



IT'S A WRAP — Participating in the ribbon-cutting ceremony marking the completion of the \$518 million Microsystems and Engineering Sciences Applications (MESA) project are, from the left, Bill Jenkins, construction manager; Mike Cieslak, director of Weapon Engineering Program Center 12900; Sandia Deputy Director for Nuclear Weapons Joan Woodard; NNSA Administrator Thomas D'Agostino; Sandia President and Labs Director Tom Hunter; Sen. Pete Domenici, R-N.M.; DOE Deputy Secretary Clay Sell; and Executive VP and Deputy Labs Director John Stichman. (Photo by Randy Montoya)

# MESA — Sandia's largest project — opens

**Half-billion-dollar complex to protect US through new engineering methods**

By Neal Singer

On a beautiful summer morning, under a tent with rolled-up sides to allow air flow, approximately 100 attendees celebrated the completion of the \$518 million Microsystems and Engineering Sciences Applications (MESA) project in a formal dedication on Aug. 23 at Sandia.

Among those speaking were Sen. Pete Domenici, R-N.M., DOE Deputy Secretary Clay Sell, NNSA Administrator Thomas D'Agostino, Sandia President and Labs Director Tom Hunter, and Sandia Deputy Director for Nuclear Weapons Joan Woodard.

The 400,000-square-foot complex was completed in eight years — three

years ahead of schedule — and \$40 million under budget.

It consists of three discrete buildings: the Microelectronics Development Laboratory and MicroFab, the Microsystems Laboratory, and the Weapons

*(Continued on page 5)*

### More on MESA

- Tom Hunter on MESA . . . . . Page 5
- Construction challenges . . . . . Page 5
- Statue unveiled to honor clean room inventor Willis Whitfield . . . . . Page 6
- Comments on MESA . . . Pages 5, 6, 7, 8
- MESA in simple terms . . . . . Page 7
- MESA fact sheet . . . . . Page 7

## Sandia LabNews

Vol. 58, No. 18

August 31, 2007

Managed by Lockheed Martin for the National Nuclear Security Administration



## Sandia, partners evaluate vehicle barrier performance for borders

By Mike Janes

A joint effort involving a group of Sandians to test and evaluate various types of fencing along the US border with Mexico is helping decision makers determine appropriate fencing solutions.

The effort got under way in April with a series of crash tests to evaluate how the fences will look and perform. The tests stem from the government's commitment to deploy hundreds of miles of fencing along high-traffic, high-risk stretches of the border.

Sandia was tapped by the Fence Lab, an initiative within SBInet, to help develop and execute its fence evaluation program. A part of the Department of Homeland Security's Customs and Border Protection (CBP) directorate, SBInet is the technology network component of the Secure Border Initiative (SBI) and is responsible for integrating personnel, infrastructure, technologies, and a rapid response capability into a comprehensive border protection system.



SANDIA conducted crash tests to determine viability of different types of fences.

*(Continued on page 3)*

## New federal credential to replace current security badges

By Chris Miller

Everyone with a DOE security clearance at Sandia will begin exchanging his or her security badge this fall for what is called the new "federal credential," a new badge that will include a digital photo and fingerprints.

**The new federal credential badges will be phased in over a one-year period.**

The badge will be phased in at Sandia over about a one-year period ending Oct. 27, 2008. During the phase-in period both the current security badge and the new federal credential will be accepted for security access throughout Sandia.

Two federal credentialing centers will be established at the new Sandia badge office at the Innovation Parkway Office Center (IPOC) in the Sandia Science and Technology Park off Eubank Blvd. The credentialing centers will begin taking appointments for the new badge with a pilot group in

*(Continued on page 4)*

## Researchers making cars smarter

Cars already automatically lock doors when they sense motion and turn on warning lights if they detect potential engine problems. But they are about to get smarter, thanks to new research being done at Sandia. The story is part of Chris Burroughs' series on augmented cognition. **Page 9.**



## Also inside . . .

- Sandia ranks high in pollution prevention . . . . . Page 2
- WebCo 2.0: New Mexico, California web groups merge . . . . . Page 3
- Brackish Groundwater National Desalination Research Facility opens . . . . . Page 4
- STAR student interns shine in and out of the Labs . . . . . Page 8
- Energized work — It's not worth the risk! . . . . . Page 10

# What's what

Even if you know all the words, language can sometimes be murky. At Sandia, labspeak – the language of engineers, physicists, chemists, and other technical folks – is often difficult for the technically challenged among us to plumb. Lacing it with government acronyms and initialisms raises the level of incomprehensibility. And when all that's overlaid with biztalk, language can become almost impassable.

It's not that you don't understand what's being communicated; you just wonder why someone somewhere would want to engage in linguistic contortions rather than just say or write it in common, everyday words. Ernest Hemingway, who had a way with words, won a Nobel Prize and acclaim for weaving simple and concise ones into unforgettable stories. Simplicity works.

To get to the point, there was a time when the group within an organization that hired people, acquired benefits for them, saw that they were trained, etc., was called Personnel. At some point, it became Human Resources. Last week, a DOE announcement of a course to acquaint people with protecting themselves in case of pandemic influenza referred to the agency's Office of Human Capital Management.

By whatever name, this is the group that acquires, trains, and nurtures the organization's employees – its personnel – so why not call it that?

Disney calls that function Casting, which is understandable, of course, considering that it's showbiz. But for most organizations – companies, government organizations, schools, etc. – it's Personnel. One simple word that describes its function.

I bet Papa would have called it Personnel. I bet he wouldn't have called it Office of Human Capital Management.

\* \* \*

And speaking of words and colorfully descriptive names, "cowboy blue" is the code for a real emergency event happening while a drill is in progress. Anybody know the origin of that one?

\* \* \*

There's been a load of information to shoehorn into recent issues of *Lab News* issues, forcing editor Bill Murphy to prioritize and delay publication of some things.

A 20-plus-year retiree called last week and noted politely that it had been a while since she had seen the listing of former Sandians who have died, which is normally a staple. And while an expressed desire to see such lists published might seem morbid to younger staffers, for older retirees – especially those living distant from the Albuquerque or Livermore areas – scanning that column is a way to keep track of former colleagues.

Bill sends assurances that that feature hasn't been dropped; it's just been squeezed out the past couple of issues.

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



HOWARD KERCHEVAL  
(circa 1972)

# Sandia ranks high in pollution prevention

Sandia employees received two NNSA Pollution Prevention (P2) best-in-class awards this year. This is the fourth year that these awards have been presented across the NNSA complex to individuals and teams.

The two Sandia awards were in the Recycling category and the Waste/Pollution Prevention category. The recycling award went to a team of nine and the Waste/Pollution Prevention award went to an individual. Here's a brief look at what these Sandians accomplished:

## Recycling award: Disassembly Sanitization Operation (DSO)

This team operation, led by Dwight Stockham (4139), began in 1998 to destroy classified material removed from the Classified Waste Landfill. Since 2004, the operation has changed to act as a service offered to Sandia organizations.

Classified material accepted for DSO is disassembled and sanitized through a variety of operations including the use of a shredder, ring mill, band saw, and/or hand tools. The material is altered and/or disassembled as much as needed to make it unclassified, eliminating the need to store it securely.

"By storing it, you have to inventory it and keep track of it, which costs," Dwight says. "We recycle 80 to 85 percent of the material that is processed."

Most of the material the operation recycles is some type of scrap metal. Depending on what needs disposing of, organizations within Sandia can schedule the DSO service by contacting Dwight (844-5493 or djstock@sandia.gov).

The following Sandians were part of the award-winning team: Max Saad (2732), Wayne McKenna (4139), Patrick Dotson (4139), Craig Wood (4133), David Biswell (4139), William O'Neill (4139), Lance Errickson (4139), and David Merren (4139).

## Waste/Pollution Prevention award: HERMES III Waste Minimization Practices

Developed and implemented by Gary Tilley (1342), new practices and procedures with the High-Energy Radiation Megavolt Electron Source or HERMES III Accelerator have minimized waste and saved tens of thousands of dollars.

The HERMES III Accelerator is a modular, high-power, large-area, gamma-ray simulation source that has been in operation for 18 years. It requires maintenance that can create large amounts of hazardous and solid waste.

Personnel at the HERMES III Accelerator have been working to minimize its waste for the past 18 years, and Gary has taken it to the next level by incorporating the following processes: sulfur hexafluoride (SF6) optimization, elimination of hazardous chemicals for parts and equipment cleaning, deionized water resin bed – extended use, and hardware reuse.

According to Gary's P2 Nomination, "Instead of purchasing new equipment in an effort to enhance the process, he worked with what he had and increased the overall efficiency of the process by doing so." — Jacqueline Cieslak

# LDRD Day symposium set for Sept. 19

Sandia's Laboratory Directed Research and Development (LDRD) program will celebrate its second annual LDRD Day symposium and awards ceremony Sept. 19 in the Bldg. 962 auditorium in Tech Area 4. Thirty-six of the approximately 400 current LDRD projects will be featured from 8:30 a.m. to 3:30 p.m.

All laboratory members and interested government sponsors are invited. L- and Q-cleared individuals can enter without escort. Uncleared individuals may only enter with an escort.

For detailed information on the agenda for posters and presentations, see the symposium website at <https://ldrdsymposium.sandia.gov>. Opening speakers will include Sandia Chief Technical Officer and Div. 1000 VP Rick Stulen and LDRD program manager Hank Westrich, with Wendy Cieslak serving as emcee and host.

# Sandia LabNews

## Sandia National Laboratories

<http://www.sandia.gov/LabNews>

Albuquerque, New Mexico 87185-0165  
Livermore, California 94550-0969  
Tonopah, Nevada • Nevada Test Site • Amarillo, Texas •  
Carlsbad, New Mexico • Washington, D.C.

Sandia National Laboratories is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin company, for the US Department of Energy's National Nuclear Security Administration.

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: John German (844-5199), Neal Singer (845-7078), Stephanie Holinka (284-9227), Howard Kercheval (columnist, 844-7842), Iris Aboytes (844-2282), Michael Padilla (284-5325), Julie Hall (284-7761), Rod Geer (844-6601), Patti Koning (925-294-4911), Michelle Fleming (Ads, Milepost photos, 844-4902), Darrick Hurst (intern, 844-8009), Dept. 3651 Manager: Chris Miller (844-0587).

Lab News fax . . . . . 505/844-0645  
Classified ads . . . . . 505/844-4902

Published on alternate Fridays by Media Relations and Employee Communications Dept. 3651, MS 0165



## Sympathy

To Bill Murphy (3651), on the death of his father, Charles F. Murphy, in New Bern, N.C., who passed away Aug. 21.

## Lab News Reader Service

The *Sandia Lab News* is distributed in-house to all Sandia employees and on-site contractors and mailed to all Sandia retirees. It is also mailed to individuals in industry, government, academia, nonprofit organizations, media, and private life who request it.

### Retirees (only):

To notify of changes in address, contact Benefits Dept. 3332, Customer Service, at 505-844-4237, or Mail Stop 1021, Sandia National Laboratories, Albuquerque, NM 87185-1021.

### Others:

To receive the *Lab News* or to change the address (except retirees), contact Michelle Fleming, Media Relations and Communications Dept. 3651, 505-844-4902, email [meflemi@sandia.gov](mailto:meflemi@sandia.gov), or Mail Stop 0165, Sandia National Laboratories, Albuquerque, NM 87185-0165.

### Employees:

To change the number of copies of the *Lab News* your mail stop is receiving, please call Honario Anaya, Mail Services Team 10268-4, at 505-844-3796. At Sandia/California, contact the Mail Room at 294-2427.

# Barrier

(Continued from page 1)

As successful as the fence tests were, Sandia has the capability to include other aspects of intrusion delay and detection and other advanced security technologies, says Brian Damkroger (8130). Brian leads Sandia's Borders and Maritime Security program, an element of its Homeland Security & Defense Strategic Management Unit, which functions as a virtual organization spanning — and drawing upon — both sites and several centers. Sandia's border security efforts range from systems analysis and R&D on new detection technologies to field testing of deployed systems.

Brian was originally contacted by Fence Lab project managers in late 2006 to explore potential collaborations. Though CBP program managers were aware of Sandia, notes Brian, they hadn't yet visited the lab and wanted to learn more about its capabilities. A December meeting convinced CBP that Sandia could clearly provide the technical depth needed for the project.

For the recent Fence Lab activities, the team assembled personnel from 6400, 6700, and 8100, with Mark McAllaster (6422), a member of Sandia's Active Response and Denial Department, serving as principal investigator. Following the crash tests and initial evaluations, the Sandia team and its collaborators provided their assessments and recommendations on May 11.

"CBP was delighted with our work," says Mark. He says CBP was particularly impressed with the team's ability to pull together all the project elements — materials procurement, fence installations, vehicle purchases, and the crash tests themselves — in the required eight-week time frame. "It required an extraordinary effort by a lot of people," says Mark.

In addition to the tight deadline, weather emerged as a factor in the test and evaluation activities. An unusually wet April and May led to several close calls, Mark says, and a staff member



SANDIA EVALUATED nine different types of fences.

at the Texas Transportation Institute (TTI) is routinely assigned to observe weather radar information to keep test and evaluation staff up to date on changing conditions. Still, tests were occasionally in jeopardy of being postponed, and a severe downpour occurred only 10 minutes after the conclusion of testing on one particular day. "When you have to pull off nine tests in eight weeks, every day on the schedule counts," Mark says.

Sandia has more than 50 years of experience developing and testing physical security systems for the nation's nuclear stockpile and facilities, including the execution and documentation of many tests of both commercial and custom vehicle barrier designs. Its researchers conduct physical security activities for DOE facilities as well as special DoD sites.

Mark and other Sandia team members, including Rita Baca (10248), Ken Black (8134), and Tim Crawford (6755), applied that expertise to the testing of candidate fence technologies at TTI. The tests involved nine separate fences being developed and constructed under the direction of CBP.

The fences, six of which were designed by commercial companies around the country and constructed onsite in Texas (the other three were designed and recommended by CBP), were selected from a much larger group of proposals submitted in response to a solicitation from CBP

and Boeing. Last year, Boeing was awarded a contract to perform as the lead system integrator for the overall SBInet effort.

The vehicle barrier component of the fences evaluated by Sandia at TTI came in three varieties: cable-style, surface-mounted, and bollard-style. Though the evaluators aren't at liberty to reveal how each of the tested fences performed, border locales such as those in El Paso or San Diego have different terrains, population densities, or other environmental factors that necessitate pedestrian fences and vehicle barriers with different characteristics than a barrier that would be deployed in the wide open, rural areas of southern New Mexico.

"The border agents we interacted with were extremely helpful to us," Mark says. "They gave us some really useful insight into how current barriers are being defeated by the adversaries, intelligence that we can then use when recommending future barrier designs."

Now that the eight-week first phase of the fence test effort has been completed, Brian and Mark anticipate that the next phase of the Fence Lab project will begin quickly.

"Discussions have already begun around next steps," Brian says. "A lot of things are happening at once, but we'll probably be looking at some mix of design, deployment, and additional testing. Right now, we're waiting for the green light from SBInet management."

Brian and Mark emphasize that physical fences are only one component of a comprehensive border security system, and only one of several areas where Sandia is involved in border security work.

"Sandia doesn't merely analyze fence barriers," Mark says. "Our capabilities are truly state of the art and encompass the full spectrum of physical security, including intrusion detection alarm assessment technologies, performance testing, technology evaluation, vulnerability assessment, design, development, installation, and training."

"The work along the nation's borders is just beginning," Brian adds, "and this Fence Lab testing work is only one component of an integrated technology solution for the problem at hand. We think Sandia can continue to play a valuable role."

## WebCo 2.0: New Mexico, California web groups merge

By Julie Hall

Until recently, Sandia's two primary sites maintained separate groups of web developers: WebCo in New Mexico and WebWorks in California. Each group was an independent service center and, to a large extent, each had its own processes, work styles, and best practices.

In the past couple years, however, increased interaction and collaboration between web developers at both sites, coupled with a corporate effort to get a better handle on material posted on external websites, resulted in a merger. As of June 29, all 16 web developers from the two groups now report to manager Neal Fornaciari (8944) at Sandia/California. No one has physically moved; the new group, which will retain the WebCo name, functions as a virtual department like many other organizations at Sandia. It will continue to offer development of websites, custom web-based applications, and collaborative applications. Each site will have a team leader to coordinate and oversee projects.

The consolidation, says Neal, is the next "logical step" following the action late last year to move all web developers at the California site to his department. Managers in Computer Science and Information Technologies Center 8900 were concerned about the site's proliferation of public-facing servers and the lack of accountability for content housed on those servers. In addition to consolidating staff, they also decided to give 8944 control of the site's primary servers.

"The new WebCo and the office of the CIO [Chief Information Officer] are trying to get a better handle on the web presence at Sandia," Neal says. "We're trying to provide a more consistent web presence."

### New opportunities, better efficiencies

The merger should be transparent to customers, says Cara Corey, acting team leader for the New Mexico group who also works half time for Strategic Web Infrastructure Framework and Technology (SWIFT). "Combining both web development teams means that we're able to share resources to serve customers across all areas of Sandia," she says. Plus, the consolidation "forces both teams to reevaluate their ways of doing business and make improvements that are good for the team members and our customers."

WebCo staff also benefit from having more experts to learn from and share knowledge with, she adds.

One of the opportunities afforded by consolidation, Neal and the team leaders say, is to improve the information architecture (IA) of Sandia's external website. IA is the structure and organization of a website and comprises taxonomy and common navigational elements that support usability and findability.

If you google "Sandia computing," you get outdated information, a multitude of different website designs, and little consistency in the text of the sites, says Joe Lewis, California team leader. "People show up at your website to retrieve written content. There's no overarching information architecture to any of this," he says. "Our long-term goal is to improve that and make it a more seamless transition from one section to the next. This will ultimately make things more findable and improve Sandia's brand recognition."

While Div. 8000 has long had its own website linked to [www.sandia.gov](http://www.sandia.gov), its look was distinct from the corporate website. However, it is currently being redesigned so it appears "as one lab," Joe says. This is important from a public relations and branding standpoint, says Joe, who has worked as a web developer and web communications manager — often as part of the marketing department — in various Bay Area companies before coming to Sandia about three years ago.

"My belief is the web for any organization is one of the biggest public relations vehicles that you have," he says. "I think that the web department, even though we're in a different role, should be very closely aligned with the PR group to make sure the website is doing what it's supposed to do."

### Delving into social media

Another area the new WebCo is exploring is the social media arena. Social media refers to web-based tools, such as podcasts, message boards, wikis, and blogs, that people use to share text, images, and video.

WebCo is looking into and trying to identify and implement a comprehensive social-networking solution for Sandia that would include a social-bookmarking tool, individual profiles, and blogs, Neal says. Individual profiles (as in MySpace or Facebook) could be used by a Sandian looking for someone possessing special expertise or skill to collaborate with, he says. "This allows us to capture that expertise here in a way that's easy to get to and collaborate more effectively," he says.

WebCo discussed the concept of deploying a social-networking platform with the Operation and Planning Action Group, a decision-making body led by Deputy CIO Barry Hess that evaluates and makes recommendations on information technology investments. The next step is a detailed evaluation of the commercially available products, Neal says.

The new WebCo is also involved in a pilot study to develop and implement a common user interface for Sandia's internal websites, Cara says. "Giving these sites a common look and feel will provide users with a consistent and useful way of navigating our content and also helps the organizations better manage and maintain the content they publish," she says.

# Brackish Groundwater National Desalination Research Facility opens with ribbon cutting

## *Sandia begins water experiments at Bureau of Reclamation facility*

By Chris Burroughs

The new Brackish Groundwater National Desalination Research Facility in Alamogordo officially opened Aug. 16 with a ribbon-cutting ceremony attended by Sens. Pete Domenici, R-N.M., Jeff Bingaman, D-N.M., and Rep. Steve Pearce, R-N.M. It will be the home of a new round of water treatment technologies from many organizations including Sandia.

Making the research facility possible was a partnership among the Bureau of Reclamation, Sandia, and New Mexico State University. Over the past four years, Domenici led the effort to secure more than \$20 million in federal funding to facilitate construction of the facility and to

## New badges

(Continued from page 1)

September, and based on the results, start setting appointments for all Sandia employees in October. The new badge will be issued about two to four weeks after the appointment.

The rollout will then proceed to include Sandia employees at Sandia/California by late fall or early winter, followed by remote sites and then cleared consultants, contractors, and subcontractors. For all remote sites and individuals not at a site, there will be a credentialing center established in their vicinity. More information will be provided as it becomes available.

"This is a massive undertaking that requires a great deal of coordination throughout Sandia and the federal government," says Sandia Chief Information Officer Art Hale (9600).

### 250 individuals per week

The two credentialing centers at Sandia will be able to handle up to about 250 individuals each week, says Sally Uebelacker (4230), who is coordinating the Sandia implementation. "Individual appointments probably will take about 20 to 30 minutes each," she said.

Electronic Data Systems Corporation (EDS), a global technology services company under contract to the federal government, will notify individuals by email when to make an appointment online at one of the credentialing centers. Each individual will be asked to bring two forms of identification. A list of appropriate forms of identification will be provided.

Sandia's badge office will continue to issue site-specific badges to all uncleared individuals. Uncleared employees, consultants, and subcontractors will not receive the new federal credential at this time.

The principal changes of the new federal credential include:

- Federal employees will use it when visiting or working at a Sandia work site, and Sandians will use it at all federal sites.
- DOE agency individuals, including contractor-operated sites such as Sandia, will retain a "Q" or "L" on the face of the credential to indicate clearance level, but it is not prominently displayed.
- The new badge will use a color differentiation to indicate foreign national, contractor, first responder, and federal employee.
- It will be valid for five years.
- Individuals will not need a project/task for the first credential, but will be responsible for replacement of lost or stolen credentials. A replacement will cost at least \$30 and take from two to four weeks to obtain.

Additional information about the process will be provided periodically in the *Lab News* and the *Sandia Daily News*. Sandia has a website about the federal credential at <http://ln.sandia.gov/badge>. It will be updated periodically throughout the federal credentialing process.

launch research capabilities.

The Bureau was responsible for the engineering design and construction of the 15,000-square-foot building that sits on a 40-acre site in Otero County. It consists of six indoor and three outdoor bays where testing can be done side by side. The facility also has several evaporation ponds for concentrate management.

Experiments at the facility will focus on new desalination technologies, concentrate management and reuse technologies, and use of renewable energy in the desalination process.

"We have long worked with the bureau and other partners to make this badly needed facility a reality," Domenici said. "It is my hope that it will help us identify and pursue more efficient and affordable ways to sustain the water needs of New Mexico and other arid states. The partnerships formed bringing this research facility from concept to reality will become the basis of our nation's future in water purification technologies."

Robert Johnson, commissioner of the Bureau of Reclamation, also heralded the facility's construction and opening as an example of "great partnerships." He noted that the research planned for the facility promises "to improve technology, reduce cost, and eventually make desalination technology readily available."

"We think it will help solve water problems in rural communities," he said.

Margie Tatro (6200), line of business director for Fuel and Water Systems, noted that Sandia researchers are excited to finally be able to use the facility to demonstrate the differences between water treatment technologies, an area in which the Labs has been involved for many years.

"This will be a great opportunity for us to be a partner in helping expand our nation's water supplies," she said.

During the ceremony preceding the ribbon cutting, Sandia researcher Mike Hightower (6332) and Tom Hinkebein (formerly 6316), retired manager of the Geochemistry Department, were



SEN. PETE DOMENICI, R-N.M., center, talks to Margie Tatro (6200), line of business director for Fuel and Water Systems, Terry Marsh, left, of Dow Water Solutions, and Walker Rast of ZDD, Inc., at the Sandia research trailer at the new desalination research facility in Alamogordo. (Photo by Chris Burroughs)

recognized for helping with the planning of the new research facility.

Sandia has set up its initial research project at the site in a trailer and is conducting the experiments in conjunction with Dow Water Solutions and ZDD, Inc.

The Tularosa Basin, where the new desalination research facility is located, provides one of the most ideal locations in the world for desalination research due to the abundant availability, easy accessibility, and variability of its saline water supplies. The northeast portion of the basin alone consists of more than 200 million acre-feet of saline water ranging from 1,000 to 10,000 parts per million (ppm) total dissolved solids (TDS) with more than 20 million acre-feet with less than 4,000 ppm TDS. In addition, water levels are relatively shallow, allowing easy access to the saline groundwater supplies.

## School supply drive nets 20,000 items



Members from Community Involvement (3652), Office Professionals Quality Council's Community Outreach Team, and Sandia Laboratory Federal Credit Union collected more than 20,000 items in the recent Sandia School Supplies Drive. The items were given to the following schools: Alamosa, Armijo, Barcelona, East San José, Emerson, Kirtland, Kit Carson, La Mesa, Los Padillas, Lowell, Navajo, and Valle Vista. Sandia was also able to support two nonprofit organizations, Crossroads for Women and Life Options. Yucca Mountain office employees in Las Vegas collected 35 boxes of school supplies. The supplies raised there were given to Lincoln-Edison Elementary School, one of the neediest schools in Clark County.

# MESA opening

(Continued from preceding page)

## Integration Facility.

It will combine the most advanced design and simulation tools and the most advanced microsystems and nanotechnologies to meet NNSA mission requirements.

Said Labs Director Tom Hunter, "This is an event that truly defines this institution. [It will mean] unquestioned technological leadership in the synthesis of the almost unlimited potential of integrated microsystems and the awesome power of the world's fastest computers.

"We could have conceded to the easy, taken the road more traveled, [joined with those who are cutting back on their expectations] but not doing so has made all the difference. We join with the yea-sayers — those who had the commitment and conviction to see [this project] done."

Every speaker praised the team that had completed the complex under budget and ahead of time.

Also unveiled was a seven-foot-tall bronze statue of retired Sandia engineer Willis Whitfield, inventor of the "clean room" technology that made modern microelectronics production —

and therefore MESA itself — possible, as well as hospital surgery rooms safer (see "Statue of clean room inventor Willis Whitfield unveiled at MESA opening," page 6).

The MESA ceremony, which involved both a ribbon-cutting for the buildings and unveiling of the statue, took place at the heart of the space in which the three physically beautiful buildings are housed.

In addition to fabricating electronic circuits, the MESA facility also makes microelectromechanical systems (MEMS) for advanced security systems, sensors, guidance systems, and other applications.

The complex also includes the world's most complete compound semiconductor fabrication facility. This will produce advanced optoelectronic and custom electronic components for sensors, communications, quantum computing, and other emerging technologies.

While the facility is designed to support



TECH CORRIDOR — The opening ceremony took place at the heart of the space in which MESA's three buildings are located. (Photo by Randy Montoya)

NNSA missions, it is expected to have a broad impact on national security technologies beyond nuclear weapons and meet the technical challenges faced by several government agencies. MESA is also expected to be a major scientific research center for micro- and nanotechnologies, and contribute to international competitiveness through partnerships with US companies.

## MESA: 'It is this place, it is this time, that will define a different future'

### Remarks by Labs Director Tom Hunter at the MESA dedication

Note: Labs Director Tom Hunter was among several speakers during the dedication of the MESA facility last week who offered their congratulations and their thoughts on the significance of the MESA facility to the Labs, to DOE, and to the nation. The remarks here are excerpted from Tom's presentation:

\*\*\*

MESA is the biggest investment and construction project in Sandia's history. It's roughly a half billion dollars that was invested here by the nation, not just in buildings but in some of the world's most sophisticated microelectronics equipment.

It does not just offer the potential to deliver products; it has already done so. Over 40,000 individual products have been delivered to customers already from these facilities. And these have included key electronic components for the enhancement of the nuclear deterrent and the first micromachines ever to be placed in space orbit.

MESA is a unique facility. It allows that which can be conceived in one's mind to be created; it allows that which is beyond our conception to seem achievable. I sometimes tell audiences that this capability that you see around you will allow this laboratory to develop little things that you cannot see that do things you cannot imagine.

Fittingly, the president two weeks ago



TOM HUNTER

signed the America Competes Act, which said that our nation will not stand idly by while the world increases its relative strength in science.

Against this challenge in the global competition for innovation and creativity, MESA stands out. It is an example of our nation's resolve to never fall behind, to never accept mediocrity, and to never risk our security on the chance that we'll be found inferior, or worse, surprised.

So today we dedicate this Corridor of Innovation to the nation's future.

As you gaze to the west, behind you all, you'll see the origin and the first location of the world's most powerful general purpose computer.

Moving eastward, you'll pass by the computational engineering laboratory, where computer applications that, when I started my career, were unthinkable, a decade ago were impossible, today are done routinely.

The Weapons Integration Facility . . . where designers working across all the traditional boundaries of organizations and disciplines can create the products of tomorrow. Slightly further to the east is the microfabrication facility that turns the ideas into working solutions. And around the bend to the north, as you go off the base, the nanotechnology facility that allows even atoms, the building blocks of nature, to be assembled into novel and unique materials.

Taken together, this is a place like no other. I hope you get a sense of a different kind of place.

## MESA construction process had turns, twists, and excitement

By Neal Singer

It's easy to drive by a construction site and mark it down mentally as, well, just another site. But the people working at that site can have a spirited community life going on, particularly when they're committed to one of the most difficult construction jobs ever to be completed at Sandia: the nearly half-billion-dollar MESA project.

Late last month, past and present members of the MESA construction group met at the Mountain View Club to celebrate the arrival of the CD-4 approval letters for the project. (CD stands for Critical Decision; CD-4 is final DOE sign-off and significant approval for start of operations.)

"This was one of the most complex projects we've ever undertaken," says Bill Jenkins (12920), the unflappable construction chief who saw the project through, "and this is the best team I've ever worked with." The buildings, says the senior manager, included "the first fabrication facility in the world to integrate silicon and compound semiconductor materials, and would be "a legacy to Sandia's future." Silicon is used in computer chips for its electrical transmission and insulation properties; gallium arsenide and its sister materials are used for radio frequency and optoelectronics — the more exotic, complex material of choice for devices that use light rather than electrons.

Discussion of the project began in July 1999. The design package was submitted to DOE the day before Sept. 11, 2001. The horror of that day resulted in increased security requirements that slowed the project down a year. Final DOE signoff was achieved in June.

Of the roughly \$450 million allotted to the on-budget project, \$100 million went for new equipment and basic building systems for the Microelectronics Development Laboratory, \$250 million to replace the Compound Semiconductor Research Laboratory, and \$100 million to build the Weapons Integration Facility. The balance of the \$518 million total cost is for contingencies as they occur and for project management.

### The 'roast' tradition

The late afternoon celebration showed spirit with the affectionate "roasting" of the "Toolman," Jim Beals, in charge of stocking the MESA complex with its technical equipment. The roast — the last in a series poking gentle fun at the project's managers — gave some idea of the stress of bringing a huge building and its tools online in a timely manner. Jim agreed to pose for a *Lab News* photographer with two gifts from his staff: a mock crown and an oversized wrench.

### John Stichman . . . on MESA



JOHN STICHMAN

Says Deputy Labs Director VP John Stichman, "We intend for MESA, in its fullest sense, to be utterly transformational to Sandia's approach to solving complex engineering problems; in particular, it facilitates the integration of technologies for small, smart things and for computational modeling and simulation."



MOMENT OF GLORY — The Toolman, facilities manager Jim Beals. (See story at right.)

# Statue of clean room inventor Willis Whitfield unveiled at MESA opening

Rare event meant to honor 'fearless optimism' of all engineers

By Neal Singer

Textbooks usually don't mention the origin of the clean room technology that makes the modern microelectronics age — let alone nanotechnology — possible. Or they give passing credit to NASA or Bell Labs.

But patents for the clean room were issued in 1962 to Sandia's Willis Whitfield, who enjoyed some celebrity throughout the 1960s for the achievement. He hobnobbed with astronauts. He was sought after by industrialists wanting to lessen production failure rates as high as 50 percent in the increasing number of enterprises requiring electronics. His work was a factor in significantly lowering infection rates in hospitals because the invention improved the cleanliness of surgery rooms.

It was a small thing to Willis. In his own mind, it was not one of his greater achievements. He simply examined the systems available at the time that were used to keep rooms clean. These included ideas that seem bizarre today: walls sloped to hinder dust from settling on them; perpetual, minute-by-minute maintenance by janitors wielding cleaning cloths. The problem, of course, was that the dust — small by ordinary human standards — loomed big as boulders in etching processes as circuits grew smaller, increasing industrial component failure rates. Many solutions were proposed but nothing sufficed.

Then Willis devised the system still in use today. Like many noteworthy ideas, it was simple. Among the increasingly convoluted efforts of the time, the idea was, you might say, a breath of fresh air. Air, in fact, would be his janitor. By blowing cleansed, monotemperature, unidirectional air not only into the room but through louvers leading from it, he was able to clean rooms yet avoid whorls that would send dust spiraling and depositing. The method, on its initial tests, left rooms a thousand times cleaner than ever before, and that was just the start.

Today the patent — let for free by the Atomic

Energy Commission, which oversaw Sandia at the time — is used around the world so casually that few remember the technique had an inventor.

And Willis, who lives quietly with his wife in Albuquerque's Northeast Heights on a Sandia pension, is more or less anonymous in the world and happy with that status.

But without Willis, there might not have been a MESA. So Sandia decided to honor the quiet inventor, and through him, all engineers, with a unique response: a seven-foot-tall representation of him at the heart of Sandia's largest project. He is the only Sandian — and one of very few engineers worldwide — ever so honored with a statue.

The statue was unveiled at the MESA ceremonial opening.

Funded by Lockheed Martin and sculpted out of bronze by former Sandian Neal McEwen, it sits outside, near the ceremonial fountain of the MESA center, a testimony to the effect of engineering on the future of humanity.

"I made him bigger than life, in a somewhat casual pose, like a college professor sitting on one edge of a desk lecturing a

class, to convey someone with authority but approachable," says Neal. "We wanted to honor engineers in general through a representation of Willis."

The document near Willis' hand is a copy of his initial drawing of a clean room.

Says Sandia Executive VP John Stichman, "We're fortunate that one of our own invented the absolutely key enabling technology known as the clean room. As a laboratory known for solving important, complex problems through engineering excellence, it is fitting that we honor engineers and this special person on this site. We are especially grateful that Lockheed Martin is sponsoring this tribute."

At the statue's base is a brief summary of Willis' work, and a quote from President Dwight Eisenhower: "Engineers build for the future, not only for the needs of men, but for their dreams as well. Thus, inherently, the engineer's work is a fearless optimism that life will go forward, and that the future is worth working for."



STATUE UNVEILING — Retired Sandian Willis Whitfield stands next to a statue of himself that was unveiled at the MESA dedication last week. He is being honored for inventing the clean room. (Photo by Randy Montoya)



Read quotes from John Stichman, page 5; Paul Hommert and Don Cook, page 8

## Tom Hunter

Says Tom Hunter, "The nation faces many challenges to its security. We must maintain confidence in our nuclear deterrent. We must further address an ever-evolving set of other threats that endanger our people and their well-being. One common theme is contained in all these concerns. We must maintain our technological superiority in all areas related to national security. MESA is dedicated to that end."

TOM HUNTER

"The MESA project is a cornerstone in the foundation of the nation's science and engineering future. It uniquely provides a design environment and combines the power of the world's most powerful computers with the development of small, smart things (microsystems) that are integrated into applications of unlimited potential. There is no other place like it. We are proud the nation chose Sandia as the place for this investment. We are equally proud to complete the project on time and on budget. This is a defining achievement for Sandia."

## MESA fact sheet

- MESA is the largest federal investment in computationally enabled microtechnologies worldwide, with an original budget of \$518 million.
- The 400,000-square-foot complex was completed in eight years, three years ahead of schedule and \$40 million under budget.
- More than 600 people will work at the MESA fabrication facilities continuing Sandia's long history of miniaturizing and integrating emerging technologies to build useful and sometimes novel hardware.
- MESA is the first fabrication facility in the world to integrate silicon and compound semiconductor materials. Silicon is used in computer chips for its electrical transmission and insulation properties. Compound semiconductors like gallium arsenide and its sister materials are used for radio frequency and optoelectronics — the more exotic, complex material of choice for devices that use light rather than electrons.
- MESA's fabrication facility makes electronic circuits and computer chips that can survive assault by radiation. These so-called hardened electronics are not obtainable elsewhere. They offer security that an adversary will not explode a nuclear weapon in the atmosphere to wipe out US satellite communications or render US retaliatory weapons into duds by frying their electronics.
- The center can also provide a secure foundry for electronics and optics required for sensors designed by other US agencies.
- Access to high-performance computing simulations should make MESA a world leader in a new type of simulation-led engineering that will ultimately improve the quality of consumer goods.
- Discussion of the project began in July 1999. The design package was submitted to DOE the day before Sept. 11, 2001. Final DOE signoff was achieved in June 2007.
- For the technically inclined: MESA interests will include strained-layer superlattices, multilevel silicon sacrificial surface micromachining, photonic lattices, microfluidics, and nanotechnology discovery platforms.

## Joan Woodard



JOAN WOODARD

Says Joan Woodard, Sandia Executive VP and deputy director for nuclear weapons, "MESA is a core facility for the future of the nuclear weapons program. First, it maintains an essential capability to meet the requirements for survivability in radiation environments. This facility, along with the expertise of our outstanding staff for radiation-hardened microelectronics, will enable the advancement of microsystems as well as MEMS advanced technology to improve the safety and security of weapons. It will improve our stockpile evaluations. Finally, the MESA complex allows us to make another giant leap in the application of modeling and simulation to the design and certification process for weapons. We'll take advantage of the collocation of these integrated teams to produce key products."

## Al Romig



AL ROMIG

Senior VP Al Romig says, "MESA is the realization of a vision born more than 10 years ago when Tom Zipperian and I began working on the microsystem core of the MESA facility. That was when the concept of merging the CSRL, MDL and Advanced Packaging facilities to realize the dream of creating intelligent integrated microsystems was first created. We were looking for mechanisms to reduce infrastructure costs and to improve the efficiency of R&D and prototype production. The concept was first taken to [former VPs] Bob Eagan and Roger Hagengruber so that we could craft a strategy to communicate that vision to the DOE. We enticed Vic Reis [at DOE] with the concept and he became a strong ally of the effort. Later, [Sandia President] Tom Hunter began thinking that a merger of what was to become JCEL and this new microsystems facility might be able to revolutionize the entire way that we thought about engineering. And, thus, the MESA concept was conceived. By 2000, MESA as we know it today began the actual birthing process and the time had come for us to begin the dialogue with DOE to secure funding. Some time later, Don Cook moved into the leadership role, and as they say, the rest is history! I want to offer thanks to all the folks at Sandia who contributed so much thought, intellect, and energy to making the vision a reality; to the folks at DOE; and to the members and staff of our congressional delegation. Thanks to all these people, we now have before us an opportunity to revolutionize the way in which microtechnologies are developed and engineered into larger national security systems."

## Mike Cieslak

Says MESA Director Mike Cieslak, "MESA is a half-billion-dollar collection of bricks, mortar, and equipment with a foundation in nuclear weapons."



MIKE CIESLAK

"We physically make here the circuits that go into electronic brains so that weapons can survive radiation assaults. But MESA's use is envisioned to extend beyond that. It will serve other national security needs as well as unclassified collaborative work." (See "MESA: In simple terms, what it is," below right.)

## Rick Stulen

Says Division 1000 VP Rick Stulen, "The MESA complex represents the largest single national investment in microsystems around the globe. It is an essential supplier of unique products for our nuclear weapons and national security programs that are unobtainable anywhere else in the nation."



RICK STULEN

"But it is much more than just a collection of buildings and state-of-the-art equipment. It is the combination of scientists and engineers along with this facility that makes Sandia so special. Hundreds of people across the laboratory are a part of the discovery and innovation engine that have enabled MESA to be the extraordinary national asset that it is. As we look to a future that will include an increasing set of interactions with universities and industry, I believe we will see a new dimension of the impact of MESA on national competitiveness as well."



SEN. PETE DOMENICI, R-N.M.

*"The employees and officials of Sandia National Laboratories have delivered a new facility and capability for the federal government that is unlike any other facility in the world."*

Sen. Pete Domenici, R-N.M.

## MESA: In simple terms, what it is

By Neal Singer

Because abstract terminology sometimes confuses with nonreleasable information to make basic Sandia work not as readily understandable as it could be, here is a summary in down-to-earth terms of the importance — current and expected — of MESA.

The MESA project has nuclear origins and financing but projected larger ends.

### Nuclear weapons

A major concern of nuclear weapons as a deterrent to enemy attacks is that these potent weapons be protected against circuit failure caused by radiation.

Sandia's job is to analyze where that radiation might cause failure and protect against it.

The circuitry of a weapon sits within the weapon warhead, itself a radioactive source, for decades.

A launched missile passing beyond Earth's protective atmosphere exposes circuitry to the harsh radiation of outer space.

Reentering Earth's atmosphere near a potential target, an adversary with even a tiny nuclear arsenal might feel he has nothing to fear from these weapons because he could explode a nuclear weapon of his own in Earth's atmosphere. This would emit various forms of radiation, electromagnetic pulses, and pressure bursts from shock waves that would decommission the circuitry of any incoming nuclear weapon, essentially turning it into a dud.

The blast could also disable communications satellites, leaving US military planners blind.

A blast over the continental US could achieve the same ends.

To remove any doubt of the effectiveness of US retaliatory nuclear weapons or its satellite information system, MESA's upgraded silicon fabrication facility makes chips that retain function in extreme radiation environments.

The number of these 'hardened' circuits needed in weapons and communication satellites is too small and has too stringent a set of requirements to interest an industrial chip manufacturer. So Sandia is the supplier of these circuits, built at MESA, for defense needs.

"We physically made the chips here that will go into the W76-1," says MESA director Mike Cieslak.

Why redo them? "The physics package is fine," says Mike. "But our electronic systems are getting older than my kids. Who has the same cell phone or computer, the same oil in their car, as they did five years ago?"

And time has brought social changes as well. "Since 9/11," says Mike, "there's been a reassessment of security threats against many things — metros, power plants, and so on, as well as nuclear weapons. We want our weapons and facilities secure against threats we haven't even imagined till now."

All of MESA, he says, will be available to that purpose.

"We're developing technology options applicable either to RRW or any lifetime extension (the refur-

bishment of old weapons) deemed by Congress to be appropriate."

The point to deterrence, he says, is that foes know the weapons would work as designed if used. "The mission," he says, "is deterrence."

Only system studies, not system designs, will be made for the more advanced weapons systems at this time.

### Further defense factors

But while weapon survivability is important, so are other factors.

Surveillance devices that can help assess the reliability of these weapons can be built in MESA's facilities, which include silicon and compound semiconductor materials fabrication. Devices manufactured in these fabs also help monitor subways and ports for dangerous chemical, biological, and radiological devices. A small area permits joint fabrication between the different classes of materials — the only such facility known in the world.

MESA is also available to be a trusted foundry for national security products required by other government agencies such as DoD and others.

"We're defending against people very different from ourselves," says Mike. "Our job at Sandia is to imagine every way someone like that could attack us, and create ways to address that possibility."

### Innovative collaboration

Finally, the buildings and their researchers in MESA's unclassified areas will design innovative products in collaboration with industry and academia. The collaboration helps American companies, as in the much praised collaboration with Goodyear Tire, and also helps national defense.

"Rubber parts aren't only on tires," says Mike. "They're the O-rings and gaskets of our weapon systems. And we use polymeric foams and encapsulants in all of our weapon systems."

To accomplish this end, MESA has continued its innovative approach of placing researchers from various Sandia line organizations next to each other — if not cheek by jowl, at least in the same common area — instead of maintaining the traditional Sandia approach of pairing like with like from the same organization.

"We did this in our prototype MESA facility (MESA-TOP)," says Mike, "and it worked very well at accelerating the pace of development." Researchers maintain membership in their line orgs, where their work is still judged.

Research areas in which MESA participates include fluidics, thermal, mechanical, structural, and electrical. The work will involve computational simulations, engineering design, and actual production of parts. Microsystems involving microdevices (such as the gold louvers providing shade for NASA satellite components) as well as microcircuits are included under the MESA umbrella.

"We want to assure the safety, security, reliability, and survivability of our components and weapon systems," says Mike. "We'd like to be able to have a 'check weapons' display like we currently see 'check oil' on our dashboards."

He's looking for MESA to provide this.

# STAR student interns shine in and out of the Labs

**Lockheed Martin-Sandia program highlighted nine outstanding local high school students**

By Jacqueline Cieslak

Just through with its sixth year, Sandia's STAR program hosted nine local entering high school seniors for a special eight-week internship this summer. Norb Tencza (3650) selected the students based on nominations from their high schools and their own applications.

"They have high grades, and a passion for science and engineering," Norb says. "We see them as the best of the best in the technical fields, and specifically as having a future in engineering, maybe even at Sandia."

Each student was matched with a scientist or engineer working in a field of interest to the student. Funded directly by Lockheed Martin, the students finished the program by preparing and presenting both a written and an oral report on their experiences at the end of the summer. Here's a look at who these students are and what they did:

**Joseph Baca** of Los Lunas High School says his experience at Sandia over the summer has made his desire for an engineering career absolute.

"Before, I didn't really know how science could be applied," he says. "In school, the labs you do don't really have a certain purpose, but here, you're actually doing labs to fix a specific problem or make something more effective."

Joseph worked with Tim O'Hern (1512) on Strategic Petroleum Reserve research. He hopes to study electrical engineering when he goes to college next fall, but as he heads back to high school, he's focusing on his leadership roles as vice president of his class council and president of Los Lunas High School's National Honor Society.

**Susannah Clary** of Los Lunas High School has quite varied ambitions, from flying F-16s as an officer in the Air Force to working as a medical doctor to studying aerospace engineering.

"There are so many things I like to do," she says. "I just like to learn, and there's a certain knowledge that you get from working at Sandia that is very positive."

After placing in the International Science and Engineering Fair three years in a row, Susannah



STAR STUDENT interns spent eight weeks at Sandia. All have high grades and a passion for science and engineering.

is no stranger to lab work. She worked with Graham Yelton (1725) on nanotech electrodes while at Sandia and says she was thrilled by the high grade of science.

**Patrick Glennon** of Rio Rancho High School says he applied for a STAR internship at the recommendation of a teacher because he enjoys doing technical work — anything from working on his truck to building computers.

"I like to build things and do hands-on work," he says. "I kind of like how things work, and I'm good with computers. I knew that I wanted to do something technical, and it showed me a little about what engineers do in general."

Working with Ken Mikkelson (1342) on programming in Area 4, Patrick says his experience was different from anything he'd ever done before, as the programming he worked on was visual, not text-based.

**Sarah Hoppe** of Sandia High School spent her summer working on a project on ferroelectrics with Tim Boyle (1815). She says her experience this summer has helped her begin to realize her aspirations in science.

"Right now I want to go into chemistry, so this is pretty much exactly what I want to do," she says. "I'm more interested in research than in doing something monotonous or working with people."

Sarah says she would like to study chemistry and neuroscience after high school, potentially leading to a future career in research at someplace like the Labs. She also enjoys playing tennis, which she does on the varsity team at her high school.

**Megan Johnson** of Rio Rancho High School also worked with Tim in the Advanced Materials Lab. She says she originally thought she wanted to be a teacher, but after this summer, is reconsidering.

"Now I'm thinking I want to do something in the areas of chemical or applied sciences," she says. Although she is quite involved in music — playing keyboard, guitar, and vocals in her church band — she's mostly sold on a science career now and says she would even like to come back to Sandia for that.

"I feel like, even if I change the specifics of what I'm interested in, there will be something I'm interested in at Sandia," she says.

**Brenden Laughlin** of Rio Rancho High School spent the summer working on solar technology programming with Mike Quintana (6337). Although he has always been deeply interested in computers, he says the experience was just the push he needed to know he wants to go into computer programming.

"I always used to think it was just a bunch of guys in lab suits working on nerdy stuff," he says. "But it's actually just a bunch of guys working on stuff that really matters."

Like other STAR students, Brenden says he would consider coming back to Sandia for an eventual career. However, until then, he'll stay occupied with school and his many hobbies, which include playing the piano and writing music.

**Beth Ann Lopez** of Sandia High School worked at the Cancer Research Center at the University of New Mexico before coming to Sandia to work in the biofilms labs with Susan Altman (6313).

"What I really want to do is get an MD and a PhD, so I can work in a hospital and a lab," she says. She hopes to major in biochemistry when she heads off to college next fall.

Outside of work and school, Beth Ann spends a lot of her free time playing the clarinet. She plays in the Albuquerque Youth Symphony and multiple smaller groups, including a jazz combo and a Dixieland jazz combo, of which she says "those are my two babies."

**Martha Muna** of Highland High School spent the summer working at the Airworthiness Assurance Non-Destructive Inspection Validation Center behind the airport, doing nondestructive testing with Joe Dimambro (6416) on airplanes.

"I thought it would be an interesting summer job," she says. "It definitely has made me more interested in science. It's just really interesting, thinking up something new and not just going by what everybody else says."

Although she is definitely planning on pursuing a science-related career (either something in engineering or medicine), her interests remain very broad. She runs cross country, is involved in student senate and service club at her high school, and hopes to audition for some productions at the Adobe Theater in the fall.

**Brandon Tafoya** of Highland High School worked with Glen Argabright (10861) on fire protection and engineering. He spent a lot of time working around architects, which he enjoyed because he is interesting in going on to a career in architecture.

"I was able to go in and find my own things to do," he says. "I was able to go out with architects to different buildings and see a lot of what Sandia does. Everyone who works at Sandia was really friendly."

Entering his senior year in high school, Brandon has already taken two classes in architecture. He also plays varsity soccer, a sport he has played for the past 12 years.

## MESA dedication comments

### Don Cook

From Don Cook, managing director of the UK's Atomic Weapons Establishment and former MESA director: "MESA is the largest federal investment in computationally enabled microtechnologies worldwide. This brings great opportunity to Sandia and to DOE, and an obligation to use MESA in the best interests of US national security, wherever the need is in the government. The MESA project has been well-supported by DOE



DON COOK

and it has been executed by an exemplary Sandia-wide project team. Many of the members of the team have been with the project for years, and Sandia has done well to support this highly matrixed team across all the Sandia divisions. Although a matrixed approach appeared risky at the inception of the MESA project, Sandia has delivered fully on its capital construction management commitments. MESA is the largest capital project that I know of that has remained on its originally baselined scope, cost, and schedule. We will work to forge strong

UK/US collaboration and programs between AWE and Sandia. I look forward to being in the US for the MESA dedication so that I can give my own personal congratulations to the Sandians who brought the MESA project to successful fruition."

### Paul Hommert

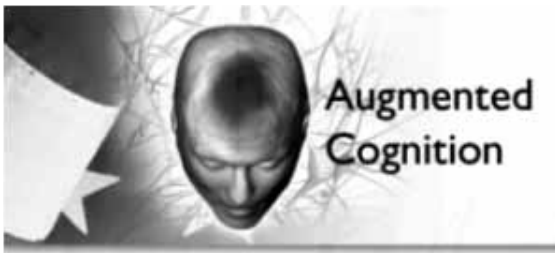
Div. 8000 VP Paul Hommert says, "MESA will enable the design and development of microsystems for applications in weapon safety, security, and surveillance as well as other national security applications. It will be a trusted foundry essential for rad-hard microelectronics for weapons, as well as for producing selected circuitry for key national security customers where US manufacturing is a



PAUL HOMMERT

must. For weapons, there'll be the option to use microsystems for certain design applications. As a key part of the whole innovation corridor, it also will enable microelectronic and microsystem product development using science-based engineering.

# Sandia researchers help to make cars smarter



By Chris Burroughs

*Editor's Note: The following story is part of a series of articles on Sandia's Cognitive Science and Technology Program.*

Cars already automatically lock doors when they sense motion and turn on warning lights if they detect potential engine problems.

But they are about to get smarter.

Sandia's augmented cognition research team is designing cars capable of analyzing human behavior.

The car of the future that the team is developing may, for example, deduce from your driving that you've become tired, or during critical situations, tell your cell phone to hold an incoming call so you won't be distracted.

The project started about five years ago with funding by the Defense Advanced Research Projects Agency (DARPA). Four years ago Sandia part-



SANDIA RESEARCHERS drive a modified military vehicle in smart car driving experiments at Camp Pendleton. The driver and a passenger sitting in the passenger's seat were fitted with caps connected to electrodes.

nered with a major commercial automobile manufacturer, and three years ago did actual experiments on European roadways.

"We utilized data that already existed on the car's computer to collect a wide range of physical data such as brake pedal force, acceleration, steering wheel angle, and turn signaling," says Kevin Dixon (6341), principal investigator. "And specialized sensors, including a pressure-sensitive chair and an ultrasonic six-degree-of freedom head tracking system, measured driver posture."

Five drivers were fitted with caps connected to electroencephalogram (EEG) electrodes to gauge electrical activity of the brain as they performed driving functions.

The researchers collected several hours of data in unstructured driving conditions that were input into Sandia software, referred to as "classifiers," that categorized driving behavior. These classifiers could detect certain driving situations such as approaching a slow-moving vehicle or changing lanes in preparation to pass another vehicle.

The system detects the difficulty and stress of the task the driver is attempting. It then tries to modify the tasks and/or environment to lower the stress and improve specified performance parameters.

Similar experiments were conducted for off-road driving where conditions were much less structured than typical roadways.

"The beauty of this is that we aren't doing anything new or different to the car," Kevin says. "All the software that can make the determination of 'dangerous' or 'safe' driving situations would all be placed in the computer that already exists in the car. It's almost like there is another human in the car."

More recently, the researchers conducted experiments at Camp Pendleton with Marine Corps personnel driving a modified military vehicle. Once again the driver and a passenger sitting in the passenger's seat were fitted with EEGs. The software classifier determined how difficult the driving situation was and the best person of the two to perform a task. For example, during a difficult driving maneuver, it might be best for the passenger to receive radio transmissions in order to not distract the driver.



THINKING CAP — Sandia cognitive researcher Chris Forsythe sits patiently as he is fitted with a cap connected to EEG electrodes that he wore during smart car driving experiments.

"Every year tens of thousands of people die in automobile crashes, many caused by driver distraction," Kevin says. "If our algorithms can identify dangerous situations before they happen and alert drivers to them, we will help save lives."

## Team members

Kevin Dixon – principal investigator, algorithm building; Chris Forsythe – project manager, psychological issue advisor; Justin Basilico — Sandia Cognitive Framework developer (all 6341)

# Sandia hosts aircraft inspectors for training in inspection technology

## Hangar full of retired aircraft serving as testing ground

By John German

Dozens of aircraft inspectors from the US Coast Guard, US Air Force, and the commercial aviation sector were in Albuquerque last week for a weeklong training course hosted by Sandia.

The workshop, sponsored by the Coast Guard, gave specialists responsible for the safety of government and corporate aircraft valuable experience using sensors and scanners to help them find small or hidden cracks and other flaws in aircraft structures early in their formation, before the defects become a safety hazard.

The training was held at a unique facility near the Albuquerque International Sunport, the Airworthiness Assurance Non-Destructive Inspection Validation Center (AANC), which houses several retired aircraft with known defects in their structures.

The AANC's focus is developing and evaluating technologies that extend the service lives of aging aircraft. Sandia operates the center for the Federal Aviation Administration.

Sandia's research at the center since 1991 has resulted in the development and certification of a variety of aircraft inspection and repair technologies now used in the commercial and government aviation sectors. More recently the center has

examined in situ, or permanently mounted, sensors for monitoring the health of aircraft structures over time (*Lab News*, July 20, 2007).

"While retired aircraft can be obtained from aircraft boneyards, there is no place else in the

***"While retired aircraft can be obtained from aircraft boneyards, there is no place else in the world that has aircraft with characterized defects."***

Sandian Mike Bode

world that has aircraft with characterized defects," says Mike Bode of Infrastructure Assurance & NDI Dept. 6416.

He says the workshop is an example of cooperation among government agencies and private sector officials, who have the common goal of increasing the proficiency of inspectors who do critical safety assessments of aircraft.

The program supports the Department of Homeland Security's US Coast Guard aging aircraft program. Another program with Dassault Falcon Jet provides similar training for corporate and business jet inspectors.



ADAM HOKE, an aviation maintenance technician with the US Coast Guard, inspects the belly of an AANC aircraft using an eddy current scanner. (Photo by Randy Montoya)



# Energized work – It's not worth the risk!

By Iris Aboytes

Why? Why that moment? Why me? Those are questions a Sandian asked himself after an electrical incident.

He came to work just like any other day. He checked his messages and email and went to his lab. He opened the door to an equipment rack to perform a routine exchange of thermocouples. At this point, he had unknowingly violated Sandia's corporate policy regarding energized work and would soon learn a lesson — the hard way.

The rack contained exposed voltage greater than 50 volts and even though he was not working on those systems, he was within their limited approach boundary. His attention turned to an unused piece of equipment in the rack that had been there since he went to work there, about eight years. "It did not look right," he says, "It should not have been there, and at that moment, after all this time, I decided to clean it up."

"It" was a wire from the unused equipment, which was loosely wrapped around a bundle of other wires. As he pulled the loose wire from around the bundle, the wire fell and the exposed leads on the end of the wire contacted an energized 277-volt termination. (A wall outlet has 110 volts.) The contact resulted in an arc flash explosion.

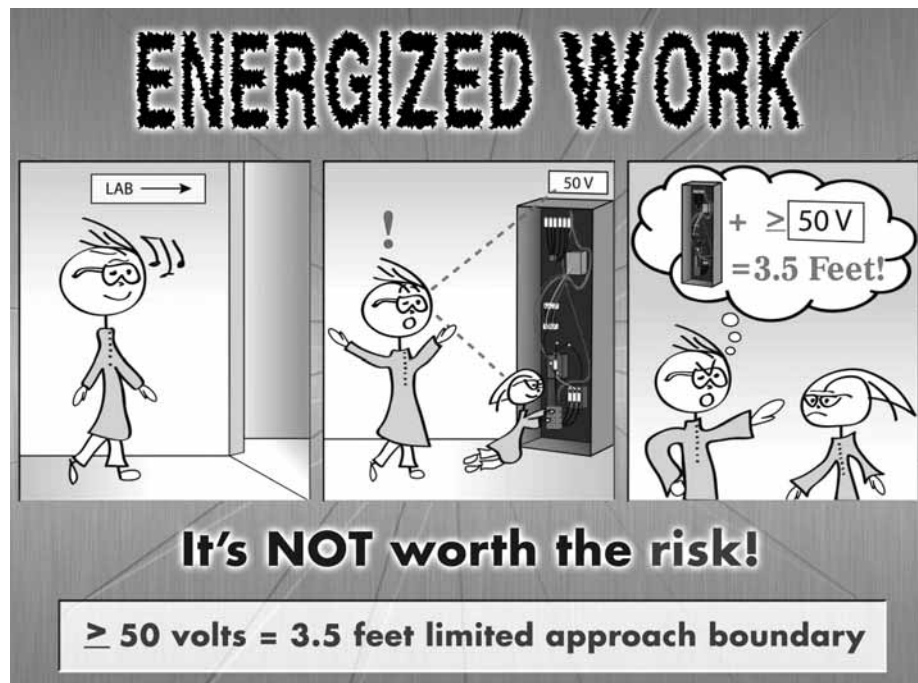
His face was about arm's length from the explosion. In about a millisecond, he was down on the floor, instantly blinded, his ears ringing. "I thought I couldn't see because I thought I was on fire," he says, "I was just waiting to feel the burn, but it didn't happen. I stood up and took two steps backwards. I still couldn't see or hear. Slowly my sight and hearing returned. Miraculously, I realized I wasn't injured. It took me about two minutes to realize I could have lost my life."

He had no burns from the arc flash. The spray of molten metal did not touch him. He was not

shocked. His eyes had no damage. "I was calm," he says, "but wondered what had happened. The unused equipment had no voltage. I didn't realize that piece of equipment was still grounded and so when the wire contacted the energized 277 volts there was an immediate short to ground, which caused the arc flash explosion."

People in surrounding offices heard the explosion and came to see what had happened. The power went out in half of the building, so the building electricians quickly descended. "It took all day to clean up the mess," he says. "All the time a constant parade of ES&H personnel kept going in and out. I did not realize what impact the incident would have. It has been over six months and we are still not fully recovered."

"When I was notified about the incident, my primary concern was for my employee," says the employee's manager. "The consequences could have been severe. I felt that we were very lucky that he was not injured, or worse. He is one of my most conscientious workers so I knew it had to be something we had overlooked. With the help of ES&H and our Sandia safety experts, we are trying to get the word out to help others avoid our mistake. It has been time consuming and expensive but definitely worth it. I never want to have to tell somebody that their loved one will not be coming home to them due to an



accident like this."

"I am a logical thinker," says the Sandian. "I realized how fortunate I was and shifted gears with regards to the way I think about safety. That is why I agreed to tell this story. Hopefully, my story will raise the awareness of exactly what is energized work. You don't have to be working directly on voltages greater than 50 volts; simply standing or working on something else within the limited approach boundary is considered energized work." In this particular instance the limited approach boundary was 3½ feet.

"If I had to do it over again, I would have never opened the rack while it was energized," he says. "It was an adrenaline rush I never want to experience again. I prefer to get my adrenaline rushes from racing motorcycles or skiing."

## Speaker at EMS lecture addresses biotech concerns

By Teresa Goering

Genetic technology has introduced an array of major scientific advances including genetically modified organisms, stem cells, and cloning. These developments, Richard Hayes, executive director of the Center for Genetics and Society, told an audience of Sandians recently, can be "profoundly consequential."

As guest speaker for the recent Environmental Management System Awards & Lecture Series last month, Hayes asserted that biotechnology, which can be applied to everything from medical advances to genetically modified bioweapons, is capable of radically reshaping the world for good or ill.



RICHARD HAYES

"One of the biggest challenges humanity has ever faced," Hayes said, "is how to understand these technologies and then how to set up rules and regulations that will allow them to be used in ways that truly enhance human well-being and are not used in ways that degrade the quality of lives."

In order to avoid biotech concerns and embrace the benefits, Hayes suggested creating an international treaty that permits positives like medical research or food production and prohibits life-threatening and eugenic practices. He stressed that the agreement must be universal to

*"One of the biggest challenges humanity has ever faced, is how to understand these technologies and then how to set up rules and regulations that will allow them to be used in ways that truly enhance human well-being and are not used in ways that degrade the quality of lives."*

— Richard Hayes  
Center for Genetics and Society

be effective and that every nation in the world adopt the same laws.

"One of the most important international treaties was the Convention on Biomedicine and Human Rights that the Council of Europe negotiated . . . It applies to most of the 48 nations in Europe; this could potentially serve as a model internationally for other countries to adopt or come into agreement around," Hayes said.

Hayes outlined five scenarios that could help people understand the development of genetic technologies over the next 20 years and said he hopes these drastic scenarios will aid in making preventative decisions (see "The scenario approach," below).

### The scenario approach

**Cold Fusion Redux** — Over a 20-year period, genetic technology is too weak to conquer the complexity of the human genome. Biotech leads to some benefits but comes nowhere near fulfilling its big predictions.

**Libertarian Transhumanism Triumphs** — Over a 20-year period, genetic technology strongly advances with few problems. Society's individual outlook leads to a hyper-biotech future. This eventually causes inequality to rise and a great genetic divide. Humans and plants alike become artifacts and this becomes "the end of nature."

**One Family, One Future** — Over a 20-year period, big advancements in genetic technology lead to bigger social problems. A rise in accidents and scandals causes a strong social reaction that undividedly rejects biotechnology and the modern way of life. Ultimately,

the benefits from biotechnology aren't worth the costs, resulting in strict control and skepticism for technology in general.

**A Techno-Eugenic Arms Race** — Over a 20-year period, genetic technology strongly advances. Major problems arise as accidents and harmful experiments occur. Instead of rejecting the root of the problems, people embrace technology and react by becoming nationalists, survivalists, and competitive. Then, worldwide genetic warfare breaks out and threats of extinguishing all life on Earth become a reality.

**For the Common Good** — Over a 20-year period, genetic technology advances lead to social problems. Concerns bring humanity together and society agrees to create biotechnology policies. International treaties and laws regulate medical research and eugenics.

# Science fair students get hands-on Labs experience

Nineteen Intel International Science and Engineering Fair (ISEF) students spent two weeks at the Labs this summer in a special internship program sponsored by Div. 1000 VP Rick Stulen's office. Conceived by Rick and VP Lenny Martinez (100), the program was part of an effort to reach out to talented high school students.

"I think many of them came here with no knowledge of what a national laboratory is or does," says Kim Maxwell (3555) of student programs, who helped to develop and administer the program. "But I think all of them walked out of here with a greater respect



NATALIE ALBERMAN listens to an instructor while working with a glovebox in the Advanced Materials Laboratory.

for what we do and the potential to think of Sandia as a future career destination."

From July 29 through Aug. 10, the students learned about nanotechnology and computer modeling. The first week they spent doing crime scene investigation activities, and the second week they participated in cyber boot camp, learning about cyber security and how to build a computer from the ground up.

Students were selected for the program based on the overall merit of their ISEF projects and a personal résumé. Wendy Cieslak (1010), Dominique Foley Wilson (1012), and Roberta Rivera (3555) reviewed more than 60 applications before picking the interns.

"The technical staff who hosted them said these kids are definitely the best and the brightest that they've ever worked with," Wendy says. "We're trying to help these students to want to go into professional careers as scientists and engineers."

Although the idea for the internship program was sparked by ISEF's presence in Albuquerque this year (see *Lab News*, May 25), Wendy says there will definitely be discussions on continuing interactions between Sandia and ISEF students in the future.

"This is a great program that we can tap into to make a difference in educating our nation's youth," Wendy says.



ISEF INTERN BECKY GROUT prepares to work with a glovebox in the Advanced Materials Laboratory. Becky, who is now studying physics at Saint Louis University, was selected on the merit of her ISEF project: "Surface Properties of Sugar Cookies."

Story by Jacqueline Cieslak  
Photos by Randy Montoya



BERNADETTE HERNANDEZ-SANCHEZ (1815, lower left) shows a group of ISEF interns how to make gold nanoparticles.



ISEF INTERNS Mustafa Iqbal (front) and Rajasree Roy listen carefully to a Sandia instructor. Mustafa's ISEF project, titled "The Effects of Electricity on Paralyzed Worms," won the fourth grand award at ISEF, and Rajasree's ISEF project, titled "Efficacy of a Modified Conditioned Defeat Model in Odor Recognition," examined a way to alleviate symptoms of post-traumatic stress disorder.

## Past, present Labs directors meet



LABS DIRECTORS MEET — Retired Sandia Labs Directors Al Narath and Paul Robinson share a moment with current Sandia President and Labs Director Tom Hunter during last week's dedication of the \$500 million Microsystems and Engineering Sciences Applications (MESA) project. Tom pointed out in his address at the ceremonies that, "In an era of increasing complexity for projects of this size, MESA stands out. It has not exceeded its budget. In fact, it's under its baseline costs. It has not exceeded its schedule. In fact, it's on track or ahead of schedule." (Photo by Randy Montoya)



REBECCA RAYMOND (1815, right), a year-round undergraduate intern at the Advanced Materials Lab, works with a group of ISEF interns.