuclear Regulatory Commission, and others.

Iraqi area of concern

The program focuses on the Al Tuwaitha nuclear complex near Baghdad, which contains major facilities left from Saddam Hussein's dictatorship. The nuclear complex covers more than a square kilometer and includes the remains

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The program focuses on the Al Tuwaitha nuclear complex near Baghdad.



NTS TOUR — Iraqi government officials have toured two operating radioactive waste disposal facilities in locations with a climatic and geohydrologic conditions similar to those in Iraq. Here John Cochran, second from left, leads a tour of the Nevada Test Site.

ECP, SHARE campaigns to begin



- ECP campaign is Oct. 4-26
- SHARE campaign is Sept. 29-Oct. 22

See stories on pages 6-7.

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Managed by Lockheed Martin for the National Nuclear Security Administration

HRCs to begin reporting to HR Division on Oct. 1 New business partner model designed to improve HR services

Next week, 10 Human Resources Consultants (HRCs) and two HRC assistants now reporting to various divisions at Sandia/New Mexico will begin reporting to Human Resources Div. 3000 in a move designed to provide line customers with better, more efficient, and more consistent HR services.

The HRCs will get new titles as well — Human Resources Business Partners (HRBPs) — reflective of their evolving roles.

Although the HRBPs will continue to work in the line organizations to which they are assigned, HR & Communications VP John Slipke (3000) says the new reporting relationship will allow for improved communication, common training and professional development, and an ability to draw on the collective wisdom of the HR division, which will enable the HRBPs to better serve the needs of their organizations.

“Our goal will be to provide the right skills at the right place at the right time so our customers

(Continued on page 4)

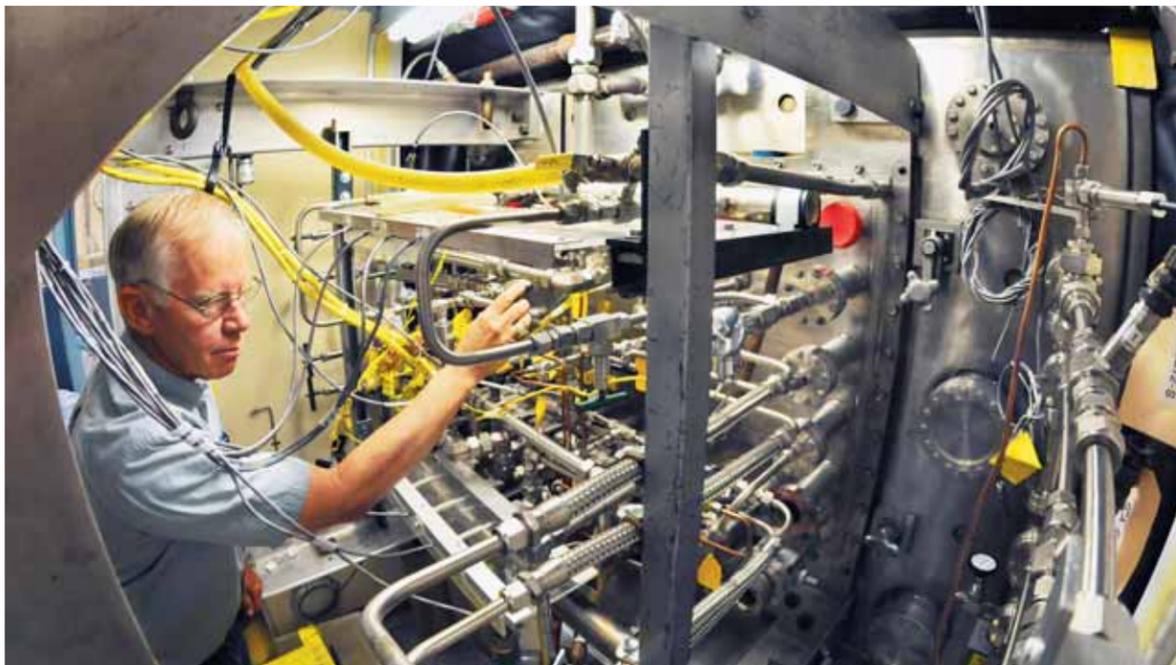


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'A small star on earth'

Sandia qualifies forward wall of ITER fusion machine as fit-for-use



JIM McDONALD checks calorimetry diagnostics for the cooling system supporting first-wall tiles qualified by Sandia as fit for installation at the \$14 billion ITER fusion machine under construction in Cadarache, France. (Photo by Randy Montoya)

By Neal Singer

Two prototype systems expected to help contain plasma exceeding 100 million kelvin have been qualified as fit-for-use by Sandia researchers. The systems, each fronted by tiles with a heat absorption system behind them, are from the US and the European Union.

The plasma will be housed at the \$14 billion International Thermonuclear Experimental Reactor (ITER) in southern France. The 10-story-high machine — the world's first burning plasma device — is intended to show that electrical energy can be harvested essentially from seawater, the most widespread material on Earth.

ITER also happens to be a Latin word that means “the

path” or “the way.”

ITER, expected online in 2019, will provide a different path to nuclear fusion from the nanosecond compression of tiny capsules of hydrogen isotopes caused by the megagauss magnetic fields generated by Sandia's Z machine.

Instead, ITER's task will be to show that stable magnetic fields in the 50 to 130 kilogauss range — generated by the most powerful magnet of its type on Earth, twice as powerful as CERN's — can contain a heated plasma of deuterium and tritium for a long time in a large volume. That would be six times hotter than the sun's 15 million K core, for roughly 15 minutes, in a containment device called a torus that resembles an elliptical donut with a major axis of 6.2 meters and a

(Continued on page 4)

That's that

Do you remember the story we ran in the *Lab News* a few months ago (Jan. 4, 2008) about the young woman – a girl, really – who had competed in the 2004 Paralympics in Athens, winning three gold medals in swimming at age 12? That young woman, Jessica Long, spoke at Sandia last December in observance of Disabilities Awareness Month. Her story is a remarkable one, and she shared it with Sandians, who were moved and inspired by her courage and charmed by her winning personality. Well, Jessica, who's now 16, just competed in the 2008 Paralympics in Beijing and captured another four gold medals. That caught my eye and sent me scrambling back to our *Lab News* story and to the video of Jessica's Sandia presentation. If you didn't get a chance to see her in person or see the video previously, I'd strongly encourage you to do so now. You can see it on Sandia's internal web at <http://ln.sandia.gov/jessica-long>.

Jessica's story in a nutshell is this: She was born in Russia to a single mother. She had severe deformities in her legs and her mother, unable to provide the care she needed, placed Tatiana – that was her name then – in an orphanage. An American couple adopted her at 13 months and embarked Jessica on a series of surgeries, including the amputation of both legs at the knees.

Jessica Tatiana Long was an active child, determined to do everything every other kid does: running, climbing, jumping – everything. She really found her element in the swimming pool and by age 12 was already one of the world's top disabled swimmers. Besides winning gold medals in Athens and now Beijing, Jessica is the recipient of the Amateur Athletic Association's Sullivan Award, which honors America's top amateur athlete – not the top disabled athlete, but top athlete, period. As a Sullivan honoree Jessica finds herself in the company of such notables as Mark Spitz, Jackie Joyner-Kersey, Michelle Kwan, and, yes, Michael Phelps.

A note about the Paralympics: As Jessica pointed out, many people equate the Paralympics with the Special Olympics. They're not the same. The Special Olympics – which Jessica called a wonderful program – is conducted for individuals with intellectual disabilities; everyone who participates is treated as a winner. The Paralympics Games, always held in the same venue as the quadrennial Olympics, is highly competitive and fiercely contested. The champions who emerge are world-class athletes by every measure. How fierce is the competition? Well, Jessica sometimes wears a T-shirt that says: "I'm a girl. I'm an athlete. Swimming is my sport. Prepare to be humiliated." She likes to win, and says so.

Oh, and here's a little tidbit: Jessica's hometown is Baltimore, Md. So is Michael Phelps'. Must be something in the water.

* * *

Say, have you been following the roll-out and first firings of the Large Hadron Collider, the LHC? It's the world's most powerful particle accelerator, designed to facilitate some amazing physics research. (An aside: Going back almost 20 years now, the US was building the supercollider superconductor, which if completed would have dwarfed even the LHC. It was derailed by politics and – to my mind – misplaced and short-sighted priorities.) As some of you have probably read, the LHC is having a few shakedown problems – nothing unusual for an engineering project of this scale. Anyway, if you want to get a pretty good layman's sense of what the LHC is all about, you might get a kick out of a rap video produced by a bunch of CERN employees. The link to the four-minute video is here: <http://tinyurl.com/477h4q>. These folks are obviously having way too much fun. I dare anyone here at Sandia to do something similar. If you do, we'll see that you get an audience.

See you next time.

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

Employee death

Do-It-Now team member leaves legacy of honor

George Paul (4843-1), DIN (Do-It-Now) team lead, died on Sept. 18. He was 60 years old. He had been at Sandia 37 years.

"George made outstanding contributions to the success of the DIN team," says his manager, Ernest Nevada. "He had an impeccable work ethic, craft skills, and customer focus. He arrived at 5 a.m. daily and was always the last to leave.

"He served his fellow workers in varying leadership roles with the Metal Trades Council, all while seeking to achieve win-win situations with great professionalism. He earned the respect of both management and peers.



GEORGE PAUL leaves legacy of honor.

George's sense of civic duty was equally important, as he was ever-present as a poll official during elections."

Leroy Garcia (4843-1) says he was privileged to work with George for

the past 34 years. "He had a big heart," says Leroy. "It seemed as though he was driven by a powerful conscience that inspired him to do his best and make things better for those who were fortunate enough to be around him. He was a strong man who had a high level of integrity with strong values. He was the backbone of Sandia's DIN team. George was no pushover. He was a team player who always put the needs of his customers and others before his own. He stood firm with resolve when debating critical issues."

"I was blessed to call George Paul my friend," says Cheryl DesJardins (1381). "The very essence of George was humility, service, honor, selflessness, and pride – in his family, his creator, and his country. He was a phenomenal human being."

For Freddie Martinez (4843-2) George was a great leader and mentor. "It was not unusual for us to come in at two or three in the morning and get work done before our customer arrived," says Freddie. "George was the first one to remember your birthday and offer to buy your lunch, or at least coffee. He was a great family man. He would always take vacation during the Christmas holidays so he could care for his grandchildren."

"George was a man of integrity," says Sherry Dann (4843-4). "His work ethics were outstanding and rare. He would go the extra mile if you needed something done. I enjoyed our conversations and will miss him."

"He will be remembered for his sense of duty, his unwavering commitment to doing what was right, and his concern and respect for his fellow man," says Ernest. "Through the humble principles with which he lived his life, he inspired others to be the best they could be. George's legacy is one of honor."

– Iris Aboytes

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NNSA Albuquerque Service Center's Joseph Romero wins first Linton Brooks medal

NNSA Administrator Thomas D'Agostino has announced that Joseph Romero, a general engineer at the NNSA Service Center in Albuquerque, will receive the first Linton F. Brooks Medal for Public Service.

"Joe contributed greatly to developing and implementing new business system models in support of NNSA's nuclear nonproliferation programs," said D'Agostino. "His drive and commitment to our important national security work is an excellent example of Ambassador Brooks' work ethic and dedication to public service."

Romero's accomplishments have included developing an improved process for approving and implementing changes to NNSA's Second Line of Defense contracts and implementing a management and tracking tool that ensures that critical contracting actions for NNSA's Global Threat Reduction Initiative are addressed in a timely manner. His work has helped NNSA and American taxpayers save money. A Marine Corps veteran and graduate of the University of New Mexico, he has been with NNSA since 2006.

The Linton F. Brooks Medal for Public Service was established to recognize those employees whose actions and deeds serve to exemplify the spirit of public service, commitment, and achievement manifested during the leadership tenure of NNSA's past administrator, Ambassador Linton F. Brooks. Recipients of the award must have less than five years of federal and professional experience.

Sandia/California launches podcast to reach new audiences

By Patti Koning

If you want to learn more about exciting research happening at Sandia/California, you can now do so on an airplane, in the gym, or anywhere else you can take an MP3 player.

That's because this month the Public Relations Office at Sandia/California launched a monthly podcast, which debuted with an interview with Todd Lane (8321) on algae biofuels research.

"We're always looking for innovative ways to reach new audiences, and we are all aware of the new media out there — the almost daily innovations happening on the web," says Mike Janes (8528), public relations officer for Sandia's California site. "When you consider how inexpensive a podcast is to produce, it was a no-brainer."

According to Wikipedia, a podcast is a series of audio or video digital-media files distributed over the Internet by syndicated download, through Web feeds, to portable media players and personal computers. Though the same content may also be made available by direct download or streaming, a podcast is distinguished from other digital-media formats by its ability to be syndicated, subscribed to, and downloaded automatically when new content is added.

Neal Fornaciari, manager of Visualization and Scientific Computing Dept. 8963, describes the podcasts as a

Sandia California News

great new tool. "It's important to embrace new technology to reach a younger and broader audience," he adds. "I think this will help us do that."

The Sandia podcasts are a collaboration between the Public Relations and Strategic Communication Department (8528) and Collaborative Applications Development and Integration (8944). "We've been talking about podcasting for years and just looking for the right vehicle," says Joe Lewis (8944), lead web developer for WebCo California. "Podcasting has become very impor-



SAY WHAT? — Sandia/California public relations officer Mike Janes interviews computer scientist and gaming expert Donna Djordjevich for a future "Sandia Now" audio podcast episode. Mike and his colleagues in Sandia's web development department plan on offering a new podcast episode each month, a venture that they anticipate will reach and inform a variety of external audiences. (Photo by Randy Wong)

tant in the modern web culture. This was a great opportunity because Mike was looking for a way to replace the *Sandia Now* television program, which flows nicely into a podcast format."

Mike hosted *Sandia Now*, a 30-minute television show focusing on current Sandia research that appeared on community television, for five years. The program was cancelled about a year ago due to Integrated Enabling Services (IES) budget cuts.

Podcasting is very flexible in many ways. The programs have no set length so they can be as long as the topic warrants, although Mike says most will be between 15 and 30 minutes. Joe created the standard front and back matter, which includes the *Sandia Now* jingle and an introduction from Mike, so now the content — an interview between Mike and a researcher — is simply dropped in place.

"I think the podcasts will aid recruiting," says Mike. "They will reach the whole gamut of external audiences — current partners and constituents, potential recruits and business partners, along with anyone interested in science."

Joe adds that the podcasts should appeal to the so-called Millennials, the generation born in the 1980s and 1990s and the first to grow up surrounded by digital media. "Most people in their 20s growing up in America have lived in a world where personal computers and the Internet have been commonplace," he says.

Sandia is not the only national laboratory getting into the podcasting game; Pacific Northwest National Laboratory and Oak Ridge National Laboratory have regular podcasts. (In fact, you can find a podcast on almost any topic under the sun — APS Stamp Talk, Napoleon 101, or the Alaska Real Estate Podshow.)

The process is simple. Mike chooses an interview topic, records the interview with a digital audio recorder, and then passes the file onto Joe. The podcast version can be ready for consumption the same day as the interview.

There is almost no editing of the interview. "It's meant to be a conversation, what we in the media business call 'live to tape,'" Mike explains.

In addition to monthly podcasts, Mike is resurrecting the *Sandia Now* brand with video clips that will be available on Sandia's website and through the iTunes Music Store. Video clips on the Sandia Heuristic Intelligent Network Imaging tool (SHINI) and enzyme engineering are available now and Mike is working on an update of work at the Bay Area's Joint Bio Engineering Institute (JBEI).

"Now that we've got this program off the ground, our goal is to integrate the podcasts and video clips into all of our communications tools," he adds. Such integration would include links to podcasts and video clips in online versions of *Sandia Lab News* and news releases.

You can find the Sandia podcasts and video clips at www.ca.sandia.gov/podcast/ or in the iTunes Music Store, search for Sandia. To suggest a topic for a future podcast, contact Mike Janes at 925-294-2447 or mejanes@sandia.gov.

In New Mexico . . .

Sandia recognizes five green-certified buildings in ceremony

Buildings awarded LEED New Construction certification

By Chris Burroughs

Sandia recently recognized five green-certified buildings in a brief ceremony organized by the Labs' Environmental Planning Department.

The buildings have been awarded Leadership in Energy and Environmental Design (LEED®) — New Construction (NC) building certification given by the US Green Building Council. LEED is a standard that recognizes the environmental and energy performance, use of materials and resources, and indoor environmental quality of a building. Sandia has more than 600,000 square feet of LEED-NC-certified space, equivalent to 10 percent of the Labs' total building footprint.

Three of the five buildings are part of Microsystems and Engineering Sciences Applications (MESA) complex dedicated to the advancement of microelectromechanical systems (MEMS). The buildings were planned to be the cornerstone of a campus-style technical area. The MESA complex of four new buildings includes about 377,000 square feet on a 30-acre site. It is dedicated to the design, analysis, prototyping, development, and qualification of MEMS components.

"The LEED rating system is a prestigious, independent recognition that a building has achieved the highest level of environmental performance," says Jack Mizner (4131), who coordinated the LEED celebration event. "These buildings also provide a healthful, resource-efficient, and productive environment for our workforce."

Sandia's LEED-NC certified buildings include:

- **MESA MicroFab facility** (LEED-NC certified), the first microchip fabrication facility in the world to obtain the LEED certification. The microfab includes sophisticated safety systems and controls because of the hazardous materials used in the production of semiconductors. The facility provides clean rooms and transition clean room space, support labs, chemical and specialty gas rooms, and a service yard.



LEED CERTIFICATION — The Center for Integrated Nanotechnology (CINT) is one of five Sandia buildings recently awarded Leadership in Energy and Environmental Design (LEED) building certification given by the US Green Building Council.

- **MESA Microsystems Laboratory** (LEED-NC silver), dedicated to light labs for chemical, electrical, and laser work. The lab provides facilities for research and development of MEMS components, rapid prototyping, and testing of integrated systems. The building maximizes natural lighting into occupied spaces by placing the sensitive labs on the interior of the building. All offices have windows that provide day lighting from the skylights above. On the south elevation, a sunscreen provides shading along all the offices.

- **MESA Weapons Integration Facility (WIF)** (LEED-NC silver), a three-story building that consists of a classified and an unclassified portion. The classified portion houses weapons, computational, and engineering sciences (C&ES) and microsystems staff

and will facilitate design, system integration, and qualification of weapons systems. The unclassified portion houses C&ES staff and MESA partners. The building is designed to foster collaboration among partners from industry, academia, and Sandia scientists and engineers. The WIF facility is integrated into the MESA campus design and shares many of the green features of the other new buildings.

- **Joint Computational Engineering Laboratory (JCEL)** (LEED-NC silver), a 66,143-square-foot office/computational facility designed to accommodate classified work. It is the first building at Sandia that incorporates sustainable

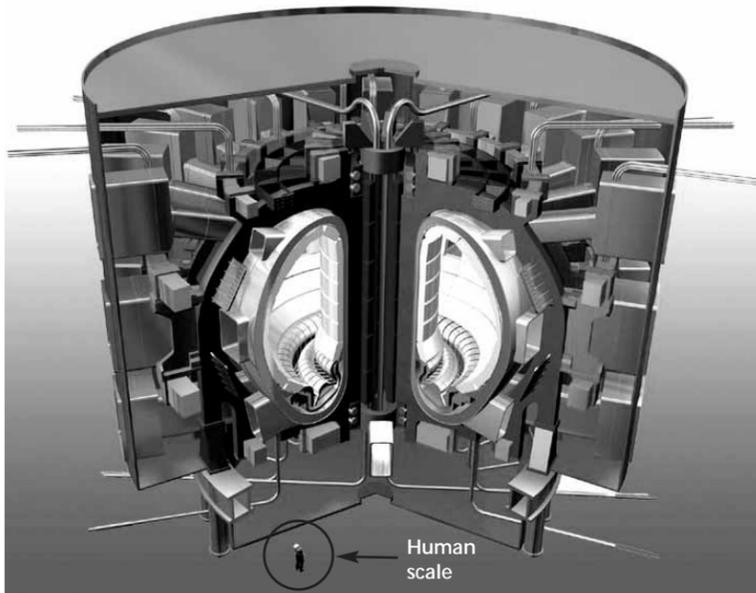
design from the beginning of the project.

- **Center for Integrated Nanotechnology (CINT)** (LEED-NC certified), a 97,294 square-foot facility that houses both labs and office space for research into advanced nanotechnology. Using LEED as a central design guide, this sustainable facility maximizes site potential, water use and preservation, energy conservation and appropriate energy building materials selection, and indoor environmental quality.

Sandia has two additional building projects currently registered under the LEED-NC program. Sandia is also planning to "green" its existing facilities using the LEED rating system. The goal is to certify one or more buildings each year under the LEED Existing Building (EB) or LEED Commercial Interior (CI) rating systems.

Sandia and ITER

(Continued from page 1)



HOW BIG IS ITER? — This cutaway image depicts the ITER reactor with a human visitor drawn in to provide a sense of scale. The D-shaped area is the torus that will house the plasma. (Published with permission of ITER)

volume of 500 cubic meters.

The systems tested by Sandians have a dual purpose.

Their tiles will form the first line of defense for ITER's nuclear shield modules that protect the magnets and vacuum vessel from neutron damage.

The systems also absorb plasma ions, energetic neutral atoms, and X-rays while minimizing the amount of contamination reentering the plasma. The energy absorbed is transmitted through a mostly copper support structure to pipes containing a water coolant.

In a power plant, helium coolant would spin turbines

to generate electricity.

To test the response of the system and its ability to withstand heat fatigue, Sandia researchers rastered an electron beam over the mostly beryllium tile surface.

Infrared cameras observed heat distribution and whether any tiles came loose from their heat-sink backing.

The system endured more than 140 watts of energy deposited on each square centimeter of tiles — the equivalent of 1.4 megawatts over a square meter.

"These are not solar panels," says Dennis Youchison (1658) of the test output heat intensity. "This is nuclear fusion. This will be a small star on Earth."

There will be 468 of the tile-fronted systems, one for each nuclear (basically, neutron) shield module in ITER. Eighteen minor variations in module size are required to completely cover the complex torus surface of 500 square meters.

Each one-meter system will be covered by about 800 50-millimeter-square tiles.

To the plasma, "It will look like a fully tiled wall in an ancient Roman bath," says Dennis.

The tiles will be supported by a copper backing strengthened by the addition of chrome and zirconium. The metal support, almost as strong as steel, will have four times steel's thermal conductivity, important in removing heat absorbed by the tiles through the metal support structure. By design, the tile temperature will vary between 100 and 340 degrees C, setting a new standard for heat sinks in a nuclear environment with plasma flux.

The US tiles are mortared to their heat sink by thin layers of titanium and copper, diffused together at high temperatures.

"The toughness and stability of the joining layer is

the heart of the technology developed by Sandia for the US tiles," says Mike Ulrickson (1658), Sandia project lead. "This is the first time anyone has created a heat sink that can handle this intense an environment."

Only Sandia and the European Union lab BESTH in the Czech Republic are approved by the ITER international organization to test the prototype systems, pairs of which will be made in Russia, China, Korea, and Japan, in addition to the EU and US.

The Czech lab uses a radiative, ohmic heater.

"Because of our e-beams, we can see the entire surface during testing," says Dennis. "Tiles in the Czech lab are covered up with their heater. They can run unattended, but they could have a tile melt and not know it."

Sandia has a unique capability in engineering, testing, design, and process development. Roughly 20 people at Sandia in Centers 8700, 1600, and 1700 do thermal hydraulic analysis, electromagnetic calculations, stress analysis, materials and joining, applied physics, and plasma wall interactions to support the final design for ITER.

In ITER's later stages, the 0.5-meter-thick steel nuclear shield is expected to be replaced with a lithium "blanket" equally thick that will make lemonade out of lemons, so to speak, from the dangerous neutrons — almost all of which will penetrate beyond the tile wall. Instead of merely absorbing the neutrons, as will the steel shield, lithium will utilize neutrons to breed tritium gas, which can then be pumped back into the plasma for fusion purposes.

Initially, ITER's tritium will be imported rather than produced internally by the machine.

Should ITER succeed, demonstration power plants based on the ITER model (and lessons learned from it) are expected to be built among the ITER partners during the decade of the 2030s.

Sandia property coordinators locate 100 percent of items in 2008 statistical inventory

By Chris Burroughs

For the first time in anyone's memory, Sandia property coordinators located 100 percent of items selected for inventory review this summer.

"We're thrilled," says Barbara Bays (10267), who leads the inventory team. "Every year we get better and better at finding inventory, and this year we did exceptionally well."

Attractive property and equipment

NNSA requires Sandia to do "wall-to-wall" inventory checks every fourth year, which means all of the Labs'

HR consultants

(Continued from page 1)

— those who use HR services at Sandia — can achieve their business objectives," says Anna McKee, manager of HR Business Partnership Dept. 3503, to whom the HRBPs will report.

Officially, the change is part of Sandia's workforce functional alignment initiative, through which some 500 finance and other business management personnel now supporting the divisions have been more closely aligned with Div. 10000 — the organization that owns the policies and provides the direction and oversight for their function (*Lab News*, May 23, 2008).

The transition to an HRBP model also is indicative of a long-term strategy to standardize Sandia's HR processes so that policies, practices, and even salaries can be applied more equitably and fairly across the Labs, John says.

Although the HRC model served the line organizations well for many years, the new model will prove to be more effective in modern times, he says.

"Sandia's future success will depend on an ability to attract and develop talent, work in flexible team structures, and standardize HR processes," he says. "This will require us in HR to get better and faster at aligning talent with Sandia's business strategy. The HRBP model is one way we are doing that."

The HRBPs at Sandia/California will continue to report to Center 8500. — John German

assets must be accounted for. The other years it is required to do statistical checks, where property is randomly selected for the inventory process based on how many assets Sandia is known to have in the "attractive" property and "equipment" categories, past inventory shortages, and NNSA goals.

Attractive property includes items like computers of any kind, Blackberrys, cameras, and projectors. Equipment includes assets valued at \$7,500 or more.

This year — a statistical inventory year — 1,587 items were selected to be inventoried, including 652 equipment assets and 935 attractive assets.

Each year Sandia property coordinators improve their efforts at finding property, Barbara says. During the wall-to-wall inventory review in 2003, a total of 459 property items could not be located. That number was reduced by more than half to 157 in the 2007 wall-to-wall inventory.

Statistical years showed similar improvements. In 2006 three items could not be found. By 2008, 100 percent of the items were located.

A complex process

Barbara says that even in statistical years the month-long inventory process is complicated.

It starts with 300 property coordinators — people throughout the Labs appointed by department managers — attending a morning training session where they learn timeframes, procedures, and requirements. In the afternoon they receive the list of items they are to inventory.

The coordinators go back to their departments where they track down the equipment, run it through scanners, and return the scanners to Property Management for inventory inclusion.

"The amount of assets to be inventoried by each department depends on the department size and amount of property it has," Barbara says. "Some departments only have to locate one item in a statistical year; others have to find hundreds."

During the entire month Barbara and her team troubleshoot, helping departments find assets or figure out what happened to them. For example, they can help determine if a computer listed in the system was returned to a vendor.

"We put everything in place," Barbara says, "but the property coordinators are out there hitting the pavement and getting it done."

Sandia entrepreneurs take wing under angels at TVC

Technology Ventures Corporation will be hosting an event for inventors and entrepreneurs who want help in getting their idea off the ground. Past successful presenters at TVC's annual New Mexico Equity Capital Symposium will be on hand to talk about their experience in forming and funding a venture-backed technology company. Complimentary refreshments will be provided. The event is Thursday, Oct. 2, 11:30 a.m.-1:15 p.m. or 4:30-6 p.m. at Emcore Corp. in Bldg. 2 at the Sandia Science & Technology Park (Research Road at Eubank SE).

TVC's assistance has led to the licensing of Sandia technology to 11 entrepreneurs in less than five years. These 11 have gone on to create new companies and jobs for the state of New Mexico. The Sandia-related companies were all presenters at one of TVC's annual New Mexico Equity Capital Symposia.

Take the case of Randy Normann. He successfully licensed technology from Sandia to form his company, Perma Tools Inc., which builds high temperature electronics for deep-hole well-logging and drilling tools. Randy is the latest person to take advantage of Sandia's entrepreneurial leave program and was a presenter at TVC's 2008 symposium. Randy's company will be based in Albuquerque. TVC played a significant role in the formation of this company, assisting with intellectual property and business plan development.

Advent Solar licensed Sandia technology based on the inventions of James Gee, a Sandia technologist who separated from Sandia under the entrepreneurial leave program. James and Advent Solar founder Rusty Schmit went on to raise more than \$113 million in equity financing. Schmit was a presenter at TVC's 2004 symposium. Advent Solar seeks to become a leading manufacturer of solar cells and modules.

Sandia inventors or entrepreneurs seeking to get started in the business world or already-formed technology companies seeking capital can meet the TVC team and find out what they can do to help create, start, or grow technology. TVC helps take innovations to market, assisting entrepreneurs in all of the steps along the way: creating great products, building successful companies, and assisting with access to capital. TVC's help is always free.

For information, go to www.techventures.org or call 505-843-4110.

Aiding Iraq

(Continued from page 1)



JOHN COCHRAN demonstrates the pump used to extract groundwater samples from 150 m deep monitoring wells at Sandia. (Photo by Michael Padilla)

of two research reactors, a fuel fabrication facility, plutonium separation facilities, and other infrastructure. The Osiraq research reactor at Al Tuwaitha was bombed by Israel in 1981 and the IRT-5000 research reactor was bombed and disabled during Operation Desert Storm in 1991.

In 2003, following Operation Iraqi Freedom, looters removed contaminated scrap metal and dozens of 50-gallon barrels that contained yellowcake uranium. The looters poured yellowcake on the ground and in the waterways surrounding Al Tuwaitha and on the village outskirts. Today, the site contains uncharacterized radioactive wastes, waste uranium compounds related to yellowcake, sealed radioactive sources, and activated metals. There are also other sites in the country that have some degree of contamination and will require decommissioning and remediation to ensure radiological safety, John says.

The fresh nuclear fuel, spent nuclear fuel, and enriched uranium have been removed from the country, along with approximately 1,000 radioactive sealed sources.

The sites that previously housed

Iraq's nuclear facilities remain in a radioactively contaminated and hazardous condition. Since Iraq has generated radioactive waste for more than 50 years, and because the country has never had a licensed radioactive waste disposal facility, there are relatively large quantities of radioactive waste and material in guarded storage. John says Iraq has no national strategy or system for radioactive waste management.

Sandia's role

Sandia provides consultation, training tours, and hands-on demonstrations to Iraqi professionals from the Iraqi regulatory authority, the owner of the Al Tuwaitha complex (the Ministry of Science and Technology), and the Ministry of Environment. The cleanup of a bombed and looted nuclear complex is unique, with no direct analogues in the US, John says.

The Iraqi NDs work is focused on characterization, cleanup, dismantling nuclear facilities, waste management, and waste disposal.

Touring US sites

As part of the project, Sandia researchers took Iraqi scientists on tours through two operating radioactive waste disposal facilities with climatic and geohydrologic conditions similar to those in Iraq. The first site visited was the Nevada Test Site (NTS) and the second was a radioactive waste disposal facility operated by EnergySolutions Inc. located near Clive, Utah.

At NTS, the Iraqis learned about disposal of radioactive wastes in trenches and in 36-meter-deep augered shafts known as greater confinement dis-



LAMA CLEAN UP — One of the first sites to be cleaned up is the Active Metallurgy Testing Laboratory (LAMA) at Al Tuwaitha in Iraq.

posal (GCD) boreholes. John had led a 10-year study of the ability of the GCD boreholes to isolate long-lived transuranic wastes. The security at NTS required significant coordination and support from DOE's Nevada Field Office.

Sandia has also provided training in the fundamentals of project management, radiological waste management, and the laws governing safe disposal of radioactive waste in America.

"On-the-ground progress is the focus of the training," John says. "Iraq has budgeted \$10 million to the project, and on July 1 the Ministry of Science and Technology began cleaning up the Active Metallurgy Testing Laboratory at Al Tuwaitha."

Another purpose of the work is to help make radioactive waste management work real and interesting to the scientists who were isolated from their counterparts for more than a decade by United Nations sanctions.

John says professional relationships have been forged between Iraqis and national and international waste management experts.

"This is a modest international program that has an important effect," says David Kenagy, the US State Department official who is the sponsor of the work. "The project is going very well."

Other Sandia team members include: Bill Arnold (6781), Jeff Danneels (6761), Carolyn Daniel (6034), Stacy Griffith (6765), Sid Gutierrez (6700), Marvin Hadley (4128), John Inman (4128), Franz Lauffer (4133), David Miller (6765), Joe Schelling (6772), Brian Thomson (4128) and Anisha Quiroz (6051).



JUST A SHELL — This ground-level photo of the Active Metallurgy Testing Laboratory at the Al Tuwaitha site in Iraq shows the extent of damage to the facility.

New DOE renewable energy program managed by Sandia

DOE to invest up to \$24 million for breakthrough solar energy products

By Chris Burroughs

Sandia has been chosen to serve as project manager of a new DOE renewable energy program, Solar Energy Grid Integration Systems (SEGIS), which will involve 12 industry teams from around the country. DOE will invest up to \$24 million in FY08 and beyond on the project, depending on the availability of funds.

The program will provide critical research and development funding to develop less expensive, higher performing products to enhance the value of solar photovoltaics (PV) systems to homeowners, business owners, and the nation's electric utilities. These projects are part of President Bush's Solar America Initiative, which aims to make solar energy cost-competitive with conventional forms of electricity by 2015.

SEGIS Team

Dan Ton (DOE team lead), Ward Bower (Sandia project lead), Carolyn David, Scott Kuszmaul, Abbas Akhil, Lisa Sena Henderson, Sigifredo Gonzalez, Randy Shibata, Mellie Cannady, Anne Rimbart, Renee Baros, Jaci Hernandez



"We are pleased to have the opportunity to lead this large effort that promises to be an important component of our country's energy strategy for years to come," says Margie Tatro, director of Fuel and Water Systems Center 6200. "Increasing the use of alternative and clean energy technologies such as solar is critical to diversifying the nation's energy sources and reducing our dependence on foreign oil."

The SEGIS funding opportunity was announced in November 2007. The projects selected for awards focus on collaborative research and development with US industry teams to develop products that will enable photovoltaics to become a more integral part of household, commercial, and utility intelligent energy systems.

A mid-August DOE news release announcing SEGIS

SEGIS contracts awardees

Apollo Solar, EMTEC, Enphase, General Electric, Nextek Power Systems, Petra Solar, Princeton Power, Premium Power, PV Powered, Smart Spark, Florida Solar Energy Center of the University of Central Florida, VPT Energy Inc.

cites examples of research teams working together to develop intelligent system controls that integrate solar systems with utility infrastructures and traditional building energy management.

DOE in collaboration with Sandia selected 12 industry teams to participate in the first slate of cost-shared collaborative contracts focusing on conceptual design of hardware components and market analysis.

For these 12 winning projects, \$2.9 million in DOE funding is leveraging \$1.7 million in industry investments. The plan is to award follow-on contracts in FY09 and beyond — subject to the availability of funds — for projects demonstrating the most promising technology advances exhibiting a high likelihood of commercial success. When the projects are combined with the overall industry investment of up to \$16 million, more than \$40 million in total could be invested in these SEGIS projects, with future funding subject to appropriations from Congress.

ECP Employee Caring Program



Helping the most vulnerable in our community

Feature by Iris Aboytes

The leaves on trees are beginning to change color. Soon the ground will be a carpet of gold. These telling signs announce the coming of the cold weather.

At Sandia, the signs also announce the annual Employee Caring Program, the sharing campaign for the most vulnerable in our community. This year's campaign begins on Oct. 6 and continues to Oct. 24. Last year Sandia employees and Sandia retirees contributed \$3,702,968 to the United Way of Central New Mexico.

The paperless campaign enables Sandians to contribute to the needs of our community in two ways. You can either designate an agency or you can contribute to the Community Fund.

The Community Fund has four priority areas: Empowering Victims of Violence; Increasing Self Sufficiency; Helping Children and Families Succeed; and Improving Health and Wellness. For a list of funded, local programs, go to uwcnm.org and click on About Giving.

The agencies featured on these pages are among the 98 programs currently receiving UWCNM Community Fund grants. If you contribute to the Community Fund, you enable these programs to feed, clothe, shelter, protect, teach, and give hope. Your donation is combined with the donations of others to make far-reaching change possible. Though the overall campaign grew significantly last year, the Community Fund grants represented 50 percent of the requests United Way received.

Winston Churchill said, "We make a living by what we get, but we make a life by what we give." Churchill was probably not thinking about community giving, but it describes Sandia's ECP campaign.

APS Title I Homeless

www.cabq.gov/progress/pdf/homeless.pdf

As families face increasing levels of economic and social stress, one of the primary causes of such stress is the increasing impact of homelessness on children. It is not unusual for a child who is homeless to move multiple times during the school year. Such mobility can result not only in the need to adapt to a new living space, but also to a new classroom, teacher, and classmates, leading to delays and gaps in academic progress.

The Title I Homeless Project served a young man and his mother earlier this year. They lost their home in a fire, leaving them homeless in a tent in the mountains. Their despair had caused severe depression. The young man had refused to abandon his mom and lived with her in the tent.

APS was able to connect the mother and son with a case-worker to help get mental health support and other assistance. The young man and his mother read books every night and did homework. Their particular favorite book was "Love you Forever."



PRESBYTERIAN EAR INSTITUTE



CUIDANDO LOS NINOS

Presbyterian Ear Institute

www.presbyterianearearstitute.org

Presbyterian Ear Institute Oral School is unique in the state of New Mexico and one of fewer than 50 oral schools in the nation. Families benefit when parents learn how to cope with and understand their child's hearing loss. Children, in turn, learn to advocate for themselves as they navigate in the hearing world.

Presbyterian Ear Institute Oral School was founded on the belief that many children with hearing loss can develop the ability to listen, learn, and speak. PEI Oral School provides an educational program where children with hearing loss learn to communicate using spoken language. They provide a supportive and stimulating learning environment in which children who are deaf and hard of hearing can grow socially and emotionally as well as linguistically and academically.

Phil was born prematurely and failed his newborn hearing test. At two, Phil was not talking and his hearing loss was still undiagnosed. At four, Phil was clearly struggling to produce intelligible speech and language. He was finally diagnosed with a hearing loss. As a second-grader, he is now reading at the appropriate level of his hearing peers.

Agora: UNM Crisis Center

www.unm.edu/~agora

New Mexico consistently ranks in the top five states with the highest suicide rates. Suicide is the third leading cause of death for youth in the US, but the second leading cause in New Mexico. Our community needs someone to not only take the calls of people, but to do outreach that educates and empowers everyday people to identify the warning signs of suicide.

A parent called recently frantically searching for a child who would not disclose his location. The child was intoxicated, completely overwhelmed, suicidal, and starting over the side of a cliff he planned to drive off of. Because of an Agora volunteer's ability to help him feel understood, he provided his location. The volunteer was able to convince him not to go over the cliff.

Authorities were able to take him to receive proper treatment.

Pegasus Legal Services for Children

www.pegasuslaw.org

The 2000 census identified 4,272 grandparent-headed households in Albuquerque, Valencia, Sandoval, and Torrance counties also have high numbers of grandparents raising grandchildren. Few of these kinship caregivers have legal authority over the children they are raising. Lack of legal authority also complicates efforts to obtain housing, medical care, and education.

MB is the 66-year-old maternal grandmother of JA, a 2-year-old girl. JA's parents have a long history of substance abuse. MB asked Pegasus Legal Services for Children for help after JA was placed in her home by the police and Child Protective Services.

A staff attorney filed a petition to have MB appointed as kinship guardian of JA.

Giving Changes Lives

Oct. 4 – Oct. 26

Roadrunner Food Bank

www.rafb.org

New Mexico leads the nation in the percentage of people who have to worry where their next meal will come from. Roadrunner Food Bank fills a basic need — the need for food. More than a third of New Mexico's hungry people are children; thousands more are seniors. In almost half of the hungry households, someone is working.

Doris is an 80-year-old retired nurse. She receives less than \$600 in monthly Social Security. Doris is lucky she lives in subsidized senior housing so she is not homeless or living in a substandard place. Doris didn't have money for food. There were many days she ate only once. There were no extras. She now gets a monthly food box supplied by RRFB.

She says getting the food box allows her to splurge once a month on a chocolate bar. She takes one bite a day and makes it last as long as she can.



SHARE YOUR CARE

Ronald McDonald House Charities

www.rmhc.com

Hundreds of New Mexico children must come to Albuquerque every year to receive medical treatments not available in their hometowns. Ronald McDonald House provides a home away from home for families facing this challenging situation. The house is not a hotel, but a warm and caring home-like environment.

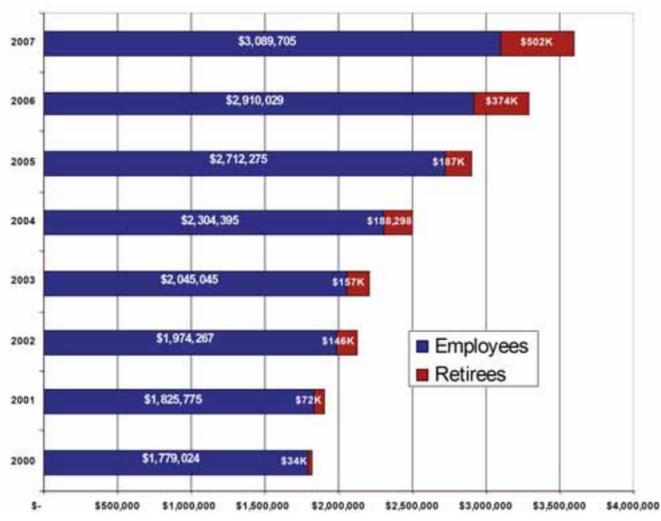
Dion, a young boy of three, is fighting a cancerous tumor on his bladder. He and his mom stayed at the Ronald McDonald House for four weeks while he received treatment. Every day Dion and his mom would play on the playground swings. Dion celebrated his third birthday at the house. The staff and guest families threw him a big party.

Dion successfully completed this round of a multiyear cancer protocol. He is doing well.



CHRISTINA KENT DAY CARE

Employee/retiree ECP contributions



Sandia California

SANDIA HELPS AND REACHES EVERYONE

SHARE

Sept. 29 - Oct. 22

Together we care, together we SHARE

On Sept. 29, Sandia/California launches its 2009 SHARE campaign with a celebration kickoff. The event begins following a site photo and coincides with the site team celebration lunch. The celebration will include remarks by Div. 8000 VP Paul Hommert and representatives from the Tri-Valley Community Foundation, participation by 50 local charitable agencies, and members of the workforce sharing their personal experiences with some of these agencies and their impact on the community.

SHARE stands for Sandia Helps and Reaches Everyone. Several years ago the name was changed from LEAP (Livermore Employees Assistance Program) to reflect Sandia's reach in

the broader Bay Area community.

"We hope to have even greater participation in SHARE this year," says Ray Ng (8940), chair of the 2009 SHARE committee. "This is chance for all of us to make an impact in our communities and give to organizations that really matter to us."

Paul says, "SHARE provides an opportunity to not only contribute as individuals but also demonstrate that we are part of an organization that has a culture of caring and giving — to each other, to the community, and to the nation. Together, we can make a big difference."

The SHARE campaign will run through Oct. 22. For more information, visit the SHARE website at: <http://public.ca.sandia.gov/SHARE>.

Mileposts

New Mexico photos by Michelle Fleming



Samuel Wallace
40 6312



Howard Arris
35 2453



Scott Reed
35 2454



David Rogers
35 2433

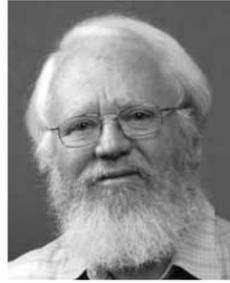
Recent Retirees



David Harris
30 5632



Thomas Plut
30 1746



Pete Roth
30 2546



Linda Scott
30 2134



David Seidel
30 1652



Matthew Senkow
30 2735



Wilma Dansby
34 10267



Stephen Bauer
25 6315



Garry Bryant
25 1822



David Cox
25 5528



Roger Hill
25 6333



Johnny Montano
25 4136



Allen Robinson
25 1431



Peggy Montoya
32 10625



Tom Salazar
25 10663



Richard Taplin
25 2664



Roger Ten Clay
25 5345



Nellie Ward
25 9317



Douglas Ammerman
20 6765



Robert Brown
20 5418



Charles Hanley
20 6335



James Smith
20 4826



William Suderman
20 4139



Michael Benson
15 6752



Ken Chen
15 1516



E. Daniel Cordova
15 2132



Regina Deola
15 4133



James Eanes
15 10626



William Moffatt
15 1233



Michael Pasik
15 1652



Janis Trone
15 6710



James Whatley
15 4825

Feedback

Will job restructure discourage internal movement?

Q: In attempting to recruit the best/brightest students to Sandia, I've noticed one of the things that this generation of recruits seems to value is the ability to change careers routinely at Sandia — we can change fields/applications/interests, without changing companies. We even encourage routine rotations as a means to grow technically and to find new/different challenges for our top performers, or to put our best on a new challenge or emerging issue that needs top talent. This relatively unique feature of Sandia is a great tool for recruiting and retaining the best and brightest. With that in mind, it is at least conceivable that this job restructuring effort could have the result of discouraging the relatively free movement we see today. That is, employees in jobs with the higher pay bands may be less willing or interested to move within Sandia if it means moving to a lower pay band to try something different/new or to help with a corporate priority. Are the folks working on job restructuring keeping these types of issues in mind and identifying the means to mitigate these risks?

A: The job structure implementation team is fully aware of the value Sandians place on changing careers within the bounds of the Labs, as well as its appeal to those considering

a position at Sandia. The team is working to develop a structure that has minimal impact on this benefit. Now, some background. The salary bands in the new job structure are being created based on the external market. The occupations and job families will be placed in the salary structure to align the jobs with the market.

The new structure will be designed to maximize flexibility of cross-Laboratory movement while still paying to market. While we do not anticipate difficulty switching between jobs based on salaries, a "business need rotation policy" will be implemented to ensure we can rotate someone from an engineering job, for example, to a Lab oversight job, for example, without a negative impact on current salary. Additionally, you will be able to bid on jobs in different families regardless of pay level. However, it will be very important to remember that movement after the new structure is in place will follow the current policies, which state that if an employee chooses to move to a position where their salary is above the range max, their salary will be decreased to the new range max. Therefore, while no salaries will be decreased upon implementation that is not to say that a base salary may not be affected by future movements. Pay in relationship to market will continue to be addressed through the normal corporate processes, such as compensation review. As the salary structure and related policies are defined, they will be communicated Labs-wide.

— Melissa Eakes, Compensation & IIS Proj. Mgt. (3002)

Hardwood heirlooms

Dreams transformed into art you can sit in, sleep on, and dine from

By Iris Aboytes

Using mostly hardwoods, Mike Clough (3651) constructs unique cabinets, desks, tables, chairs, and many other pieces for his home and his family. "It is very rewarding to create something with your own hands," says Mike.

Growing up, Mike went on an outing to an art community with his family. He was attracted to art galleries that featured works of fine furniture makers. "From that point on," says Mike, "I had dreams of building furniture."

Several woodworking classes in high school reinforced his desire. He enjoyed the classes and had fun constructing the projects. "This opened the doors to my first career as a wood pattern maker at one of the largest foundries in the Midwest," he says.

The challenge of working in an R&D environment and the climate brought Mike to Sandia. He worked in the shops, where he built wood patterns and models in the pattern shop. The work, in support of Sandia's weapons program, was gradually phased out with the emergence of computer-aided design. Mike then began his second career at Sandia and is currently the Feedback program administrator.

"During these years, building furniture did not

materialize," says Mike. "I was using my hands and creating, but I was not building furniture. It was not until I became an administrator that I began to miss the satisfaction of seeing and touching what I used to create at the end of the day. I realized I needed a creative outlet and bought some woodworking equipment and started to build furniture."

After building several pieces, he realized he had good machine skills, but was frustrated by the lack of the specialized skills needed to build fine furniture. Mike enrolled in a two-year woodworking program in Portland, Ore., and studied under a master woodworker.

The goal of the program was to give students a firm grounding in hand tools, fine furniture construction technique, and furniture design. He also developed a signature style of his own with an ultimate goal of building gallery-quality furniture.

"I had always liked Arts and Crafts [Mission]-style furniture," says Mike. "My style continues to evolve. Over the last several years my style has shown a definite Asian influence. I am currently building a dining room set that is heavily influenced by what is called the 'Greene and Greene' style. The style is essentially American Arts and Craft style with an Asian influence. "I build pieces from hardwoods, specifically

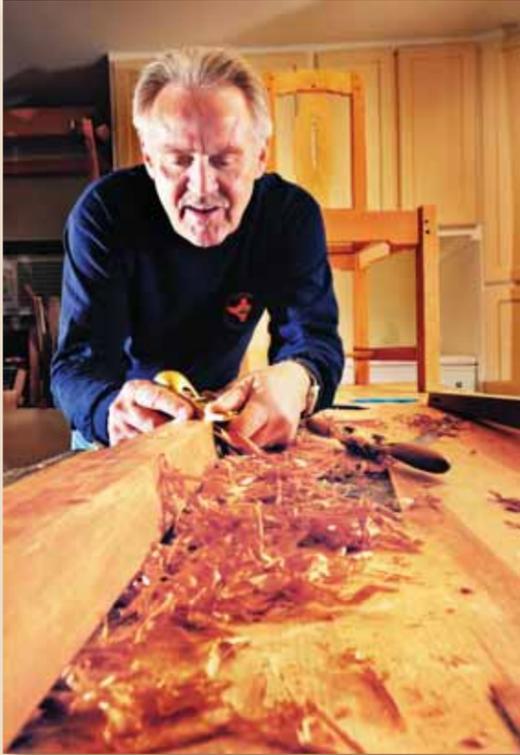
Pennsylvania cherry, which I have shipped in. I have also built pieces out of mahogany, walnut, alder, and other hardwoods. I also utilize veneer where it makes sense.

"I dread the finishing," says Mike. "It is my biggest headache. My current project is finished with a mahogany aniline dye stain, followed by seven coats of hand-applied urethane resin topcoat followed with a coat of wax. It is very time-consuming. The finish needs to be rubbed out between coats and allowed to dry between applications."

He builds the furniture for his family. "My reward comes from the hope that my work will be cherished and passed down to future generations," he says. "The challenge to design and build it with my own hands stimulates my creative thinking."

Mike plans on starting his third career — retirement later this year.

"My current project has roots that go back four years," he says. "I wanted to purchase an expensive piece of machinery for my shop. My wife Vicky agreed, but with the stipulation that I build a new dining room set for our home. Now I am working to keep that four-year-old promise."



A CLOSE SHAVE — Mike Clough methodically creates his masterpieces using elbow grease and precision. (Photo by Randy Montoya)



SIMPLE ELEGANCE — Craftsman Mike Clough stands with the bedroom furniture he has handcrafted for his home. (Photo by Randy Montoya)

Sandia wind program initiates three new projects

DOE awards wind research grants

By Chris Burroughs

Sandia's Wind Energy Technology Dept. 6333 is conducting research in three new areas, the result of additional funding from the DOE Wind Energy Program.

Sandia is sharing a \$4 million award with the National Renewable Energy Laboratory (NREL), and Pacific Northwest, Oak Ridge, Lawrence Livermore, Argonne, and Los Alamos national laboratories. The multilaboratory research agenda is focused on delivering the results needed to continue to integrate high penetrations of wind energy into the electric grid.

Of the three awards Sandia received, one involves joint research with NREL. The other two are solely Sandia projects.

"This funding gives us the opportunity to support a new mission space in areas that we have wanted to pursue but for which we didn't have the budget in the past," says Jose Zayas, manager of Sandia's wind energy department. "With growing demand for clean energy, Sandia is well-positioned to continue to provide leadership and enable the technology needed to sustain growth of wind energy technology."

The first-year funding comes through the DOE Wind Energy Program FY08 Renewable Systems Interconnection Support Laboratory Call. More funding for selected projects will be considered later.

Sandia's newly funded projects include:

- **Wind Integration Study for Kirtland Air Force Base and Sandia's Albuquerque Site.** The project allows members of Sandia's Wind Energy Program to expand on work they recently initiated to determine the feasibility of building a multimewatt wind power plant on Kirtland Air Force Base. The new research activity is focused on developing a template for future federal wind projects being investigated as part of the DOE Transformational Energy Action Management (TEAM) initiative. The TEAM initiative goal is to maximize installation of secure, on-site renewable energy projects at all DOE sites, says Energy Secretary Samuel Bodman.
- **High Level Wind Resource Assessment and Validation.** In partnership with NREL, Sandia researchers from Depts. 6333 and 4133 will evaluate Sandia-owned SODAR (sonic detection and



GARY D. HALL (4133) installs a meteorological station on a ridgeline in the Manzano mountains near Albuquerque that will be used to measure wind speed and direction. Data from the station will be used to determine if it is feasible to build a wind farm on Kirtland Air Force Base. (Photo by Bruce Reavis)

ranging) instrumentation systems near Texas Tech University's heavily instrumented 200-meter meteorological tower. SODAR remotely measures the vertical turbulence structure and the wind profile of the lower layer of the atmosphere without the need to build tall and costly meteorological towers.

- **Scalable MODSM of Wind Power Integration & Grid Coordination Techniques.** In this research, Dept. 6333 will collaborate with Dept. 6332 to further develop a framework for applying complex adaptive system-of-systems (CASOS) approaches for modeling renewable energy integration and advanced grid

concepts. They will develop a new method of assessing/studying the complexity of the electric grid to identify and assess effective ways to integrate higher penetrations of renewable energy.

In a letter to Jose announcing the Sandia awards, JoAnn Milliken, previous acting program manager of DOE Wind and Hydropower Technologies, said she is "confident that Sandia's contributions to these renewable system interconnection activities will add great value to our efforts to achieve 20 percent of the nation's electricity from wind by 2030."

Books Are Fun Sandia's 2008 ECP/United Way
Employee Caring Program

Book Fair

See what's new!

Shop in the convenience of your workplace. Save on an incredible selection of books and fine gift items. Bring your shopping list to the book fair! You'll find exactly what you want in our large selection.

Giving Changes Lives

Steve Schiff Auditorium
Tuesday thru Thursday
October 7th, 8th, & 9th
10:00 am – 2:00 pm
Watch for the Traveling B-B-Q on Wednesday out in front

IPOC – 2nd Floor Break Room
Tuesday thru Thursday
October 14th, 15th, & 16th
9:00 am – 4:00 pm

Thunderbird Cafeteria
Tuesday thru Thursday
October 21st, 22nd, & 23rd
10:00 am – 2:00 pm