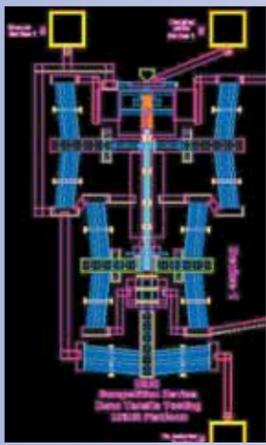




HERE COMES THE SUN — Sandia researcher Rich Diver sets up a device he has developed to calibrate parabolic trough-type solar dish collectors to maximize the amount of sunlight they capture. Says Rich, “TOP alignment could cure a significant problem with trough systems — inaccurate mirror alignment that prevents sunlight from precisely focusing on solar receivers.” The system has been very promising in tests so far. Read the story on [page 5](#). (Photo by Randy Montoya)



MEMS design contest sparks innovative entries

Winners in the third annual Sandia-run University Alliance competition for student MEMS designs have been announced. See the story on [page 7](#).

Sandia out in full force for Intel International Science and Engineering Fair

From judges, to internship offers, to a scholarship, Labs is everywhere

By John German

At the Intel International Science & Engineering Fair (ISEF) 2007 in Albuquerque next week, a thrown tube of glue stick stands a very good chance of hitting a Sandian. Labs volunteers will be out in force all week, and Sandia is supporting the event in a number of other ways, say Sandia organizers.

“This is such an important event for Sandia and for education,” says Karen Gillings (3550), who leads a team coordinating the Labs’ contributions. “It shows promising young people that we care about improving the state of science and engineering education in this nation.”

(Continued on page 4)

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Liz Holm serves on committee to study new technologies to deter counterfeit currency
Materials science plays key role in modern anticounterfeiting efforts

By Michael Padilla

Changes are coming to US currency, thanks in part to recommendations by Liz Holm, a Sandia scientist with expertise in how various materials function.

Liz, a DMSTS in Computational Materials Science and Engineering Dept. 1814, was part of a group that helped identify potential new currency features that will use 21st-century materials and technology to help deter counterfeiting.

The goal of the group’s work was to identify and evaluate significant emerging counterfeiting threats against Federal Reserve notes and recommend technologically feasible counterfeit deterrent features for use in future currency.

For the past two years, Liz served on a



A VARIETY of technologies may be incorporated into next-generation currency to make it harder to counterfeit. (Photo by Randy Montoya)

National Academies committee to study and report on technologies to deter currency counterfeiting. She joined a national panel of scientists and engineers in a series of meetings and site visits in Washington, D.C., and around the country. The committee, sponsored by the National Research Council’s Board on Manufacturing and Engineering Design at the request of the Treasury Department, gathered data on both the counterfeiting

threat and possible solutions.

The report was recently released by the National Academies.

The previous National Academies report on this topic led the Treasury Department to

(Continued on page 6)



Monitoring water supplies

Labs researchers, using MicroChemLab technology, have developed a breadbox-sized system that can continuously monitor municipal-scale water supplies for biological pathogens including biotoxins, bacteria, viruses, and protozoa. Read the story on [page 3](#).

Also inside . . .

- Labs attacks population explosion of unused, inactive computers Page 2
- Benefits trends: Expect more consumerism in health care Page 8
- Comprehensive heating system makeover means goodbye to steam plant . . Page 9
- Grandson of Sandian awarded Navy Cross posthumously Page 12

What's what

The *Sandia Daily News* noted in one issue last week that the upcoming Sunday would witness a "rare moment" because at three minutes and four seconds after 2 a.m., the time and date would be 02:03:04 05/06/07. And, it added, that "won't happen again for 100 years - until 2107."

But, answered Daniel Wilcox (2619), "there's hope for those who miss that momentous occasion," because if you eliminate the zeroes, the time just past noon that same day would be 1234567 - 12:03:04 05/06/07.

"So if you sleep through the first one, the second - and arguably more momentous - occasion can be properly observed," he wrote. "Just don't blink."

Getting into the spirit of the exercise, he wrote, "But I'd like to point out that those who like to follow these rare moments don't need to wait until the year 2107. We'll wait with bated breath for next year's rare moment: 03:04:05 06/07/08. And there's another bonus rare moment next year - 2345678, but of course you'd have to use military time."

Then, really warming to it: "Until 09:10:11 12/13/14, we get corresponding rare moments spaced one year, one month, one day, one hour, one minute, and one second apart, after which comes the aforementioned drought, but only until 01:02:03 04/05/06 in 2106, not 2107. And once again, those on military time get an early bonus - 00:01:02 03/04/05.

"Just a minor clarification."

Meanwhile, Ron Jones (5742) also wrote to point out that sequences "like this are not really rare. A more interesting date/time was 01:02:03 04/05/06 in 2006. And next year there will be 03:04:05 06/07/08. And in 2009 there will be 04:05:06 07/08/09. Etc., etc.

"Or we could talk about 09:09:09 09/09/09, which is coming up in 2009. Or 07:07:07 07/07/07, which is coming up real soon this year. And in a few years, there will be 10:10:10 10/10/10. And 11:11:11 11/11/11, etc. . . .

"Maybe every day is actually special!"

Ron didn't mention 08:08:08 08/08/08, or 12:12:12 12/12/12. Maybe he just doesn't like those numbers.

Anyway, I learned a few things about coincidental number sequences. Most important - never tempt a space systems engineer or someone who processes satellite data with coincidental number sequences.

Wonder what they'd have to say about the Easter bunny, tooth fairy, and Santa Claus?

* * *

A lot of work's been going on in the short street in front of Bldg. 800 for the past few weeks. The area was isolated with chain-link fencing; pavement was removed; a trench was dug; big trucks with large-diameter, flexible conduits appeared.

If you had a tendency to conspiracy theories, you might wonder if there really was something to that old story about an underground tunnel connecting Sandia to Los Alamos and Dulce.

- Howard Kercheval (844-7842, MS 0165, hckerch@sandia.gov)



HOWARD KERCHEVAL

Sandia reverses population explosion of computers

Lower computer census means fewer dollars to Microsoft

By Charles Shirley

What can one person accomplish by trimming \$108 from his or her software bill?

Save Sandia several hundred thousand dollars, that's what - provided enough people do it. And this year, they did.

Sandia will spend about \$375,000 less than last year on its volume license contract for the Labs-wide use of certain Microsoft products.

Even more impressive, the Labs will pay about \$570,000 less than the early 2007 population would have cost. More than 5,000 computers were removed from active status between January and March, when the annual tally is made to determine the payment to Microsoft. That left just over 26,000 active computers.

Project funds for project computers

In 2006 Integrated Enabling Services decided its indirect funds would pay the Microsoft license fee only for computers designated as "corporate supported." That's one desktop and/or one laptop per Sandia user. Previously, IES funds had paid the Microsoft license charge for every active computer.

Most workers need a desktop computer for their normal work location, plus possibly a laptop to be productive elsewhere. Any computers beyond those are probably devoted to mission work or organization-specific projects.

If they're needed for a project, IES reasoned, project funds should pay for software licensing. If they're not needed, they should be sent to Reapplication or inactivated.

"Inactive" is a designation in the Network Information System (NWIS) to indicate the computer is in Sandia's possession but not currently being used. For example, it could be a spare, held in reserve as a replacement.

The Microsoft license authorizes installing the latest versions of Office and Windows. The license fee (currently \$108 annually) is applied to every active computer at the Labs that could use these products, whether they are actually installed or not.

Inactive computers don't count, so it's to Sandia's advantage to be sure NWIS doesn't incorrectly list them as active.

Although Sandia urged owners to declare computers inactive before last year's count, the response was disappointing, says David White, senior manager of Computer Support Unit Services 4340. The big difference in 2007 was to employ a bit of practical psychology.

Robbie Evanoff (4342), project lead for NWIS, explains. "We decided that if a computer hadn't been connected to a Sandia network for three years, it was probably inactive," she says. "So when the customer looked at the NWIS listing, that's the default they would see." To change back to active status, the owner had to enter a project and task number for the license.

900 computers to Reapplication

The idea worked. More than 900 of the not-recently-seen computers not only went to inactive status, they were later sent to Reapplication and potentially left Sandia permanently.

For the rest, if someone later needs to activate a computer, they can call the Corporate Computing Help Desk to request a status change. (Sandia's networks block inactive computers from logging in.)

It's not just the license costs that a reduction in the number of computers can save Sandia, says David. "Unlike at home, everything involved with supporting a computer in a corporation costs real money.

"Computers seem cheap to buy," David continues, "but every year it takes an amount close to the purchase price to provide machine and network security, troubleshooting when that's needed, tracking the computer as property, supplying software licenses, and a lot of other corporate expenses. If we keep only the computers we really need, Sandia funds will be available for other uses."

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Bill Murphy, Editor 505/845-0845
Chris Burroughs, Writer 505/844-0948
Randy Montoya, Photographer 505/844-5605
Mike Janes, California site contact 925/294-2447
Michael Lanigan, Production 505/844-2297

Contributors: Janet Carpenter (844-7841), John German (844-5199), Neal Singer (845-7078), Stephanie Holinka (284-9227), Howard Kercheval (columnist, 844-7842), Will Keener (844-1690), Iris Aboytes (844-2282), Michael Padilla (284-5325), Julie Hall (284-7761), Rod Geer (844-6601), and Michelle Fleming (Ads, Milepost photos, 844-4902), Darrick Hurst (intern, 844-8009). Dept. 3651 Manager: Chris Miller (844-0587).

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Sympathy

To Janet Carpenter (3651) on the death of her father, Merlin Carpenter, in Minot, N.D., April 6.



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Sandia's unattended water sensor detects toxins, bacteria in water supplies using MicroChemLab technology

Breadbox-sized package has been field-tested at a large Bay Area water utility

By Mike Janes and Patti Koning

In the future, a health safety official might get a text message alert that a toxin has been detected in the city's water supply. Immediately, the official sets into motion an emergency response plan to verify the detection and prevent its spread through the water supply. All this happens before a single person gets sick from drinking contaminated water.

That future is not as distant as it might seem. Recently, Sandia's unattended water sensor (UWS) project achieved a major milestone with the deployment of a working prototype.

In late 2004, Sandia announced a multiyear research agreement with Tenix Investments Pty. Ltd., a partnership that offered the vision of a safer future for the nation's water supplies. The collaboration aspired to develop a method for constantly monitoring water supplies for biological pathogens including biotoxins, bacteria, viruses, and protozoa.

The UWS prototype has undergone successful testing at a large Bay Area water utility for more than a year and recently was deployed to a municipal water station in Arizona for additional observation and adjustments. Staff there will perform periodic maintenance and troubleshooting on the system, which is expected to further demonstrate the viability of unattended water monitoring.

"The initial research and development was focused on defining the system, identifying its core capability, and developing a concrete tool that does what we wanted it to do," says Chris Macintosh, Tenix Investment's engineering manager. "Having now met those objectives and proven the capability of the technology, the next phase of the design will be to take this knowledge and develop a product suitable for use by the water industry."

Chris says other applications for the UWS include monitoring agricultural water for contaminants, as well as water provided to sports stadiums and other key sites.

Field-deployable detection technologies in the nation's water supplies have become a high priority in recent years. According to an upcoming report by the National Research Council's Water Science and Technology Board, "Biological monitoring devices are essential to assess the type and extent of contamination in a suspected water security event. A broader range of innovative and developing detection technologies for biological agents, including methods that are field deployable . . . should be considered and evaluated."

Sandia's UWS is a roughly breadbox-sized package containing analytic instruments, pumps, tubes, and small reservoirs to handle minute

amounts of fluid. The reservoirs, playfully referred to by Sandia researchers as the "juice bar," contain chemical buffers, fluorescent dyes, proteins, and separation gel. This innovative diagnostic instrumentation package, based on Sandia's well-known MicroChemLab technology, is mounted near the water supply. The box is connected to a small, submerged probe that transports the sample into the system.

Largely due to the automated sample preparation that is the hallmark of the device, the UWS is currently able to achieve sample analysis in just 12 minutes, a marked improvement over the original goal of 30 minutes or less.

According to lead engineer Brent Haroldsen (8125), the unattended water sensor currently is able to detect protein toxins such as SEB (*staphylococcal enterotoxin B*), botulinum, and ricin. The next phase will be to expand the device's detection capability to include bacteria such as *E. coli* and protozoa such as *Cryptosporidium*.

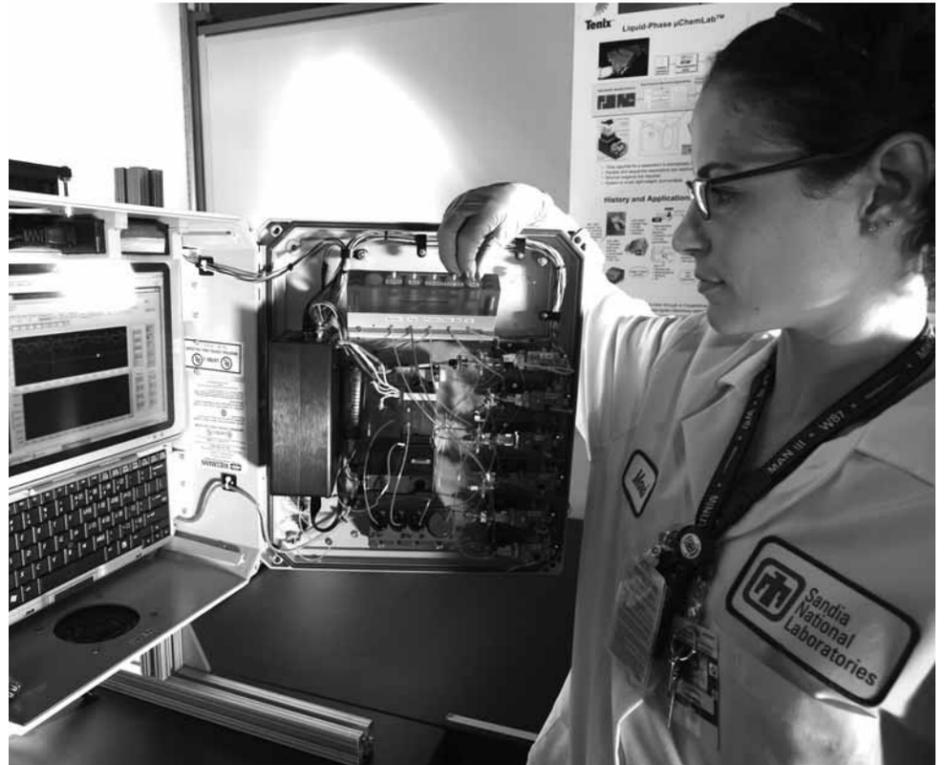
"To detect those kinds of pathogens, we will incorporate more advanced sample preparation techniques, which we have already developed for other projects," Brent says. "This requires us to solubilize, or break up the cell into individual proteins. Detecting organisms also requires improved signature recognition capability to accommodate their natural variation."

Sandia researchers need to configure a working database of organism signatures to allow them to accurately distinguish the signatures from one another. Brent and other researchers are looking at algorithm approaches that will help define the level of specificity the UWS will be able to achieve.

One such method, for example, is the Bayesian approach (Bayesian analysis is a well-known approach to data analysis that casts statistical problems in the framework of decision making, according to the International Society for Bayesian Analysis). Brent says that the technology used in the UWS could clearly discriminate between types of organisms such as bacteria or viruses, "as long as we appropriately account for their natural variability."

Lead scientist Victoria VanderNoot (8321) also notes the cost-savings advantages that come with using proteins to differentiate between organisms.

"It gets us away from having to use expensive primers or antibodies, which are needed with other techniques like



MARCI MARKEL (8324) displays the inside of the unattended water sensor. The UWS diagnostic instrumentation package includes analytic instruments, pumps, tubes, and small reservoirs to handle minute amounts of fluid. The technology is largely based on Sandia's well-known MicroChemLab. (Photo by Jeff Shaw)

Sandia California News

polymerase chain reaction or immunoassay," she points out.

A UWS with the capability and appropriate regulatory approval to detect *E. coli* and other bacteria could have great commercial potential. Utility companies spend a lot of time and money sampling and testing for such contaminants; an unattended detection system could lead to significant cost savings and the continuous monitoring capability would enable faster response if there were a problem.

Nipping blooms in the bud

Another potential commercial application is the detection of nitrifying bacteria. A large bacterial bloom can force utilities to drain and clean their entire system. Early detection would allow them to correct the problem before it reaches that stage, thereby saving both time and money.

Ensuring the reliability of the small, intricate components used to develop this prototype is a challenge that Brent and his colleagues have embraced with gusto. Sandia invented many of the components, such as a suite of microfluidic fittings, manifolds, and interconnects, because no commercial products were available to reproducibly handle small amounts of fluids.

During the deployment of the prototype, researchers expect to learn how the system will perform as the outside temperature varies. This is significant as the UWS would likely be deployed in areas with no heating, cooling, or insulation.

The UWS is expected to operate for at least three months in Arizona. Sandia and its partners would then like to bring the system to an Environmental Protection Agency facility or the US Army's Edgewood Chemical Biological Center, where it can be tested in a real-world environment that includes analysis of bona fide toxic agents situated in authentic water supply conditions. Currently, analysis is conducted in both situations individually (i.e., in a laboratory setting at Sandia or in water supply facilities in Arizona or the Bay Area), but not simultaneously.

"We've made really good progress and have proven that the concept works," says Brent. "We're proud of what we've been able to achieve."



VICTORIA VANDERNOOT (8321) observes operational data displayed by the unattended water sensor (UWS), shown here at a large Bay Area water utility. The UWS has undergone testing at the utility site for more than a year and is now deployed at a municipal water station in Arizona, where operating parameters continued to be fine-tuned. (Photo by Randy Wong)

Science and Engineering Fair

(Continued from page 1)

The event begins Sunday and continues through Friday and features science fair projects of some 1,500 precollege students representing 47 countries, regions, and territories — all winners in their regional competitions. The last time Albuquerque hosted ISEF was in 1983.

At least nine 2007 Intel ISEF participants worked at Sandia as interns or have Sandia parents or mentors. (See “Intel ISEF finalists who have ties to Sandia” below.)

Planners and volunteers

Three Sandians have played major roles in getting ready for ISEF since local planning began three years ago. Len Duda (5715) and Ted Wolff (3652) are serving as judging cochairs on

“We have a duty to help inspire and encourage students to go into technical fields. Participating in ISEF is a way for us to give back to the educational community and ultimately help our students succeed.”

Sandia VP Rick Stulen

the ISEF host committee. Manny Ontiveros (4513) is serving on the multicultural outreach subcommittee.

Among New Mexico institutions, Sandia is contributing the largest number of volunteer judges. More than 125 Sandia employees will judge, along with another 700-plus technically trained New Mexicans. The judges will review projects on Tuesday and spend Wednesday talking with ISEF finalists and scoring their projects based on ISEF criteria, says Len.

More than a dozen Sandia ISEF volunteers will perform other critical functions during the event as well.

“I want to let students know there are great, interesting careers in engineering,” says Cole Shaw (6432), who volunteered to give middle and high school students tours during ISEF’s public visitation days. “Science and engineering can change the world, and it’s important to show visiting students what they could achieve.”

Two-week internships

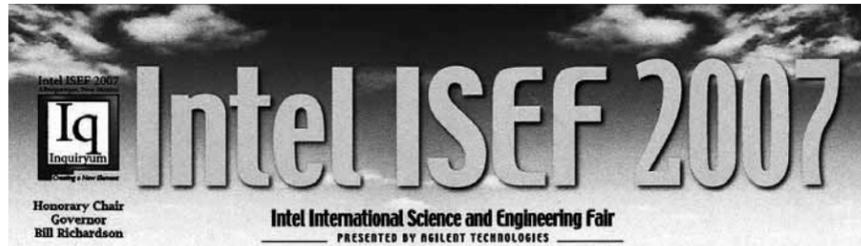
Sandia will offer some ISEF participants an all-expenses-paid two-week internship at the Labs this summer. The goal during ISEF is to get acceptances from 15 students whose projects fare well in ISEF’s 17 judging categories, says Kim Maxwell (3555), ISEF internship project lead.

While they are in Albuquerque, the students will be housed at Menaul High School and assigned to shadow members of the technical staff during the work day. The Labs is gearing up to make the program a rewarding



SCIENCE AMBASSADOR — Len Duda (5715), seen here in a tornado chamber at Explora Albuquerque’s former location in Winrock Center, and Ted Wolff (3652) are serving as judging cochairs on the ISEF host committee.

(Photo by Randy Montoya)



experience for the interns, she says. Watch the *Lab News* for more.

Event sponsorship

Sandia will offer a \$2,500 college scholarship to one ISEF project related to the application of nanotechnology in one of three categories: materials & bioengineering, electrical & mechanical engineering, or chemistry.

The winner, selected by three top Labs researchers, will be offered participation in the summer ISEF internship as well.

The scholarship will be presented during a Friday morning Government Awards Ceremony title-sponsored by Sandia. During the ceremony, Julia Phillips, director of Physical, Chemical, and Nano Sciences Center 1100, will give a five-minute welcome presentation.

In addition to the \$25,000 Sandia provided to sponsor the Government Awards Ceremony (paid for out of royalty income), the Labs provided another \$25,000 to sponsor ISEF itself (through Lockheed Martin funds to support community outreach).

Complements outreach

ISEF complements Sandia’s year-round community and education outreach efforts, says Ted Wolff of the Community Involvement Department. Most of Sandia’s programs — School to World, Family Science Night, and other Sandia K-12 programs — have a strong science component. They all aim to nurture a new generation of scientists and engineers.

“Having the Intel ISEF in Albuquerque generates enthusiasm and passion for science that will carry over long after the fair,” says Ted. “Without knowing that adults are genuinely interested in what they are discovering, many students would not continue to explore solutions to real-world challenges.”

Undoubtedly, he says, some who participate in science fairs will continue to develop as professional scientists and engineers. Those who don’t will be better informed citizens in a world where science and engineering are driving forces, he says.

Sum of support

The sum of all this support, says Rick Stulen, VP for Science & Technology and Engineering Div. 1000, is a brighter future for science and engineering in the US.

“Science and engineering are the foundations of our country’s future security and prosperity,” he says. “We have a duty to help inspire and encourage students to go into technical fields. Participating in ISEF is a way for us to give back to the educational community and ultimately help our students succeed.”

Intel ISEF finalists who have ties to Sandia

Here are ISEF finalists and their known associations with Sandia:

Tyrus Sanders (West Mesa High School), **Christian Hammond** (Rio Rancho High School), and **Quinton Smith** (La Cueva High School) wrote a stock trading program that beat the Standard & Poor 500 index, with assistance from Labs retiree James Campbell (*Lab News*, April 27). All three were participants in Sandia’s Hands On/Minds On Technologies program. Tyrus also is a participant in a Sandia-sponsored critical skills development program, the Photonics Academy at West Mesa.

Stephen Bergin (St. Pius X High School) developed a better way to identify chemicals using gas chromatography. Stephen was a summer intern at Sandia in 2006.

Sam Boling (Manzano High School) and **William Laub** (Eldorado High School) developed a program to find the most efficient way to pack crates into an airplane’s cargo hold — a classic

mathematics problem known as “the knapsack problem.” William’s father Tom Laub (1341) advised them on their project.

Melissa Hatch (Rio Rancho High School) used Sandia lab facilities and worked with John Shelnett and Zhongchun Wang (both 1112) to demonstrate the use of porphyrin nanotubes as sensors and for hydrogen generation.

Erika DeBenedictis (St. Pius X High School), who wired together eight desktop computers to solve complex problems, was a student in a Sandia-sponsored critical skills development program, the College of Cyber Defenders, and was assisted in her ISEF project by her father Eric DeBenedictis (1423) and Bill Cordwell (5614).

Zach Harris (home school) is presenting work he completed during a summer internship in 2006 working with Margaret Welk (6338). Zach’s father is Rick Harris (2997). The title of his project is “Synthesis and Characterization of Copper Doped Anatase TiO₂.”

If you go to the Intel ISEF 2007...

Members of public can visit the Intel ISEF 2007 (Albuquerque Convention Center Exhibit Halls) on Thursday, May 17, from 9 a.m. to 9 p.m. and Friday, May 18, from 9 a.m. to noon. Admission is free.

All finalists will be available from 10 a.m. to 2 p.m. on Thursday to meet visitors and discuss their work. There is no public access to any of the Intel ISEF 2007 events other than these public visitation days.

More information at www.intelisef2007.org

Sandia invention to make parabolic trough solar collector systems more energy efficient

Simple design of new technology excites solar industry

By Chris Burroughs

A mirror alignment measurement device, invented by Sandia researcher Rich Diver (6337), may soon make one of the most popular solar collector systems, parabolic troughs, more affordable and energy efficient.

Rich's new theoretical overlay photographic (TOP) technology is drawing interest from the solar industry because of its simplicity and the need to find solutions for global warming.

"TOP alignment could cure a significant problem with trough systems — inaccurate mirror alignment that prevents sunlight from precisely focusing on solar receivers," Rich says. "Improperly aligned mirrors result in lost and wasted energy."

Working with Rich on the project is Tim Moss (6337), who serves as project manager and primary software and hardware developer.

Parabolic troughs use mirrored surfaces curved in a parabolic shape. The mirrors focus sunlight on a receiver tube running the length of the trough. Oil runs through the focal region where it is heated to high temperatures and then goes through a heat exchanger to generate steam. The steam is then used to run a conventional power plant.

The world's largest parabolic trough facilities, located in the Mojave Desert near Barstow, Calif., consist of nine plants producing 354 megawatts of power at peak output. The plants range in size from 14 to 80 MW. The 30 MW plants, for example, each have about 10,000 modules with each module comprising 20 mirrors. A similar 64 MW trough plant, which will supply power to Las Vegas, Nev., is expected to go on line soon. A 1 MW plant also exists in Arizona.

An issue with parabolic trough systems, says Rich, has been lack of accurate mirror alignment



SANDIA RESEARCHER Rich Diver takes a close-up look at a parabolic trough module at the National Solar Thermal Test Facility in Albuquerque where the test unit resides. He invented a new and simple way to align trough mirrors using theoretical overlay photographic technology. (Photo by Randy Montoya)

that prevents maximum energy use.

Borrowing from variations on methods used to align mirrors in solar dish systems, Rich came up with TOP alignment, an optical approach to rapidly and effectively evaluate the alignment of mirrors in parabolic trough power plants and prescribe corrective actions.

"This method could be used during trough power-plant construction, to improve the performance of existing power plants, or for routine maintenance," Rich says. "It should be an ideal mirror alignment technique because it is simple to set up, requires a minimum of sophisticated hardware, and does not require removal of the receiver."

The TOP approach consists of a pole with five cameras positioned along it. Four of the cameras take digital photographic images of the four rows of mirrors on the parabolic module. The middle camera photographs the module's center, where a boresight gauge is attached, which is used to vertically center, or "boresight," the pole to the trough module.

'Like picking money off the ground'

Vector algebra and projection theory are then used to predict the theoretical projected image of the receiver for perfectly aligned mirrors. The calculated theoretical image of the receiver for perfectly aligned mirrors is overlaid on the photographs of the actual receiver image position in the mirrors. The images and the actual image are compared to show how the mirrors should be aligned. It then becomes a matter of adjusting the mirrors to the correct alignment.

"This whole process is very simple," Rich says. "Once the mirrors are aligned, the energy savings start. It's like picking money off the ground. And the mirrors are aligned for the life of the plant."

To address the needs of commercial-scale trough power plants such as

those at Kramer Junction in the Mojave, Rich and Tim have mounted a TOP fixture on a trailer that can be moved to parabolic power plant locations. The TOP system would photograph the modules at the plants. The images would be processed later, and work orders detailing alignment adjustment would be created. Alignment adjustments could be made when convenient, even while the plant is operating.

Rich says people have been trying to come up with ways to align mirrors in parabolic modules for at least 20 years, but their methods have always been "cumbersome and took too long."

Next steps

He and Tim have developed the TOP technique using a 20-year-old parabolic module at the National Solar Thermal Test Facility in Albuquerque. The module is the same as those at Kramer Junction. They did "shakedown" testing of TOP at a trough plant outside Tucson, Ariz., in March and October 2006. The next steps will be to test the system at Kramer Junction later this year and eventually license the technology to parabolic trough power plant operators and/or trough project developers.



Team members

Rich Diver, Tim Moss, J.J. Kelton, Daniel Ray, Mario Moreno, Doug Brosseau (all 6337), Juan Ortiz (6333)



FIELDS OF PARABOLIC TROUGH MODULES stretch to the horizon of the Mojave Desert near Barstow, Calif. Rich Diver's invention could be used to better align mirrors and make the trough power plant system more affordable and efficient.

Counterfeit

(Continued from page 1)

redesign currency in the 1990s, adding color, changing the portraiture, and including a watermark and security thread.

A unique service in the national interest

Liz used her expertise in materials science to contribute to the study. For the past 15 years at Sandia, she has worked on computer simulations to understand the behavior of materials in a variety of applications, including advanced lighting, prediction of micro-circuit aging and reliability, and the processing of innovative bearing steels. The underlying thrust of her work has been to understand how a material behaves when it performs its job, she says.

Studying technologies and concepts to help deter counterfeiting threats brings her research into the national spotlight.

"Not only is this topic something that resonates with a lot of people," Liz says, "but it was also a unique kind of service in the national interest."

Next-generation currency

The committee submitted several recommendations in two categories to the Department of the Treasury: Features in the first category could be fully developed and ready for incorporation in a banknote within seven years, while features in the second category would likely require longer than that. The second category includes revolutionary options that would dramatically shift currency away from the ink-on-paper paradigm of the past 200 years.



SHOW ME THE MONEY — Liz Holm looks over a proof sheet of dollar bills. She is a member of a group that is studying ways to make currency harder to counterfeit. (Photo by Randy Montoya)

The committee suggested 16 changes that could be incorporated in new currency within the

show up in the newly created \$100 bill due out in the next few years."

next seven years. Since the current counterfeiting threat centers on digital reproduction of paper money using scanners and inkjet printers, these suggestions focus on features that can't be successfully scanned. The ideas included the possibility of altering the feel of the bill (including analog printed patterns that create artifacts when digitally reproduced) adding a see-through registration feature, and incorporating holograms and visual effects. Patterns using metametric ink, designed to appear the same color under a particular illumination, could be used to change the color of the money in different lighting conditions. Adding a pattern of small holes in the paper using a laser, called microperforation, could also be done.

Genetically engineered cotton, twinkling eyes

Nanotechnology offers some counterfeit protection concepts that would be difficult for the casual counterfeiter to duplicate, Liz says. For instance, nanocrystal pigments could be used to provide unique color and spectral characteristics in an ink format that could be used to form images on the currency. Nanoscale printing techniques could produce printed text, images, or regular arrays of patterns at the micron and submicron range.

Long-term features include bills created from genetically engineered cotton, and solar chips implanted in bills to power electronic features — like a twinkling eye in a bill's portrait.

"It'll be exciting to see what changes are incorporated in future notes based on the recommendations the committee provided," Liz says. "Many of the recommendations may

Detection and impact of globally circulated counterfeit money

Counterfeiting is any reproduction of currency that could reasonably pass as legal tender. It is illegal to make or possess counterfeit currency, regardless of the intent to circulate it. In the US there is a greater than 90 percent chance that a counterfeiter, when caught, will be convicted.

"Counterfeiting is more of an emotional and psychological problem than a problem of the actual counterfeiting itself," says Sandia researcher and currency expert Liz Holm (1814).

Counterfeiting represents less than 0.01 percent by value of currency in circulation, she says. Nearly \$61 million passed as counterfeit in 2005 — \$56 million in the US and \$5 million abroad. Counterfeiting is not as great a problem as credit card fraud (currently \$750 million annually in the US alone) or shoplifting, which equals about \$10 billion annually.

The US dollar is the least counterfeited major currency, Liz says, with five notes per million as compared to the euro with 65 notes per million and the Canadian dollar, which at one point reached 1,000 notes per million. Lower counterfeit rates in the US, Liz adds, are attributed in large part to enforcement, particularly by a dedicated anti-counterfeiting force otherwise known as the US Secret Service.

"The [US] government takes this problem seriously and tries its best to protect its citizens from getting a worthless banknote," Liz says.

Despite low counterfeiting rates, the government cannot become complacent, Liz says. Color digital image reproduction technology has increased in quality and affordability over the past decade, spawning a large increase in domestic counterfeiting, especially by casual, opportunistic criminals, she says. Because this home-office based counterfeiting is small-scale and diffuse, it is challenging to prevent.

Liz says there are several types of counterfeiters: primitives, opportunists, petty criminals, and professionals. Primitive counterfeiters are unusu-

How money is protected

- **Optically variable ink**
Shifts copper to green when tilted
- **Watermarks**
Seen only in transmitted light
Excellent quality, 3-D look
- **Security threads**
Printed with "USA 50"
- **Microprinting**
In intaglio and offset images

ally motivated individuals using manual artistry whereas opportunists typically work solo and use home office equipment. Petty criminals use home office equipment plus specialty materials and processes.

Large-scale professional counterfeiters work predominantly in Columbia, Mexico, Hong Kong, Nigeria, and Bulgaria, often in collaboration with the illegal drug trade, Liz says.

Enemies of the US count on counterfeit dollars to help create panic and destabilize US currency, she says. Because economic responses to threats are often unpredictable and nonlinear (as the stock market demonstrates), even a small amount of counterfeiting can have a big psychological and economic impact. An example of this, says Liz, occurred when 11 percent of Canadian merchants stopped accepting \$100 bills when counterfeiting hit 300 notes per million in Canada.

Counterfeiting as a weapon

The North Korean government has been accused of manufacturing a counterfeit note termed the "supernote," says Liz, adding that the North Koreans produce this \$100 bill using the same materials, technology, and features as US currency. The note is passed through diplomats, certain banks, and terrorist networks. "Their goal

is to finance trade on embargoed items and to undermine the US," she says. "These notes can be detected by most commercial banking machines."

There are numerous types of money in circulation throughout the world, some of which are considered to be extremely difficult to counterfeit. Mexico and Australia use polymer substrates, which cost twice as much as but last four times as long as a paper dollar. The polymer substrates also offer the opportunity to include see-through windows. Switzerland uses microperforations that can't be easily removed, changed, or duplicated.

Focusing on new concepts

Nearly all worldwide notes have front-back registration features, except for the US. Liz says this is moderately challenging to duplicate but easy to verify.

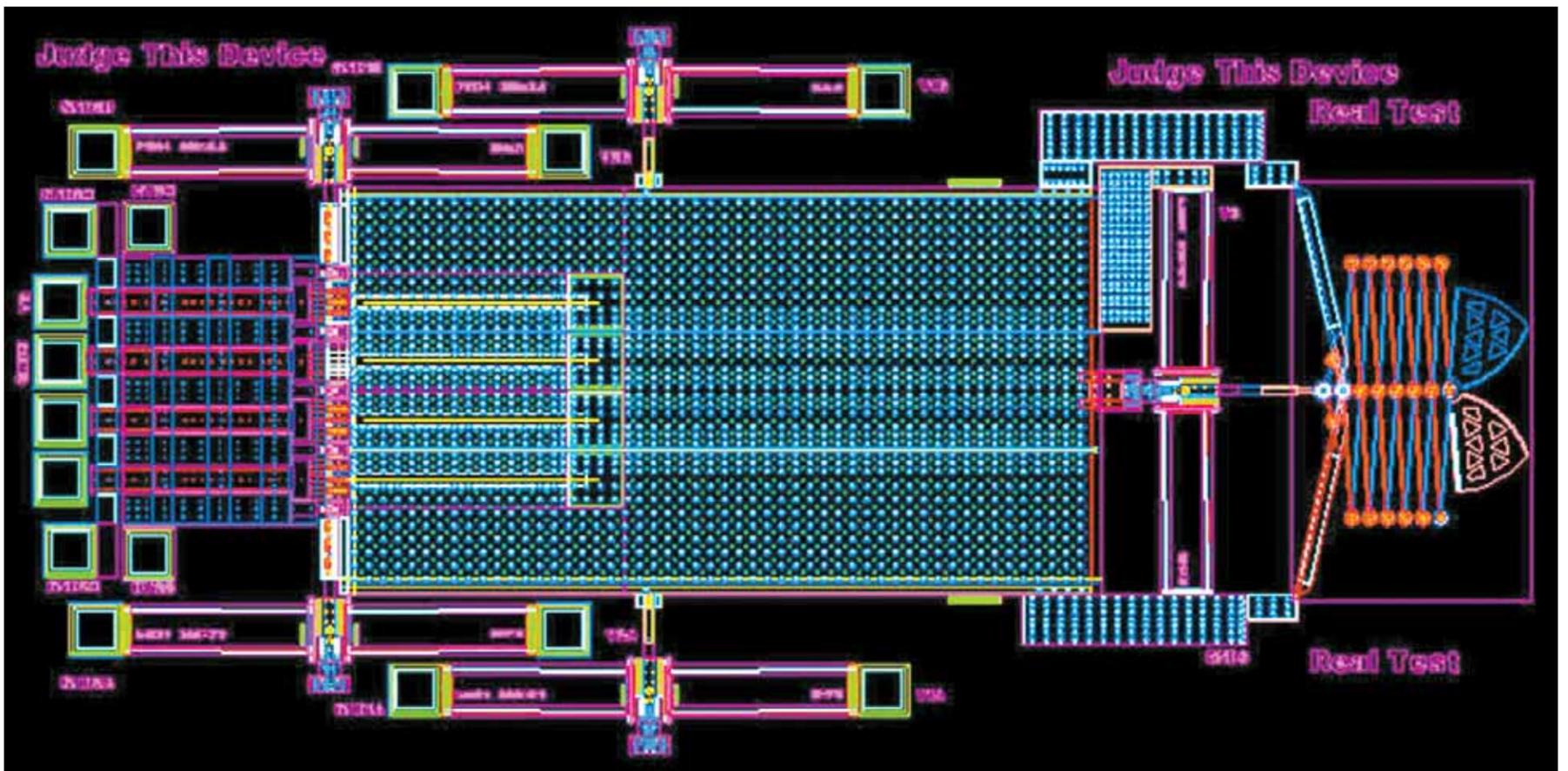
Most worldwide notes also have ultraviolet ink patterns, which require know-how and special materials to duplicate, but also need special equipment for verification.

Woven threads, iridescent inks, and dimensional features for the blind are among the features that are considered to be easy to duplicate. In addition, most currencies have holograms, but these characteristics tend to wear poorly.

Many currencies, including China's and Iraq's, have few or no high-tech features, typically because these currencies may not be desirable enough to be widely counterfeited or because the penalties for counterfeiting are so severe.

With a few exceptions, the committee avoided recommending features that are widespread in other currencies, since counterfeiters presumably are already comfortable with simulating these features.

"Instead, the committee's focus was on entirely new features and concepts that can be unique to the next generation of US currency," says Liz.



AN ACCORDION? A ROAD JACK? Neither — it's the University of Oklahoma's "smallest-arm" MEMS project, with out-of-plane extension capability and grabbers at far right.

Sandia announces MEMS design contest winners

Universities of Oklahoma and Illinois win for devices featuring 'smallest arm' and mechanical testing platform

By Neal Singer

Two winners of the third annual Sandia-run University Alliance competition for student MEMS (microelectromechanical systems) designs were announced in late April at Sandia.

The novel design category was won by a team from the University of Oklahoma, which wrested first place from perennial winner Texas Tech with a microdevice impressively named *Parvissimus brachius*, for "smallest arm."

The second category, new this year, called for a microdesign that would reliably inspect nanoscale phenomena. This was won by the University of Illinois at Urbana-Champaign (UIUC).

(This contest aligns with objectives of the National Institute for Nanoengineering [NINE], a DOE initiative headed by Sandia and led by VP Rick Stulen. The *Lab News* intends an article on NINE in a future edition.)

"This competition is an opportunity for universities around the country to participate in an experience that incorporates all the intricate details of design, analysis, and fabrication of complex MEMS devices," says Mark Platzbecker, technical team lead in MEMS Core Technologies Dept. 1749.

The University of Oklahoma students, under the guidance of mechanical engineering professor Harold Stalford, won for their design of a 3-D microstructure with a powered robotic "hand" at its summit.

"We wanted a 3-D structure with power and motion at

the top," student team leader Zach Butler explained to an audience of Sandia micro-designers. "We wanted a 3-D microrobot active above the chip and off the chip's sides to grab theoretical microfruit off a low-hanging tree."

The tool design shows a device with the ability to extend like an accordion or a micro automobile jack at the top.

The flat device when heated can rise one millimeter to a vertical position, with power available for actuators to perform tasks above the substrate through an extended arm reaching several hundred micrometers higher. Several tools for the extended arm are being investigated.

The device, said Butler, could make in vitro fertilization more efficient and provide less invasive biopsy procedures.

Kinematic simulations are in progress, he said.

In addition to Butler, other students on the team were Samuel Camp, Joseph Dingeldein, Andrew Mann, Stephen Thompson, and Andrea Watt.

The UIUC team was led by student Mohammad Naraghi under the direction of Professor Ioannis Chasiotis.

The UIUC device featured a mechanical testing platform capable of generating tens of micronewtons of force on highly deformable nanofibers, with a total displacement of 100 μm measurable by an integrated folded leaf spring-loaded cell.

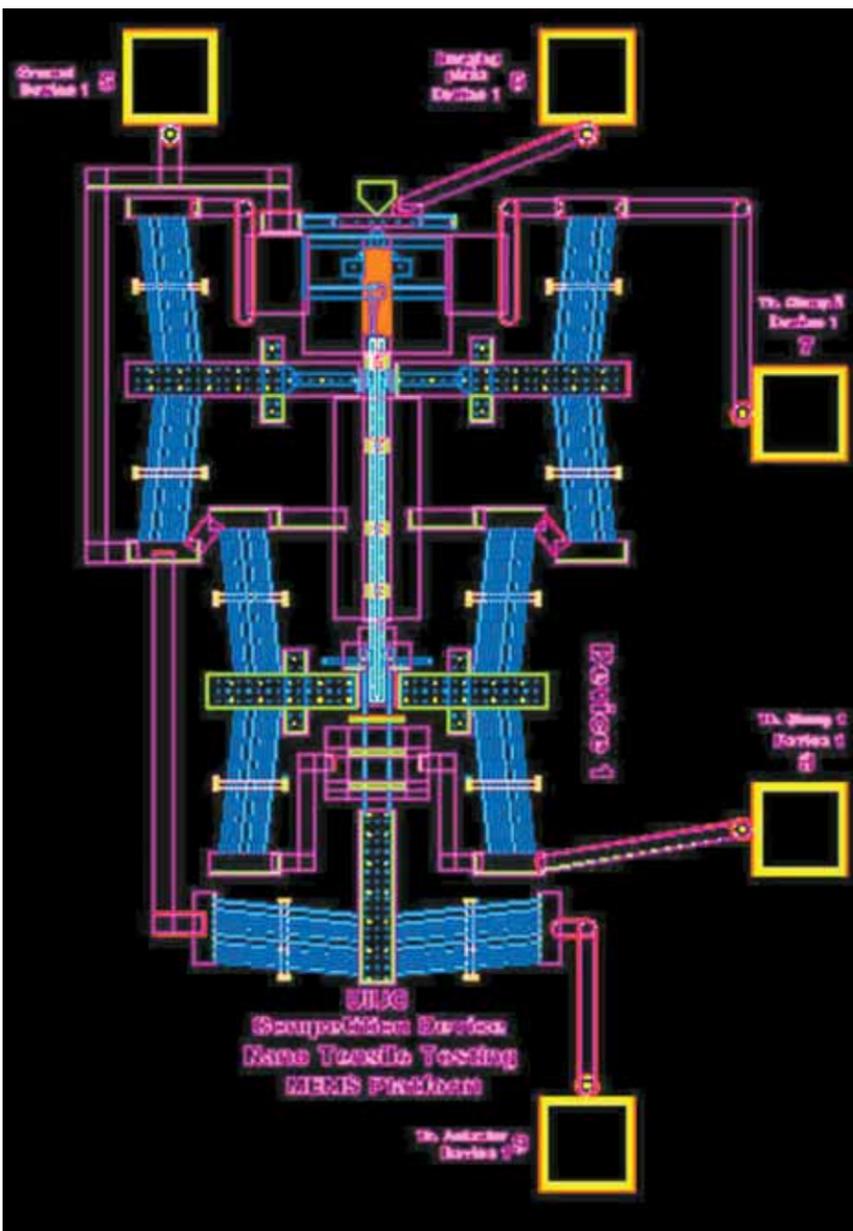
Fabrication of the designs by winners and honorable-mention finishers are among the incentives offered by Sandia for schools to join and participate in the University Alliance. Each winning school also will receive a selection of their MEMS-fabricated parts for use in their curriculum.

Seven participants in the Alliance, now 17 members strong, chose to enter this year's competitions.

"The Sandia University Alliance is steadily growing," said Tom Zipperian (1740), senior manager for MESA microfabrication. "We expect to have 20 members by next year's competition."

For more information regarding the contest or becoming a member of the University Alliance, contact Stephanie Johnson (1749-1) at srjohns@sandia.gov

More contest information can be found at www.mems.sandia.gov/ua/contest.html.



THE UIUC TENSION-TESTING MEMS structure, using a novel floating shuttle actuator, is intended to deform nano objects so their physical properties can be measured.

Benefit trends: Increased levels of consumerism in health care could help contain spiraling costs

Health plan carriers take steps toward quality and cost transparency

By John German and Margaret Lovell

In the doctor's office of tomorrow, you'll know how good your doctor is, relatively speaking, before you check in. And you'll want to play a greater role in making choices about your care because you will likely pay a greater share of the cost.

Following decades of "information asymmetry" in health care — where only the backroom plan administrators know the relative quality and cost of your selections — something more like free-market consumerism is working its way into the industry. (See "Feds press for affordable, high quality health care" below.)

"Providing the consumer with information leads to sound decision making as well as accountability on the part of physicians and health care facilities, and that inevitably will lead to higher quality and lower cost to the consumer," says Mary Romero Hart, manager of Benefits Dept. 3332.

Cost efficiency vs. quality

The cost of health care varies widely. A procedure at one clinic may cost six times what it costs at another clinic, says Mary, with no difference in the care provided. One study, in fact, suggests that higher-quality care often costs less (see "Not knowing can cost you" above right).

At the same time, employers and employees are struggling with their shares of annual double-digit cost increases for health care — a long-term trend that will eventually render the system unsustainable, she says.

"The hope is that greater access to information, combined with an increased sense of responsibility on the part of the consumer, will bring market pressures to bear on the problem," she says.

What's changing

Large insurance companies such as UnitedHealthcare (UHC), CIGNA, Aetna, and Blue Cross/Blue Shield are starting to adopt, or have already adopted, procedures to systematically assess a physician's quality and efficiency relative to other docs and present the ratings to you, the

Not knowing can cost you

A study by the *New England Journal of Medicine* reported that adults receive recommended treatments only 55 percent of the time and receive care that is potentially harmful to their health 11 percent of the time.

Another study by UnitedHealthcare finds that the cost of care provided by physicians who meet UHC quality and efficiency standards is on average 10 to 23 percent less than that provided by physicians who don't meet the standards. In other words, higher-quality care can cost less.

plan participant, via the Internet. (This is similar to what some hospitals, nursing homes, and behavioral health clinics have done for years.)

Making these ratings (based on uniform national standards accepted by the health care carriers) available to consumers should encourage doctors to improve quality and contain costs (see "How health care transparency works" at right).

What you may see at a health plan's website, for example, are doctors earning two stars, one for quality and one for efficiency; doctors with one star, denoting quality; and doctors with no stars. (Only physicians who pass the quality screen are likely to go on for a cost-efficiency analysis.)

Which doctor will you choose? The one with two stars, ideally,

but you'll likely demand at least the quality star even if you are willing to pay a bit more for an appointment tomorrow, for example.

UHC making changes

UnitedHealthcare, one of Sandia's health plan providers, has implemented such a program in 90 markets nationwide. Called the Premium Designation Program, it applies to 27 of UHC's specialty care areas.

The program is scheduled for the market that includes Albuquerque later this year. Area doctors and facilities are now being assessed against quality and efficiency standards. Their ratings will be made available soon via UHC's website.

The metrics for quality come from established national guidelines and standards that are applied equally across all markets. Efficiency of care is measured at a specialty-specific, local-market level and is based on patient care provided over an entire procedural episode of care, including appropriate use of diagnostic testing, prescribed medication, the procedure itself, and follow-up care.

Initially the premium designation will be given within select types of specialty care. The entire program may not be implemented in Albuquerque for three years or more.

Mary cautions that if a physician does not obtain a premium designation rating at first, it may simply be because he or she does not have enough cases to evaluate. Physician experience over a year or two is necessary before the doc can be considered for the program.

Making the money yours

The rest of the consumerism equation, she says, is the patient becoming sensitized to the notion that expenditures at the doctor's office belong more to the individual than in the past.

Says Mary: "I foresee a time when we will be offering employees a high-deductible preferred-provider plan plus a tax-sheltered health care savings account, into which both Sandia and the

employee will contribute, that will essentially grow or diminish based on an employee's expenditures."

Employers are beginning to adopt a health plan based on the high-deductible-plus-savings-account notion, and many more are moving in that direction. For example, in 2004 Lockheed Martin initiated a health reimbursement account program for new employees.

Mary foresees a major shift in retiree health care offered to new employees, as well. "Retiree health benefits for new employees have largely become a thing of the past for many major employers across the country. Accordingly, health care savings accounts may well become the primary savings vehicle for future retiree health care."

No decisions have been made to significantly alter Sandia's health benefits formula, says Mary. But, she adds, "Every year Sandia absorbs higher health care costs, and every year Sandians bear some of that burden by way of higher premiums, higher deductibles, and higher co-pays. We need to find innovative ways to contain these costs, both for employees and for Sandia. We're watching the national scene for solutions."

How health care transparency works

The US Health and Human Services Department website says: "Measuring health care quality is complex. As a medical discipline, it is still in the pioneering phase. Organizations of insurers and health care providers have joined forces to create standards and measures for health care quality."

The HHS provides more information about health care measurement and standards at www.hhs.gov/transparency.



DOLORES MONTOKYA, RN (3331) monitors a Sandian's blood pressure. The Labs offers several preventive medicine and health and wellness programs for employees.

(Photo by Randy Montoya)

Feds press for affordable, high quality health care

In August 2006 President Bush mandated that federal health care programs commit to four steps to improved quality and reduced costs, and in November Health and Human Services Secretary Mike Leavitt called on employers nationwide to commit to them.

The steps are:

- Technology for secure and seamless patient health information sharing,
- Provision of quality of care information on physicians and facilities to the patient in advance,
- Provision of health care costs to the patient in advance, and
- Incentives to providers to offer quality care at competitive prices.

"Every American should have access to a full range of information about the quality and cost of their health care options," Leavitt said.

Sandia News Briefs

Linda Duffy, Ed Cazzola take on new roles

Linda Duffy has been named director of Health Benefits and Employee Services Center 3300. She assumed her duties April 27. Dr. Larry Clevenger, who had served in that capacity, will remain as a director within HR Division 3000 until he retires in mid-June. Linda has more than 13 years of Sandia management experience in the health and benefits areas; during her career she has developed and implemented many programs aimed at enhancing the health and well-being of Labs employees.

In a related announcement, Dr. Ed Cazzola has been named acting Site Occupational Medical Director (a formal title used throughout the DOE complex). He also assumed his responsibilities on April 27.

System engineering symposium set for June 24-28

The 17th International Symposium of the International Council on Systems Engineering (INCOSE) will be held June 24-28 at the Town and Country Resort in San Diego, Calif. The 2007 theme, Systems Engineering: Key to Intelligent Enterprises, highlights the dramatic expansion of opportunities available to those

who learn to see and treat enterprises as systems and systems as enterprises. For information, go to www.incose.org/symp2007. Sandia is a sponsor of the INCOSE symposium and will have a booth. Sandians interested in volunteering should contact Adriana Canavan at acanav@sandia.gov.



Centralized steam plant to be supplanted by building-specific units

Heating Systems Modernization project will install 111 small hot-water boilers and eight steam boilers

By Jim Smith (10824)

An old Sandia landmark will soon be losing its steam. The steam plant (Bldg. 605) and its oil storage tanks on Wyoming Blvd., which have served parts of Sandia since the 1950s, will be replaced by individual boilers located in buildings throughout Tech Area 1.

The current steam plant has five large steam boilers. The Heating Systems Modernization (HSM) project will install 111 small hot-water boilers and eight steam boilers to address existing heating and process needs in the 48 buildings now served by the steam plant. The new boilers will save energy, water, chemicals, and maintenance costs and, compared to the pollution generated by the steam plant, will reduce air pollution (primarily nitrous oxide and carbon monoxide).

The total estimated cost for the project is \$58.5 million. The Facilities Infrastructure Recapitalization Program (FIRP) office in NNSA is providing the funds. FIRP was established to address the aging, somewhat neglected infrastructure around the nuclear weapons complex.

So, why spend the money? Consider an automobile from the 1950s. It got the job done, but by today's standards it is inefficient in almost every way. Advances in automotive technology have made many systems more efficient, more reliable, and more cost effective. The same is true with the steam plant and its modern alternatives. Like that 1950s vehicle, some replacement parts for the steam plant are increasingly difficult (sometimes nearly impossible) to obtain. The pipes that supply steam to the buildings and return condensate back to the steam plant are failing at an accelerating pace and the cost to repair or replace that piping is high.

Because funding to replace the plant will be provided in yearly installments, not all affected buildings will be converted to the new system at the same time. Buildings farthest from the steam plant will be converted first. After all buildings have been converted, the steam plant and the last two fuel-oil storage tanks will be torn down, probably in 2010.

Steam plant a fixture of Labs skyline since 1950



Photo by Randy Montoya

Built in 1950 by the US Corps of Engineers, the steam plant (Bldg. 605) was originally outfitted with four 60,000 pounds per hour saturated steam boilers. The current plant includes three of the original boilers, a 100,000 pounds per hour boiler installed in 1968, and a 150,000 pounds per hour boiler installed in 1978.

At one time, the plant served a significant portion of Sandia Base (now Kirtland East). As the base and the Labs grew, the plant's steam and condensate piping spread farther out from the Wyoming location. In 2003, the Air Force converted to local boilers, leaving parts of Sandia on the steam plant. This action, along with piping maintenance costs, energy use, and staffing concerns, led to the decision to convert Sandia to distributed boilers and to decommission, decontaminate, and demolish the steam plant.

Since 1950, the steam plant has run 24 hours a day, every day of the year. Twelve people work on a rotational basis to ensure correct staffing. An administrative team leader, mechanic, and electrician provide daily support. In anticipation of the plant's closure, the operations and maintenance organizations have already started moving employees from the steam plant to positions in building maintenance. Following steam plant demolition, the site will be developed to provide additional parking to the west of Tech Area 1.

— Jim Smith

Construction on first-year buildings has already started. According to Facilities' HSM Project Manager Jim Smith, workers will first remove the existing heating systems completely in some buildings. This work is planned for warm weather months; however, Mother Nature may not cooperate. Anyone working in those buildings might want to bring sweaters on cooler days. "Please call your building manager to discuss specific situations," says Jim. "We're trying to minimize the impact of the project on those in the affected buildings while accomplishing the project scope."

People will also have to watch for trenches that will be dug to install gas lines to the new boilers, generally from the street to the building. However, there are no gas lines on L Avenue between

14th and 17th Streets, and a new loop will have to be installed. Bldg. 825 faces a similar problem — a new line will come from 14th Street across the north side of the parking lot south of Bldg. 823. These areas will see the worst of it but the work won't be as extensive as the recent excavation required by the Exterior Communications Infrastructure Modernization project. In fact, while digging for that project, workers put in new gas lines in anticipation of the HSM project so they wouldn't have to tear up the streets again later.

If you have questions or concerns as the project gets underway, contact your building manager. Don't know who your building manager is? Use the building manager query tool at <http://facilities.sandia.gov/bldgmgr/index.asp>.

Go-to guy Sherman McCorkle honored for civic leadership

TVC chief and longtime friend of Sandia wins Woodrow Wilson Award for Corporate Citizenship

When Technology Ventures Corp. President Sherman McCorkle recently was named a recipient of this year's Woodrow Wilson Award for Corporate Citizenship, he joined a select group of distinguished corporate leaders. Previous recipients of the honor, awarded each year by the Woodrow Wilson International Center for Scholars, include Intel's Craig Barrett, Lockheed Martin's Vance Coffman, AOL/Time Warner's Steve Case, Paramount Pictures' Sherry Lansing, industrialist Ross Perot, and the multifaceted Ted Turner. At the same time McCorkle won his award, Sen. Pete Domenici, R-N.M., was named a recipient of the Woodrow Wilson Award for Public Service, which also claims a long list of distinguished past recipients.

According to the Wilson Center, established by Congress in 1968 as a living memorial to President Woodrow Wilson, the corporate award is given "to those executives who, by their examples and their business practices, have shown a deep concern for the common good beyond the bottom line."

McCorkle says he doesn't know the process by which he was chosen, but says it is "humbling" to be recognized, adding that "just standing in the shadow of Sen. Domenici is in itself very gratifying."

A 2000 article about McCorkle in the *New Mexico Business Journal* quoted another Albuquerque community leader as saying, "If you want something done in this community, call Sherman."

McCorkle has longstanding connections to Sandia. As president of TVC since its inception in 1993, he has worked closely with the Labs' technology partnerships and tech transfer organizations. His team at TVC has shepherded many Sandians through the process of becoming entrepreneurs and has helped commercialize numerous Sandia-developed technologies. McCorkle is chairman of the Science and Technology Park Development Corp., the non-profit organization formed to manage development of Sandia Science and Technology Park. And he has, for 12 years, been vice chairman of the Sandia Corp. Investment Committee, which oversees the Labs' pension fund.

McCorkle, a New Mexico native and a banker in his previous career, has been involved for decades in a wide range of community development activ-

ities, including stints as chairman of a who's who of high-profile community betterment organizations.

Among his most visible accomplishments, McCorkle was instrumental in making the Barelax Job Opportunity Center a reality and in bringing the TVI (now CNM) Workforce Training Center to fruition. He played a pivotal role in the Kirtland Partnership Committee, which is widely credited with helping save Kirtland Air Force Base from closure in the 1990s.

While McCorkle is almost universally acknowledged as the community's indispensable go-to guy to get things done, he is quick to note that every community success story is the result of collaboration, cooperation, and teamwork. And he notes, too, that the key employers in his career — Albuquerque National Bank (later Sunwest Bank) and Lockheed Martin (parent company of TVC) — have made volunteerism and community involvement central pillars of their corporate ethic.

Looking back over a lifetime of involvement, McCorkle says he wishes he had spent more time working in the area of mental health. It's an issue, he says, that cuts across socioeconomic boundaries. "There is a stigma attached to mental health and even a stigma attached to people volunteering to help. We need many, many more volunteers in New Mexico.

"Mental health is a huge problem in America and it's an even larger problem in New Mexico. Most people don't appreciate that it is, by and large, a very treatable disease. It has to do with brain function and in reality is not much different than liver function or gall bladder function or heart function. And yet we treat it largely as we did 500 or 600 years ago by the stigma we put on those people who suffer, by allowing them to be homeless, by allowing them to be hungry, by allowing them to be both mentally ill and physically ill. The shame is that as individuals, as a community, as a state, as a nation, we do almost nothing about it."

While McCorkle has made a difference in a wide cross section of community activities, he is reluctant to cite any one accomplishment of which he is most proud.

"Sometimes it's a small thing that is incredibly meaningful in one person's life," he says. "At other times, it may be a public thing that has to do with job retention or job creation, but I don't know how to contrast those two against each other and say which is more rewarding. But over the years, I have learned this: Simply the act of giving is a reward and a joy in itself."



SHERMAN McCORKLE

Mileposts

New Mexico photos by Michelle Fleming



James Opalka
40 2623



Peter Esherick
30 5622



George Conner
42 4334



Lawrence Arellano
25 4538



James Aubert
25 1821



Joanna Frumkin
25 10762



Mary Phillips
25 10762



Lalit Chhabildas
30 1647



Thomas Sanford
25 1677

Recent Retirees



50 years ago . . . Work Starts on First Livermore Branch Building — A contract for construction of the first phase of the Sandia building program at Livermore, Calif., has been let. The Newark Construction Company of Newark, Calif., will build the first structure, an office building (911), for \$287,758. This is the first of six buildings to be constructed by the AEC for Sandia Corporation on a 50-acre plot on East Avenue, Livermore, across from the University of California Radiation Laboratory. The estimated cost for the entire project is \$4,500,000.

40 years ago . . . New 5,000-Ft. Sled Track Proved Successful; 75 Rocket Sleds Fired — Some 75 rocket sleds have streaked down Sandia's new 5,000-foot track in Area III since completion of the facility last October. From an operational standpoint, the new track is a complete success. The unique design features of the track provide for better sled performance, easier data collection, and more efficient braking and recovery of sleds.



5000-FOOT SLED TRACK in Area III, seen in this 1967 photo, had 75 successful rocket sled launches by May 1967.

. . . New Pair of Vela Satellites Orbiting — After a three-day delay caused by a faulty control valve, a Titan III C rose from Cape Kennedy early April 28 to place two Advanced Research Projects



AN AIR FORCE TITAN III C booster successfully lifted two Vela nuclear detection satellites from a launch pad at Cape Kennedy. (USAF photo)

Agency's Vela nuclear detection satellites in orbits 60,000 nautical miles in space at opposite sides of the earth. Sixteen Sandians participated in the successful launching of the satellites containing Sandia and Los Alamos Scientific Laboratory payloads. After the successful launch, nine of the Sandians left the Cape to join three other Sandians already at the Satellite Test Center in Sunnyvale, Calif. There they followed

the progress of the satellites to provide guidance in activating the payload systems and also to provide preliminary evaluations of detector and logic systems performance. . . .

New Microbial Contamination Sampling Device Developed Here — First sampling device known to be designed specifically for assaying microbial contamination on large surfaces of spacecraft hardware has been developed at Sandia Laboratory. The vacuum probe sampler removes more than 90

percent of the microorganisms from smooth test surfaces. In addition, it also tends to break up clumps of bacteria so that bacterial counting equipment may record the individual microorganisms instead of the clumps. Although it was developed to be used in studies at Sandia, Lawrence B. Hall, planetary quarantine officer, Bio-science Programs, Office of Space Science Applications, National Aeronautics and Space Administration, requested that the probe be used to monitor a spacecraft before launch.



USING VACUUM PROBE SAMPLER to check contamination on a metal cone in a laminar flow clean room are Virgil Dugan, left, and Willis Whitfield. The small device removed more than 90 percent of the microorganisms from smooth test surfaces.

30 years ago . . . New Accelerator to Advance Ion Implantation Research —

A new high voltage accelerator is now being assembled in Bldg. 884. The tandem Van de Graaff will produce voltages up to 6 MV and multiply charged heavy ion beams with energies up to 24 MeV. It will be used by Radiation and Surface Physics Research Dept. 5110 in a number of programs. Sandia will use the new accelerator to advance research in ion



HIGH VOLTAGE ACCELERATOR was used in advanced ion implantation research.

backscattering analysis at micron depths with applications in the fields of microelectronics and solar energy materials, fusion reactor "first wall" materials, and catalysts for use in coal liquefaction; heavy ion implantation simulation of radiation damage to materials, as well as the study of ion implanted surface alloys; nuclear reaction analysis at micron depths (sensitive detection and depth profiling of light isotopes for weapons and energy applications); and ion backscattering of light ions at high energies (applications include neutron tube development and fusion energy

materials studies). The new machine will be used in combination with an existing 300 keV accelerator.

20 years ago . . . High-Tech Video Delivers High-Tech Courses — The doors to the little tan schoolhouse, Bldg. 856, have been open for a semester. And Sandians have been able to walk in and register, with management approval, for any of two dozen technical courses offered via Instructional Television (ITV) — that's mostly "live" classes and a few taped ones. The new Education and Training facility represents a major milestone in onsite TV instruction, begun at the Labs in the spring of 1985 when the first remote class — on robotics — was

beamed "live" from UNM. The latest ITV productions are a far cry from the good old days at Sandia — of even two years ago — when a video camera basically just focused on a "talking head" or chased the instructor around the blackboard in Bldg. 892. There was no chance to ask questions. The new complex changes all that. The student is not a complete captive of a faraway instructor anymore. He or she can ask questions by telephone — soon to be replaced by a microphone system.

10 years ago . . . Metal-detecting molecules may find use for groundwater cleanup, process water recycling, virus detection, more — A new biochemical technique being refined at Sandia may soon enable sensors that can rapidly detect the equivalent of one contaminant particle among a billion other molecules in waste streams. The technique makes use of large, molecular aggregates called liposomes that are tailored to react with

particular metal ions in solution. A Sandia team is studying ways to entrap these spherical liposomes in porous silica materials called sol-gels — essentially whipped glasses —



which may open doors to a variety of practical inventions, from water purity sensors in microchip factories to molecule-sized metal detectors for environmental cleanup operations.

METAL-DETECTING MOLECULES — Darryl Sasaki holds vials of a solution containing liposomes targeted for copper. Copper ions were added to the solution on the left; no copper was added to the solution in the right vial. (Photo by Randy Montoya)

Christopher Adlesperger, grandson of Sandian José Montoya, awarded Navy Cross posthumously

By Iris Aboytes

Marine Pfc. Christopher Adlesperger joined the Marines in the fall of 2003, shortly after his 19th birthday. Last month he was awarded the Navy Cross posthumously. The citation reads "for extraordinary heroism while serving as a Rifleman, Company K, 3d Battalion, 5th Marines, Regimental Combat Team 1, 1st Marine Division, in support of Operation Iraqi Freedom."



CHRISTOPHER ADLESPPERGER

More than 140,000 Marines have served in Iraq, but only 14 had received the Navy Cross, second only to the Medal of Honor for bravery. Adlesperger was the 15th recipient.

Pfc. Adlesperger was the grandson of Jose Montoya (2132). "Although there is a void in our hearts, we are proud of what he's done; our hearts burst with pride and pain together," says Jose. "Chris is our hero. He was doing what he believed in and we respect him for that. He will always be loved and honored. We cherish the gift we were given; even if for too short a time."

Adlesperger grew up in Albuquerque, where he ran track and was a tae kwon do national champion. "Before a competition he would go into his 'Christopher mode,' and a sense of maturity and purpose seemed to take over," says his former tae kwon do coach Phillip Blackman. "I am sure that's how he was in boot camp and the battlefield. He only knew one way: straight ahead."

There was no 'retreat' in his vocabulary."

According to reports published in November 2004, in 30 minutes of combat Adlesperger's battalion attacked an enemy stronghold in Fallujah, Iraq. They searched the Jolan neighborhood for insurgents. The houses were close together, and the curved streets too narrow for tanks. They set out shortly after dawn. For hours they had faced only minor resistance. There were just a few buildings left before they would call it a day.

As they entered one of the houses, insurgent fire and grenades rained down on them, immediately killing Adlesperger's point man and injuring two others.

Adlesperger fired back and became the target of enemy gunfire — Adlesperger took aim at the machine-gun position to suppress its fire while he helped the two injured up the outside stairway to the roof. Insurgents tried to storm the stairway, but Adlesperger killed them before they could reach the roof. Shrapnel landed on his face, but he kept going.



JOSÉ MONTOYA (2132) proudly holds a photograph of his grandson and hero, Marine Lance Corporal Christopher Adlesperger. (Photo by Randy Montoya)

From the rooftop position, unable to penetrate the building with his M-16, Adlesperger shifted to the grenade launcher. By the end of the battle, Adlesperger was credited with having killed at least 11 enemy fighters and saving the lives of countless Marines. The building had been an insurgent command-and-control center.

Adlesperger was promoted to lance corporal because of his actions but was killed one month later while again clearing houses in Fallujah.

"By his outstanding display of decisive leadership, unlimited courage in the face of heavy enemy fire, and utmost devotion to duty, Private First Class Adlesperger reflected great credit upon himself and upheld the highest traditions of the Marine Corps," reads his citation.

"It means a lot to the family that Chris got this recognition," says his mother Annette Griego.

"He loved his family, he loved his friends, and he especially loved the Corps. Chris was the star of our family and that is how he died, a star."

Take Our Daughters and Sons to Work Day



More than 1,200 sons and daughters, nieces, nephews, and friends of Sandians in grades 6-12 visited the Labs on April 26 during the first ever combined Take Our Daughters and Sons to Work Day in New Mexico. (Sandia/California has done a combined sons and daughters day for several years.) The photos here, which convey the scope of activities offered that day, were taken by the daughters of *Lab News* photographer Randy Montoya.



Photos by Amanda and Laura Montoya, ages 13 and 15

