

After the freeze: Repair, restore, regroup, renew



When the Arctic dropped in on the Land of Enchantment in early February, the Gas Company of New Mexico shut down the natural gas supply line that feeds Kirtland Air Force Base and its tenants, including Sandia. The measure was taken to accommodate unprecedented demand during a declared statewide emergency, one that left tens of thousands of New Mexicans without heat for several bitterly cold days. In the wake of the shutdown, a number of Sandia facilities sustained cold-related damage. At left, Tom Quirk (1384) begins the messy task of repairing substantial damage to his lab. Below, David O'Brien and Michael Chavez (both 4827) clean up water damage caused by a burst pipe. During the gas line shutdown, as a subzero front sank its teeth into the state, Sandia Facilities personnel worked long shifts under trying conditions to minimize the damage to the Labs. (Photos by Randy Montoya)



New Brayton cycle turbines promise giant leap in performance

Supercritical CO₂-based system dramatically increases thermal-to-electric conversion efficiency

By Nigel Hey

Sandia is moving into the demonstration phase of a novel gas turbine system for power generation, with the promise that thermal-to-electric conversion efficiency will be increased to as much as 50 percent — an improvement of 50 percent for nuclear power stations currently equipped with steam turbines, or a 40 percent improvement for simple gas turbines. It is also very compact, meaning that capital costs would be relatively low.



HOT STUFF — Impellers from Brayton cycle turbine being demonstrated by Sandia researchers and associates. The turbine is “basically a jet engine running on a hot liquid,” says researcher Steve Wright (6221).

Research focuses on supercritical carbon dioxide (S-CO₂) Brayton cycle turbines, which typically would be used for bulk thermal and nuclear generation of electricity, including next-generation power reactors (Continued on page 4)

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Sandia/California

An exciting grand opening for the Combustion Research Computation and Visualization facility

By Patti Koning

After 30 years of research into how things burn, it was fitting that at the grand opening of the Combustion Research Computation and Visualization (CRCV) facility, the ribbon wasn't cut with the traditional pair of oversized scissors. Instead, it was torched by Div. 8000 VP Rick Stulen (8000), Eric Rohlfling of DOE's Office of Science, and Stephen Goguen of DOE's Office of Energy Efficiency and Renewable Energy (EERE).

The grand opening of the CRCV marks the start of a new chapter for the Combustion Research Facility (CRF), harnessing the power of supercomputers to further understand and develop combustion processes. Bob Carling (8300), director of the CRF, recalled the origins of the facility in the nuclear weapons program.

“Back during the time of the oil embargo, some folks here thought you could use the lasers from the nuclear weapons program to interrogate combustion systems.

The idea was that with research and collaborative work with scientists and engineers from around the world, you could improve combustion processes, from the point of view of both better efficiency and reduced pollutants,” he said.

Bob recalled how, 30 years ago, the CRF began with one big laser piped to a few different labs, a model that worked for a time. Eventually lasers became so ubiquitous that most labs in the CRF have several — an evolution similar to that of computers. Back when the CRF was first opened, scientists and engineers were still using punch cards to run programs. Today, noted Bob, computers are so common that everyone has one on their hip.

(Continued on page 3)



CARRYING THE TORCH — Div. 8000 VP Rick Stulen and Center 8300 Director Bob Carling torch the ribbon at the grand opening of the Combustion Research Computation and Visualization building.

(Photo by Randy Wong)

cards to run programs. Today, noted Bob, computers are so common that everyone has one on their hip.



So long, Joe

Div. 9000 VP Joe Polito, who has been at the Labs for more than 23 years, has announced he will retire in April. Joe has headed the Enterprise Transformation Division, which provides program management for Integrated Enabling Services, since 2007. Story on page 2.

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A valentine love story

Diana de la Rosa and her daughter Jenna discover that “a trip to Holland” is a very special trip, indeed, even if it's not the trip you thought you signed on for. On page 8, read about this special story of a mother's love for her child.

That's that

As I write this on Monday morning, 20,000 New Mexicans are still without gas to heat their homes after that record-breaking cold spell last week that shut down most of the state – including not the least Sandia and Kirtland Air Force Base. What was a nuisance for most of us has turned into a real hardship for some of our fellow New Mexicans. Let's hope that by the time you read this, everyone is back in their own homes sitting by a warm fire with their loved ones.

By the way, did you see where the natural gas shutdown at Sandia freed up more than a million cubic feet of natural gas and 82 million megawatt-hours of electricity? That was enough to heat more than 1,300 homes and power 3,000. In that regard, it seems we did our part in the state of emergency. But we paid a price, too. There's no number yet on the amount of damage we sustained due to cold weather and unheated buildings, but it was not insubstantial.

How cold was it, you wonder? There was a day last week when we were colder than Barrow, Alaska, the northernmost town in the US. The only thing north of Barrow, in fact, is the North Pole. As it happens, Sandia has for many years had a team of researchers based in Barrow as part of DOE's ongoing climate study program. Everyone who gets assigned to that post goes through rigorous polar bear safety training. New Mexico hasn't come to that, yet, but who knows? There are some contrarians out there in the climate study community – certainly not mainstream, but not crackpots, either – who are convinced we're on the cusp of a new ice age. If you'd asked me a few days ago, I would have agreed with them.

This has been a tough winter all around. Chicago and the Midwest got that record blizzard last week – the photos of the cars abandoned on a Chicago freeway and buried under snow drifts looked like stills from a post-apocalyptic movie – and New York City and the Northeast have been battered by one "storm of the century" after another for the past couple of months.

So the weather, of course, is on everyone's minds, topic No. 1 everywhere you go. I was getting a propane tank refilled the other day when the subject of the cold spell came up. The guy filling the tank told me, with a straight face, that the Chinese are controlling the planet's weather. I thought at first he was kidding, making conversation. But he was serious, enlightening me, too, about how the Chinese caused the earthquake in Haiti last year. Oh, yes. Who knew?

* * *

A quick aside. That line above about "storm of the century" reminded me of a *Sports Illustrated* article I read more than 35 years ago about the "Thrilla in Manila," the third in that series of epic fights between Muhammad Ali and Joe Frazier. Each of the two preceding bouts between these titans – a clash of the titans? – had, inevitably, been billed as "the fight of the century." So in writing about the Thrilla in Manila, the reporter started his story with: "This year's 'fight of the century' . . ." I got a kick out of that; a sly way, I think, of deflating some of the media hype that always attends big sporting events.

* * *

On the theme of extreme events, weather and otherwise, there was a piece recently in the *MailOnline*, a UK publication, that talked about the "supervolcano" lurking beneath Yellowstone National Park. The story tells us that scientists studying the region say the volcano has been rising at a faster clip lately than at any time since their studies began back in the 1920s. According to *The Mail* headline, when the volcano goes off it will wipe out two-thirds of the US. Despite that sensational assertion, though, the story hedges on exactly when this eruption is supposed to occur. Scientists just don't know. Not enough data to make any kind of prediction. Except to say, of course, that when it goes it's going to be big. Really big (as William Shatner would say).

It's easy to laugh off – or at least shrug off – these end-of-the-world scenarios. These things all happen in geologic time, after all. True. True. But I do think there's cause for some prudent alarm. After all, remember the quip that's popular among geologists, cavers, and climbers: Geologic time includes now.

Hasta la vista.

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

VP Joe Polito retires after more than 23 years

By Iris Aboytes

Joe Polito, VP of Enterprise Transformation Div. 9000, is retiring from Sandia after more than 23 years.

The Enterprise Transformation Division provides program management for Integrated Enabling Services (IES), implements the corporate quality program and the Integrated Laboratory Management System (ILMS), hosts the CIO office, and provides information technology for corporate applications, network and computer infrastructure, and cybersecurity.

Joe began his career at Sandia in 1977 as a staff member in energy systems analysis for geothermal drilling. From 1980 to 1990 he worked in the private sector, returning to Sandia in 1990, to work in technology transfer for manufacturing. He has also led the business office for Work for Others programs and held several WFO program manager roles, including counterterrorism, counterproliferation, and directed energy. In the Nuclear Weapons program, Joe was the program director for Science and Technology Programs and later for Stockpile Systems. In 2004 he became the program director for the IES Strategic Management Unit, and in 2007 he was promoted to his current position.



JOE POLITO

Working with Joe

By Pauline Duran

I've had the pleasure of working for Joe Polito for about three-and-a-half years. It has been an enriching experience. Joe is a very intelligent, meticulous, and detail-oriented individual. He is a good listener and treats everyone with respect.

Joe has become an important part of my life. It's not all about the job. It's about relationships and caring. When my mother-in-law was in hospice, he was very kind and supportive. Sharing the good and the bad with someone who cares alleviates life's challenges.

We celebrate birthdays in the division office with food, singing (including Joe), and laughter. Everyone really enjoys these moments, especially Joe. These are the times we get to see his other side. His sense of humor comes out, and he regales us with his many stories about his experience as an Air Force pilot. Joe's face lights up whenever he talks about the EC-47 aircraft he flew in Vietnam.

My favorite story is the one he tells about losing an engine over Vietnam. Normally, an emergency got you to the front of the line for landing. On that day, Navy carrier fighters were recovering at Da Nang. There were six emergencies ahead of him. He was advised to stand by. [Joe was subsequently able to land his aircraft safely.]

Our division came together because of Joe. I will miss our daily interactions, and working with the challenges of the day.

Before coming to Sandia, Joe had several positions, including vice president of Pritsker & Associates, a supplier of simulation software, director of R&D for Sperry Sun Corporation, a petroleum services company, and director of simulation and analysis for BDM Corp.

Joe has a bachelor's in aerospace engineering from Iowa State University and a master's and doctorate in industrial engineering from Purdue University. Prior to attending graduate school, Joe was a pilot in the US Air Force. He is a Vietnam veteran. (See Nov. 6, 2009 *Lab News*.)

When asked about his career at Sandia, Joe contrasted his Sandia experience with other places he has worked. "The most remarkable characteristic about Sandia is the depth and breadth of capability of the staff," Joe says. "When I first came to the Labs as a staff member, I remember discovering that no matter what I needed help with, there was an expert at Sandia on that subject. And even more surprising, they were willing to help me.

"Few places exist with the breadth of deep technical expertise and the eagerness to work together on hard, cross-disciplinary problems," he adds. "It is a defining characteristic of Sandia that makes it a unique and exciting place to work as well as an institution perfectly suited to providing exceptional service in the national interest."

Joe has special memories. "In 2004, I accepted the position of program director for IES working for Frank Figueroa," Joe says. "I was chagrined to discover that there were thousands of Sandians in IES that I had never met, and they were working with dedication every day to ensure the success of Sandia's mission. Like the technical staff, the IES professionals are deeply knowledgeable in their specialties and are equally eager to work together for the Labs' success. It has been a privilege for me to contribute to the IES team. I am proud of their collective successes."

Joe says he will miss the people the most. "It has become a cliché to say 'the people,'" Joe says, "but in fact, it is the people. The excitement and satisfaction that I have enjoyed in my career at Sandia has always resulted from developing trusting, professional relationships with fellow Sandians, our NNSA/DOE colleagues at SSO and headquarters, and with other labs and sites. I will miss them all."



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CRCV facility

(Continued from page 1)

“The founding concept of the CRF remains the same, to bring together people from throughout the world to work collectively with our scientists and engineers,” he said. “As we’ve evolved from heavy experimental work, we know and understand that to face the next challenges in combustion we need sophisticated models and predictive capabilities.”

The new collaborative research facility will serve as a focal point to accelerate the realization of predictive modeling and simulation for combustion. The CRCV will provide interactive data visualization and collaborative workspaces, as well as a 2,000-square-foot machine room for the dedicated computational capability. Sandia is in the process of achieving LEED certification for the use of “green” technologies in the building’s construction.

Collaboration is ‘outstanding’

The CRCV is cofunded by the DOE’s Office of Science and EERE. Rohlfsing, director of the chemical sciences, geosciences, and biosciences division at the Office of Science, noted that this partnership, while unique, is one that DOE would like to replicate elsewhere. He has a distinct vantage point, as both an alumni of the CRF — he recalled working with one of those facility lasers — and now as a leader at one of the funding organizations.

“The collaboration between Basic Energy Science and EERE’s vehicle technologies program is outstanding and effective. This is probably one of the only examples where these two organizations have come together to



JEFFREY NICHOLS, associate laboratory director at Oak Ridge National Laboratory, spoke about how the CRCV’s capabilities will help researchers overcome the complexity of the massive amounts of data produced by supercomputers such as the one housed in the building. (Photo by Randy Wong)

fund a modest, yet very effective, building,” he said. “The work that this building will facilitate is a natural part of the evolution of combustion science and technology and we are delighted to help cosponsor it.”

Goguen, a senior engineer in EERE’s office of vehicle technologies, commented that proof of the CRF’s success is visible on roads everywhere. He recalled as a child seeing big belches of black smoke coming off buses and spewing from big trucks, something that doesn’t exist anymore, thanks, in part to the CRF.



WITH THE OPENING of the Combustion Research Computation and Visualization building, shown to the far left, the Combustion Research Facility (CRF) now comprises four buildings: offices (middle), labs (not visible), and an auditorium (right). Div. 8000 VP Rick Stulen said that the resources and capabilities of the new building will serve to accelerate the engine research that has made the CRF a leader in the field. (Photo by Randy Wong)

“It’s amazing, but at the same time, you’d think there’d be a penalty to be paid, but there wasn’t. In that same time period, the efficiency of engines also has gone up significantly. From what I saw today, walking around and listening to new ideas being explored in the labs, it’s a new beginning,” he said.

In the audience at the grand opening were current and past CRF researchers, including former Div. 8000 VP Tom Cook, who oversaw the startup of the CRF. Also on hand were regional elected officials and their representatives and educators from Las Positas College, the University of California, Davis, and the University of Michigan. Rick received certificates of commendation from US Representatives John Garamendi and Jerry McNerney, State Assemblymember Joan Buchanan, State Senator Loni Hancock, the Alameda County Board of Supervisors, and the City of Livermore.

“This facility represents a very important step toward the accomplishment of the innovation hub, i-GATE, which the City of Livermore, other Tri Valley cities, Sandia, and Lawrence Livermore National Lab have been working on for over a year,” said Jeff Williams, a Livermore city council member. “Speaking on behalf of

the surrounding cities and region, Livermore enthusiastically supports the new opportunities that this capability brings to the area and we congratulate Sandia and DOE for taking the bold step of creating and building this facility.”

To conclude the program, two invited speakers spoke of the history and future of large-scale computing. Jeffrey Nichols, associate lab director at Oak Ridge National Laboratory, gave a talk on complexity and how work done at the CRCV will aid researchers in making sense of massive volumes of data. Daniel Haworth, a professor of mechanical engineering at Pennsylvania State University, led the audience on journey through the history of computational combustion.

In 30 years, the CRF has come a long way — from a single laser and punch cards to lasers as regular lab equipment and a 50-teraflop computer, which puts it in the top 100 fastest computers worldwide. What combustion research will look like in 2040 is still the stuff of science fiction, but perhaps 50 teraflops of visualization capability can give us a hint of what the future might hold.

Sandia California News

Energy technology, policy tools to be explored at summer institute for top grad students

By Mike Janes

Graduate students pursuing careers in energy, policy, science, and environmental matters are encouraged to submit applications for *Technology and Policy Tools for Energy in an Uncertain World*, a week-long summer institute at Sandia/California. The program will take place Aug. 7–12 and is open to US citizens and foreign nationals.

Twenty students will be selected to participate. Applications are due by March 15 (see http://www.sandia.gov/summer_institute for details and online application).

Participating students will collaborate in small teams, working side-by-side with leading Sandia scientists and researchers at the Labs’ world-renowned Combustion Research Facility (CRF) and other cutting-edge Sandia facilities.

“A summer institute for graduate students is one of many ideas we are pursuing to increase awareness and collaboration with our staff,” says Bob Carling, director of Transportation Energy Center 8300. Bob says Sandia/California has an ongoing interest in exposing a

variety of outside scientists and engineers — including students — to the lab and its new open access.

Bob says he hopes the experience will help persuade participating students to consider Sandia as a future place of full-time employment.

“We also hope they will spread the word back at their home institutions regarding the importance of the work we do at Sandia and the high quality of our staff and facilities,” he says.

Students will select from the following technical focus areas:

- *Uncertainty Quantification in Predictive Simulation — Focus on Chemical Systems*

Participants will work on the development and testing of uncertainty quantification (UQ) methods for chemical systems of relevance in combustion. The work will involve algorithmic research on Bayesian inference and Polynomial Chaos UQ methods.

- *Measurement Uncertainty with Imaging Detectors — Focus on Optical Engine Diagnostics*

Students will explore uncertainty in measurement of in-cylinder soot using two-color optical pyrometry

imaging in a heavy-duty optical engine. In addition, they will run the optical engine and intensified cameras and develop MATLAB scripts for soot temperature and volume fraction imaging.

- *Measurement of Uncertainty in Biological systems — Focus on Biomass-to-Biofuels processes*

Students will explore variability and uncertainty in the various steps for biomass-to-biofuels conversion. Participants will develop biochemical assays and measure the conversion of biomass to fermentable sugars. They will then consider how the variability of sugar production impacts biofuels economics.

- *Managing Uncertainty in Policy Decisions — Focus on Electric Vehicle Adoption Drivers*

Participants will develop computer models for consumer adoption of alternative-fuel vehicles. Students will then use these models to explore key technology and policy drivers of vehicle adoption and sensitivity of their results to underlying uncertainties.

Institute participants will be provided housing at a Livermore suites hotel located near Sandia. Transportation and meals will also be provided.

Steve Plimpton earns 'special recognition' for leading development of widely used Sandia LAMMPS code

By Neal Singer

In a tribute to Steve Plimpton (1426) for his work in developing the LAMMPS molecular-dynamics software, a symposium has invited him to present its keynote lecture at the Feb. 27-March 3 Minerals, Materials & Materials Society (TMS) meeting in San Diego.

The acronym LAMMPS (Large-scale Atomic/Molecular Massively Parallel Simulator) is also a pun on the word "lamp," a device that brings light to dark places.

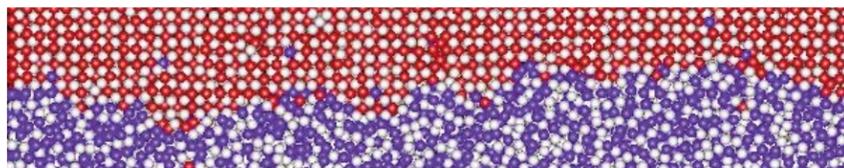
"This symposium [on Massively Parallel Simulations of Materials Response] will particularly recognize your contribution as the primary developer of one large-scale parallel code, the LAMMPS molecular dynamics simulator, which has been of great help to the technical community," writes symposium co-organizer and Virginia Tech engineering professor Diana Farkas in her invitation to Steve. "As users of LAMMPS, we feel that this contribution really deserves a special recognition."

LAMMPS is an open source code (lammps.sandia.gov) initially funded fifteen years ago through an industrial CRADA with multiple collaborators. Subsequent additions were supported by Sandia's Laboratory Directed Research and Development program, various DOE offices, and currently a CRADA focused on modeling nanoparticles in solution. Over the years, more than 100 significant contributions to the code have been made by other Sandia and external researchers.

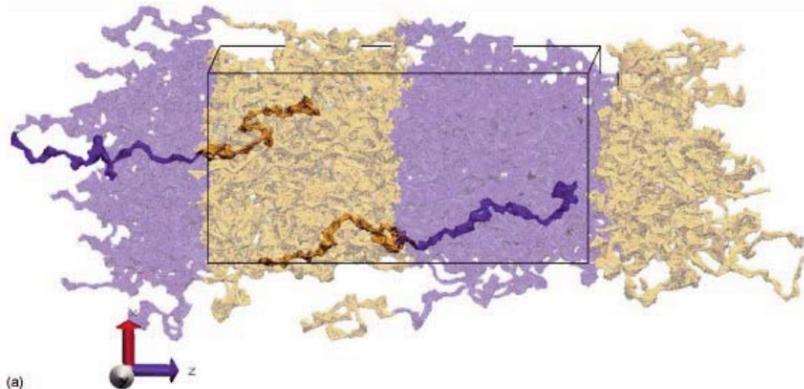
At the atomic scale, LAMMPS can model soft (biomolecules, polymers) or solid-state materials (metals, semiconductors). Via coarse-graining, it can also model mesoscopic or even macroscopic systems as a collection of interacting particles. Able to run on single processors or in parallel, the code is designed to be easy to modify or extend with new functionality.

This has led to some 65,000 downloads since its open source release in 2004, and more than 1,000 journal articles that have cited the code.

Due to its parallel scalability, LAMMPS often helps benchmark performances of the newest DOE and DoD supercomputers, including the DOE Leadership Computing Facility at Oak Ridge National Laboratory. To benchmark the next-generation LCF computer, which is expected to have a hybrid CPU/GPU [central processing unit/graphics processing unit] design, ORNL is supporting a multi-institutional team, led last year by Paul Crozier (1426), to extend LAMMPS to run



RESEARCHERS from Northwestern University and Sandia, working with the LAMMPS code, developed a simulation strategy for solidifying metals and metal alloys where the temperature of the system is carefully thermostatted so that the velocity of the interface can be accurately measured. The image here depicts a liquid/solid interface in a nickel/aluminum alloy.



WORKING WITH THE LAMMPS CODE, French researchers Michel Perez, Olivier Lame, Fabien Leonforte, and Jean-Louis Barrat used a versatile method, largely inspired by chemical radical polymerization, to generate configurations of coarse-grained models for polymer melts.

on general-purpose GPUs.

Paul is a LAMMPS co-developer, as are Aidan Thompson (1425) and Mark Stevens (1814).

A year ago, says John Aidun (1425 manager), the first LAMMPS users' meeting was held at Sandia.

"This bare-bones, invitation-only meeting [due to space limitations] was well-attended by enthusiastic users and contributors to LAMMPS," he says. "It demonstrated to me that the code has become an institution, with at least one DoD lab having discontinued its own code development efforts and now depending on LAMMPS to meet its mission responsibilities."

Images for this story from the LAMMPS code page at <http://lammps.sandia.gov>.

Worldwide contributors help expand Sandia-originated code

Worldwide participation has aided the continued evolution and expansion of the Sandia-originated code. LAMMPS originated as a cooperative project between DOE labs and industrial partners. Folks involved in the design and testing of the original LAMMPS were:

- John Carpenter (Mayo Clinic, formerly at Cray Research)
- Terry Stouch (Lexicon Pharmaceuticals, formerly at Bristol Myers Squibb)
- Steve Lustig (Dupont)
- Jim Belak (LLNL)

Since LAMMPS originated 15 years ago, there have been 100-plus contributions to the code by some 80 contributors.

Brayton cycle

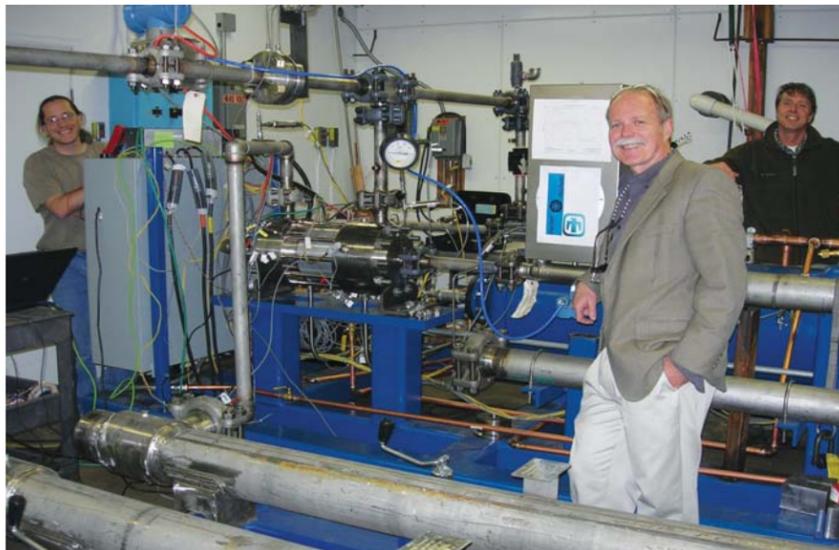
(Continued from page 1)

(see *Sandia Lab News*, Dec. 5, 2008). The goal is eventually to replace steam-driven Rankine cycle turbines, which have lower efficiency, are corrosive at high temperature, and occupy 30 times as much space because of the need for very large turbines and condensers to dispose of excess steam. The Brayton cycle could yield 20 megawatts electrical (MWe) from a package with a volume as small as four cubic meters.

"This machine is basically a jet engine running on a hot liquid," says principal investigator Steve Wright of Advanced Nuclear Concepts Dept. 6221. "There is a tremendous amount of industrial and scientific interest in supercritical CO₂ systems for power generation using all potential heat sources including solar, geothermal, fossil fuel, biofuel, and nuclear."

Sandia currently has two supercritical CO₂ test loops (the term loop derives from the shape taken by the working fluid as it completes each circuit). A power production loop is located at the Arvada, Colo., site of contractor Barber Nichols Inc., where it has been running and producing approximately 240 kilowatts (electrical) during the developmental phase that began in March 2010. It is now being upgraded and is expected to be shipped to Sandia this summer. A second loop, located in Sandia's Tech Area 5, is a research device to understand the unusual issues of compression, bearings, seals, and friction that exist near the critical point, where the carbon dioxide has the density of liquid but otherwise has many of the properties of a gas.

Immediate plans call for Sandia to continue to develop and operate the small test loops to identify key features and technologies. Test results will illustrate the capability of the concept, particularly its compactness, efficiency, and scalability to larger systems. Future plans call for commercialization of the technology and development of an industrial demonstration plant at 10 MWe.



IN THE LOOP — Steve Wright (6221), foreground right, with an early test loop of a Brayton cycle turbine. At left is Keith Barrett from PrimeCore Inc. of Albuquerque, who developed the data acquisition and control system for the loops. At far right (background) is Robert Fuller from Barber Nichols Inc., where he is their chief engineer on the project.

A competing system, using Brayton cycles with helium as the working fluid, is designed to operate at about 925 Celsius and is expected to produce electrical power at 43 percent to 46 percent efficiency. By contrast, the supercritical CO₂ Brayton cycle provides the same efficiency as helium Brayton systems but at a considerably lower temperature (250-300 Celsius). The S-CO₂ equipment is also more compact than that of the helium cycle, which in turn is more compact than the conventional steam cycle.

Under normal conditions materials behave in a predictable, classical, "ideal" way as conditions cause them to change phase, as when water turns to steam. But this model tends not to work at lower temperatures or higher pressures than those that exist at these critical points. In the case of carbon dioxide, it becomes an unusually dense "supercritical" liquid at the point where it is held between the gas phase and liquid phase.

materials (stainless steel) are required, less material is needed, and the small size allows for advanced-modular manufacturing processes.

"Sandia is not alone in this field, but we are in the lead," Steve says. "We're past the point of wondering if these power systems are going to be developed; the question remains of who will be first to market. Sandia and DOE have a wonderful opportunity in the commercialization effort."

Other individuals who contributed substantially to this project are Robert Fuller (Barber Nichols Inc.), Paul Pickard (Sandia retired), Milton Vernon (6221), Keith Barrett (PrimeCore Inc.), Ross Radel (former Sandian), Thomas Conboy (6221), and Gary Rochau, (manager 6621).

Sandia's S-CO₂ Brayton cycle program is supported by DOE with funding from the Labs' Laboratory Directed Research & Development (LDRD) program.

The supercritical properties of carbon dioxide at temperatures above 500 Celsius and pressures above 7.6 megapascals enable the system to operate with very high thermal efficiency, exceeding even those of a large coal-fired power plant and nearly twice as efficient as that of a gasoline engine (about 25 percent).

In other words, as compared with other gas turbines the S-CO₂ Brayton system could increase the electrical power produced per unit of fuel by 40 percent or more. The combination of low temperatures, high efficiency, and high power density allows for the development of very compact, transportable systems that are more affordable because only standard engineering

Nuclear Science Week

The National Museum of Nuclear Science & History hosted more than 1,000 area students during Nuclear Science Week, observed this year Jan. 24-28. A wide range of activities at the museum during the week provided students an opportunity to learn about the many ways in which nuclear science impacts their daily lives. The museum is the founding sponsor of the national recognition week for the nuclear science industries.

The special week was also recognized in the nation's capitol, where Sen. Jeff Bingaman, D-N.M., and several experts in various fields of nuclear science talked about the importance of nuclear leadership in a global economy.

"We have a great opportunity to be a leader in the development and deployment of small modular nuclear reactors and to maintain our position of leadership for this technology worldwide," Bingaman noted during a news conference/panel discussion in the Senate Natural Resources conference room.

Bingaman emphasized the need to promote increased enrollment in the nuclear sciences. He also reaffirmed support for provisions of the 2005 national energy bill that gave tax incentives and credits for new nuclear building, and cited the need to address the issues surrounding regulatory uncertainty for nuclear licensing renewal.

Other members of the panel were Audeen Fentiman, associate dean of engineering for graduate education at Purdue, Marv Fertel, president and chief executive officer of the Nuclear Energy Institute, and Guiseppe Esposito, MD, associate professor of radiology and chief of nuclear medicine at Georgetown University. The experts spoke of the promise of nuclear energy, nuclear medicine, and the potential for careers in nuclear-related fields.

National Museum of Nuclear Science & History Director Jim Walther traveled to Washington to moderate the panel.

"This week and this event on Capitol Hill," Jim said, "provide the opportunity for us to turn a spotlight on how nuclear sciences contribute to job growth and economic strength for our country. We are focusing on the clean air contributions of nuclear energy, critical patient care services provided by nuclear medicine, and the significant future career needs in the nuclear science and energy sectors."

National Nuclear Science Week is a partnership of the National Museum of Nuclear Science & History and nuclear industry partners, including Entergy, DOE, the American Nuclear Society, the Society of Nuclear Medicine, the Nuclear Energy Institute, and others.



CHARGED UP FOR SCIENCE — Students experience a static charge from a Van de Graaff generator during National Nuclear Science Week, a week designed to recognize the contributions of the nuclear science industry and those who work in it every day.

Photos by Randy Montoya



HISTORY ON DISPLAY — Two of the more than 1,000 students who participated in activities during National Nuclear Science Week 2011 marvel at the museum's unique displays.



SAFETY FIRST — Students simulate a nuclear accident clean-up event and learn the importance of safety when dealing with all things nuclear.

Z Machine

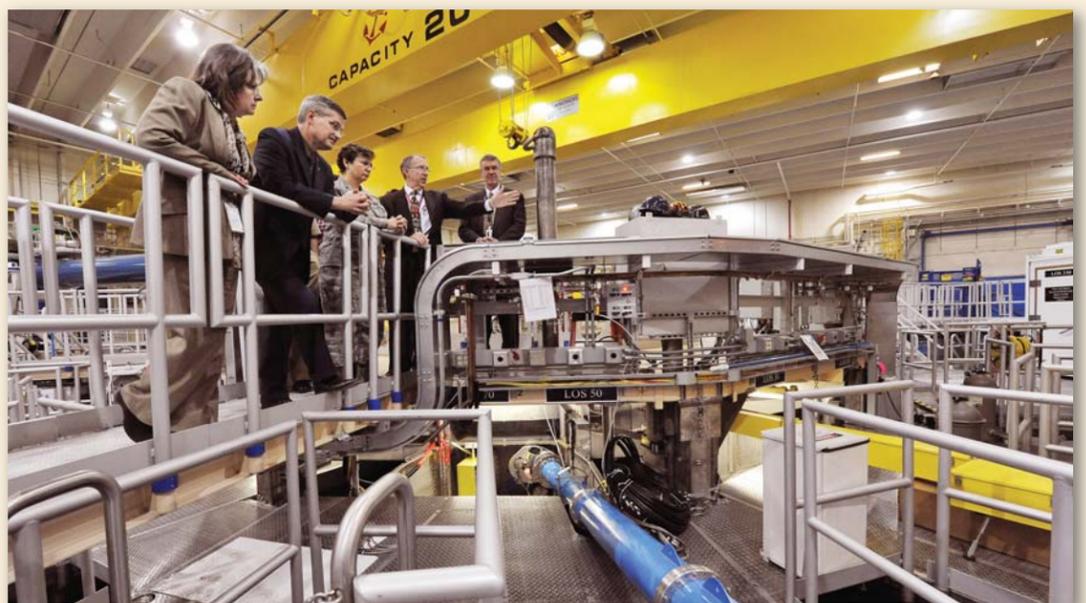


JUST A PINCH — Center 1600 Director Keith Matzen, left, explains to Brig. Gen. Sandra Finan, right foreground, how a wire array target is used on the Z facility. Looking on, from Keith's left, are Center 200 Director Bruce Walker, NNSA Sandia Site Office Manager Patty Wagner, and Lt. Commander John Adkisson, an aide to Gen. Finan.

Senior NNSA/DP official visits Labs

US Air Force Brig. Gen. Sandra Finan, NNSA's principal assistant deputy administrator for Military Applications, Office of Defense Programs, visited Sandia Feb. 2 to be briefed on key Labs' mission work and tour several NNSA/DP-funded facilities. Finan, who assumed her duties with NNSA in January, had previously served an assignment with DOE in 1999-2000. During her visit to Sandia, Finan was hosted by Div. 1000 VP Steve Rottler, who provided an overview of Sandia and its weapons program. After a tour of the Labs' weapons vault conducted by Victor Johnson (2120) and Pat Sena (2110), the general received a briefing on the Labs' surveillance work from Center 2900 Director Larry Walker. In other activities, Gil Herrera, director of Center 1700, conducted a briefing and tour of the MESA facility; Center 1600 Director Keith Matzen showed Finan around the Z facility; and Cliff Renschler (2730) and Tim Gardner (2710) provided a briefing and tour of the neutron generator facility.

(Photos by Randy Montoya)



THE PULSE OF THE LABS — Center 1600 Director Keith Matzen, second from right, describes some of the diagnostics on the Z facility to Brig. Gen. Sandra Finan (standing just to Keith's right). Also attending the Z facility tour are NNSA Sandia Site Office Manager Patty Wagner, left, and Div. 1000 VP Steve Rottler. Standing at far right is Nuclear Weapons Planning, Operations, and Integration Center 200 Director Bruce Walker.

Mileposts

New Mexico photos by Michelle Fleming
California photos by Randy Wong



John Didlake
35 8316



Laurance Lukens
35 2614

Recent Retirees



Kathleen Branagan
35 1733



Paul Plunkett
32 1734



William Ballard
30 8130



Brent Haroldsen
30 8123



John Mareda
30 9537



Quenton McKinnis
30 8231



Ken Condreva
30 8135



Robert Burton
28 4211



Paul Rockett
21 1911



Mark Allendorf
25 8651



Brenda Jensen
25 216



Daniel Kral
25 5732



Spencer Luker
25 1384



Martin Mikolajczyk
25 8945



Michael Saavedra
25 1833



Pauline Duran
20 9000



Linda Houston
20 8530



Linda Konkel
20 5965



Jim Lund
15 8132

News Briefs

Black History Month breakfast

The KAFB Black History Observance Committee will host a Black History Month breakfast at the Mountain View Club Friday, Feb. 18, 8-9:30 a.m. Guest speaker Col. (Ret.) Richard Toliver, a former F-15 test pilot and second-generation Tuskegee Airman, will share his experiences of being taught and mentored by the Tuskegee Airmen. The event will include an art exhibit featuring the works of Charlee Brazier, Iraqi veteran and local African American artist, on display from 8-11 a.m. The breakfast is \$11. For reservations, contact Delvin Wood (4233-2) at 284-5870 by COB Monday, Feb. 14.

Always/Never Labs-wide premier

The first screening of *Always/Never*, the 143-minute documentary that tells the story of the development of use control, nuclear detonation safety, and survivability for the US nuclear weapon stockpile, is Tuesday, Feb. 15, 8 a.m.-noon MST in the Steve Schiff Auditorium (7-11 a.m. PST in the Bldg. 904 auditorium in California). At 8:30 a.m. MST, Div. 1000 VP Steve Rottler will introduce the film. Key players involved in the making of the documentary will be present for discussion before (8-8:30 a.m. MST), during the intermission (10-10:15 a.m.), and after (11:30 a.m.-noon) the screening, which is presented as unclassified, Official Use Only. Questions to Bob Paulsen at 505-844-0132 or rapauls@sandia.gov.



50 years ago . . . Controlled acceleration was achieved by Sandia's new 5.5 inch air gun. The new air gun can be controlled to produce sharp peaked triangular shock pulses, a revolutionary accomplishment for air guns. In these kinds of shock, the relationship of acceleration to time is much different from the old air gun shock pattern. Sandia's air gun can produce longer acceleration rise-times and shorter deceleration times. Components inside the piston of the air gun will have the shock of going from 0 to 520 miles per hour while travelling 71.5 inches. **Direct air service from Las Vegas, Nev., to Tonopah Test Range is now available to Corporation employees** under an arrangement with Alamo Airways. Until now transportation between the two points was only possible by a 200-mile drive in a rented car or a bus that left Las Vegas at 4:30 a.m. and arrived at Tonopah at 9:00 a.m., still 40 miles from the Test Range.



C.W. Wray (7322), at right, checks the operation of the air compressor of Sandia's new air gun prior to a test shot. At the breech end of the gun is H.D. Sivinski (7311) and H.R. Bowers (7322).



Arrival of the first plane making daily round trips from Las Vegas, Nev., to Tonopah, Nev.

40 years ago . . . Sandia Engineering Reactor (SER) has been retired after eight years of operation.

The five-megawatt steady-state nuclear reactor was shut down because the demand for steady-state reactor experiments dropped off and its regular maintenance and manpower costs continued. The newer Annular Core Pulse Reactor, which can be operated in either a pulse or steady-state mode, is considerably cheaper to operate, easier to maintain, and more versatile. Following the last run on June 6, 1969, after its 1,840th experiment, SER was placed on a standby basis. **A new fabrication technique that improves the optical characteristics of ferroelectric electro-optic ceramics has been developed** at Sandia Laboratories. Materials produced by the new method are more transparent and more homogeneous than those made by conventional hot-pressing. Ultimately, these ceramics are expected to have application to memory and display devices similar to those used in computer systems.



A special shipping cask containing four fuel elements from the Sandia Engineering Reactor is raised for radiation readings by health physicist Charles Berglund (3311).



TRANSPARENCY is the goal in these ceramics for electro-optic applications, and Gene Haertling (2317) displays, at left, the improved transparency resulting from his new fabrication technique.

30 years ago . . . The new technology of fiberoptics makes communication faster and cheaper. One of its first applications at Sandia is to interconnect the principal computers, some 15 in number, in Area III. Installation is scheduled for one kilometer of prototype fiberoptic cable, which will connect the Area III central computer with the computer in the Complex Wave Vibration Facility.



RICH MEYER (1521) displays a single fiberoptic strand taken from the cable in his left hand. Similar cable is being installed in Area III to handle data transmission.

20 years ago . . . Two solar wind spectrometers on board the Ulysses spacecraft, launched from the space shuttle, carry data processing, power supply systems, and mechanical housing designed at Sandia. The spectrometers are part of a package of 11 experiments on a mission to study the sun.

10 years ago . . . Some 2,000 radiation-hardened microchips developed at Sandia for the Galileo spacecraft now orbiting Jupiter have helped NASA study the giant planet and its moons in unprecedented detail.

Sandians at the Kauai Test Facility (KTF) successfully launched a target rocket as part of a flight test of an interceptor being developed for the Navy Theatre Wide missile defense system. The launch of the SM-3 interceptor from the Aegis cruiser *Lake Erie* several hundred miles northwest of Kauai was the interceptor system's second flight test.



TARGET VEHICLE (based on a modified Minuteman I second stage rocket motor) lifts off from the Kauai Test Facility.

Who needs valentines when you can have Jenna Beth Arosa hugs everyday?

Story by Iris Aboytes • Photos by Randy Montoya

“Mama, God gave me to you, and He gave you to me, huh?” asks four-year old Jenna de la Rosa, daughter of Diana de la Rosa (4137). Jenna has been diagnosed with Prader-Willi Syndrome (PWS).

Prader-Willi Syndrome (PWS) is a spontaneous genetic abnormality on chromosome 15 and occurs in 1 in 15,000 individuals. PWS typically causes low muscle tone, short stature, cognitive disabilities, problem behaviors, and a chronic feeling of hunger that can lead to excessive eating and life-threatening obesity. The extreme unsatisfied drive to consume food lasts throughout a victim’s lifetime.

Jenna was born two months premature. At birth, she weighed three and a half pounds and was 17 inches long. She spent three months in the neonatal intensive care unit. Jenna was almost nine months old when a diagnosis was finally made.

“I think she had almost every test that can be done on an infant,” says Diana. “We knew something was wrong because she did not have enough muscle strength to even suckle. During her hospital stay, she had a feeding tube and oxygen. We finally left the hospital with a G [gastric feeding] tube.”

The African proverb, it takes a village to raise a child, has taken new meaning for Diana. Her parents, Humberto and Roberta, and her sister, Kathy, have helped care for Jenna. “In the beginning, the village included several doctors and therapists,” says Diana, “If it hadn’t been for my family and the generosity of Sandians who donate vacation, I would have had additional worries,” says Diana. “I will forever be grateful to everyone.”



JENNA always has a smile on her face.



JENNA and her mother, Diana de la Rosa, sharing quality time and having fun at the park.

“This syndrome lowers your metabolism to one-third of normal,” says Diana. “That means portion and calorie control and eating light foods. It also means locking the cabinets and refrigerator, and saying ‘no’ when she wants more. Imagine feeling hungry all the time.”

Jenna loves ice cream, tacos (tacos), playing with her dolls, having tea parties, and giving hugs. “When she was in the 3- to 4-year-old class, she began the school year by hugging everybody in the class,” says Diana. “Her nickname was Hugger within the first week. There was a little boy in her class who had a sensory disorder and did not like being touched. When Jenna hugged him, he hugged her right back.”

“I know I am biased,” she adds, “but Jenna leaves a lasting impression and a smile on people’s faces wherever we go. Last weekend Jenna needed her glasses adjusted. When we got to the store there was a long line and people were very impatient. Jenna found a chair and went to sit next to a woman. Before I knew it she and the woman were in deep conversation. When it was almost time for us, I called out to her. She had taken her shoes off. The woman was full of smiles as she helped her put them back on. As we were finished and leaving the store, I don’t know what she did, but she left all the people on line with smiles on their faces. That’s my Jenna.”

When Jenna gets a reward for being a good patient or student, she wants to make sure her mama has one, too. She tells whoever gives her the little gift, “my mama?” “She always wants to make sure I have what she has,” says Diana. “She takes care of me.”

Jenna goes to gymnastics and will be able to participate in Special Olympics when she is eight years old. She also loves horses and rides them every Friday afternoon at Skyline Therapy. “I try to keep her active all the time to increase her muscle strength,” says Diana.

Diana’s mother, Roberta, took Jenna on their own special outing this past Christmas. She ordered Jenna her own ice cream with strawberries and whipped cream. Jenna does not usually have her own ice cream, she usually shares. When the waiter brought the ice cream and put it in front of Jenna her eyes lit up. She was excited it was all hers.

“This is the best ice cream in the whole world,” Jenna exclaimed.

“Occasionally my mom refers to her as Shirley Temple,” says Diana, “because she is always smiling and animated. Jenna gets mad at her and tells her that her name is not Shirley Temple, but Jenna Beth Arosa. She can’t say de la Rosa.”

Jenna is the apple of her grandpa Humberto’s eye. He and Jenna are building a rabbit hutch. Diana has told Jenna that maybe if they have a hutch, the Easter

Bunny will bring her a bunny. So grandpa and Jenna have a weekend project. Jenna will help grandpa by bringing him the tools.

Diana’s grandmother, Faye Blackwood, used to say that Jenna was her angel. “She’s taught us real, unconditional love.”

“After Jenna was born, one of my friends sent me a copy of a poem by Emily Perl Kingsley, called Welcome to Holland,” says Diana. “The poem talks about the experience of raising a child with a disability to try to help people who have not shared that unique experience to understand it. To imagine how it would feel.”

The poem likens having a baby to planning a vacation trip to Italy. Your plans include the Coliseum, Michelangelo’s David and the gondolas in Venice. After months of anticipation the day finally arrives. You are on the plane and it lands. The stewardess comes in and says, welcome to Holland. Holland, you say, I signed up for Italy. There has been a change in the flight plan and you land in Holland and there you must stay.

It’s just a different place, slower-paced and less



WHEN NOT AT WORK, Diana and Jenna are always together.

flashy. You have to buy new guidebooks. After you’ve been there for a while you catch your breath and look around. You begin to notice the windmills and tulips, and even some Rembrandts. The poem makes the point that this is not what you had planned, but if you spend your life mourning the fact that you didn’t get to Italy, you may never be free to enjoy the very special, the very lovely things about Holland.

“No, I did not go to Italy,” says Diana, “but Holland is so much more special. I realize just how blessed I am when Jenna comes running into my arms, gives me a big hug and says, ‘You’re the best mama in the whooooooole world.’”

Diversity Cinema



Join the Diversity & Inclusion Organization’s February Diversity Cinema Feature

“I HAVE A DREAM”

February 15, 2011
11:30 AM- 12:30 PM
823 Breezeway

Our nation was forever moved on August 28, 1963, when Martin Luther King Jr. spoke those famous words. Through his trials and tribulations we are able to move towards a more diverse and inclusive world. Come see this moving speech, and discuss how it has changed ALL of our lives.

Participants can register at the Diversity website:
<http://diversity.sandia.gov/>



Sponsored by the Diversity & Inclusion Organization
For questions contact Marie Brown 284-3171 or Thomas Barr 284-2830