

# Checking aircraft for defects can be done 24/7 with advances in detection

**Boeing first to accept structural health monitoring sensor as means of compliance**

By John German

Commercial aircraft one day might be fitted with networks of sensors that check for defects continuously. Like nerve endings in a human body, in situ sensors offer levels of vigilance and sensitivity to problems that periodic checkups cannot, says Dennis Roach of Infrastructure Assurance and Nondestructive Inspection Dept. 6416.

Such full-time monitoring could supplement, reduce, or even eliminate scheduled structural inspections of aircraft, he says.

"With sensors continually checking for the first signs of wear and tear, you can restrict your maintenance efforts to when you need human intervention," he says.

Dennis leads a Sandia team that is evaluating some of the first sensors for structural health monitoring, or SHM, for aircraft and other safety-critical equipment.

Initially the sensors are envisioned for hot spots where flaws are expected to form. Eventually the work could lead to "smart structures" with many sensors that would self-diagnose and signal an operator when repairs are needed.

Aircraft maintenance and repairs represent about a quarter of the US commercial airline fleet's operating costs, and those costs are rising as aircraft in the fleet age, many well beyond their design lifetimes, says Dennis.

(Continued on page 4)



IN THE BACK OF A COMMUTER JET used as a testbed at Sandia, Dennis Roach and Ciji Nelson (both 6416) examine piezoelectric sensors placed on a printed circuit board for mounting to an aircraft structure.

(Photo by Randy Montoya)

## Sandia researchers, partners win five R&D 100 awards



Sandia researchers and their partners have won five 2007 R&D 100 awards, the prestigious "Oscars of invention" presented each year by *R&D Magazine*. Read about all the winners on pages 6-7.

## Journal of Physical Chemistry honors Jim Miller with Festschrift issue

By Patti Koning

The *Journal of Physical Chemistry* has recently published (Vol. 111, Issue 19, May 17, 2007) a Festschrift issue to honor the career of Sandian Jim Miller (8353). The entire issue is a collection of articles submitted by combustion chemists to honor Jim's long and productive career.

"This is really thrilling," says Jim of his tribute issue. He describes it as a highlight of his career, along with winning the Bernard Lewis Gold Medal from the Combustion Institute last year.

A Festschrift is a book honoring a respected academic, usually in honor of an anniversary, retirement, or notable achievement. The term comes from the German word for celebration publication. This *Journal of Physical Chemistry* Festschrift is in honor of Jim's 60th birthday.

(Continued on page 4)



BEFORE SANDIA, before KAFB, there was Coyote Springs and Greystone Manor. Story on page 12.

# Sandia LabNews

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## Seeing green: OIO inspection gives Sandia Safeguards & Security program and NNSA's Sandia Site Office highest rating

By Chris Burroughs

Sandia and the Sandia Site Office (SSO) achieved an overall "Effective Performance" rating for all safeguards and security areas in a recent

DOE Office of Independent Oversight (OIO) inspection. Effective Performance, a green rating, represents the highest achievable score awarded by DOE's OIO.

All DOE facilities in the nuclear weapons complex undergo a rigorous process every two years involving some 50 inspectors who spend upwards of two months at each site reviewing records, work methods/controls, and observing and conducting performance testing.

Over the past four years the goal, focus, and drive has been for operational excellence in the security policy area, says Safeguards & Security

Center 4200 Director Mike Hazen. This area, says Mike, encompasses much more than just the Safeguards & Security Center. As such, he says, earning the green rating required the full commitment of the entire laboratory in New Mexico, California, and the Tonopah Test Range.

*"Green is my new favorite color. Sandia's inspection occurred during May and June, and we were well prepared for it. Sandians and federal oversight personnel at all locations can be justifiably proud of their combined efforts."*

Safeguards & Security Director Mike Hazen

"Green is my new favorite color," Mike says. "Sandia's inspection occurred during May and June, and we were well prepared for it. Sandians and federal oversight personnel at all locations can be justifiably proud of their combined efforts. Their commitment ensured the success that was highlighted during this intense inspection. I'd

like to congratulate everyone for a job well done." "Over the last few years Sandia worked very hard to implement sustainable and effective business practices, making inspection preparation minimal and making us 'audit-ready always,'" says Terri Lovato (4220), who served as the Sandia technical point of contact for the inspection.

The OIO inspection focused on seven major topical areas falling within the safeguards and security programs, including classified matter protection and control, personnel security, security systems, material control and accountability, program management, classification, and protective force operations. All areas showed improvement, some

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# What's what

If it sometimes seems you're lost in a blizzard of online courses, live training courses, safety briefings and assorted other administrative mandates, and you'd like a break, think about the Technology Symposium. Weapon Engineering Professional Development Dept. 2916's Marcellea Davis-Sneddon keeps the program running, with the strong support of Stockpile Resource Center 2900 Director Dave Corbett.

Most recently, retired director Leon Smith described for a packed-house audience his experiences as a member of the Manhattan Project preparing Fat Man and Little Boy for their WWII-ending role, and other reminiscences of the early years of the nuclear weapons era.

Next up, Robert McFarlane, who served as national security advisor to President Reagan and was instrumental in developing the Strategic Defense Initiative ("Star Wars") concept, will visit Sandia July 23 to talk about "radical Islam."

Other past programs have included Labs Deputy Director for Nuclear Weapons Joan Woodard talking about the Reliable Replacement Warhead program in a classified session, and retired VP Pace VanDevender discussing his longtime and ongoing research into the phenomenon of ball lightning.

So, if you need a little boost about why we're all here and the kind of work we're supposed to be doing, check out the Symposium website ([www-irn.sandia.gov/organization/div2000/ctr2900/techsym/](http://www-irn.sandia.gov/organization/div2000/ctr2900/techsym/)) and watch something you may have missed, and put the next presentation on your calendar.

\* \* \*

In the matter of kudos, a pat on the back to everyone for whatever role – however great or small – played in NNSA's Office of Independent Oversight audit of Sandia security that Principal Deputy Administrator Bill Ostendorff recently described as a "phenomenal performance."

Sandia came up green (for "great") in all seven topical areas audited, prompting SSO Manager Patty Wagner to say, "I'm proud of the diligent, hard work that went into the preparation leading up to the audit – and not just by the security forces, but by the entire lab."

To paraphrase Tiny Tim Cratchit from Charles Dickens' *A Christmas Carol*, "Congratulations to us, every one!"

\* \* \*

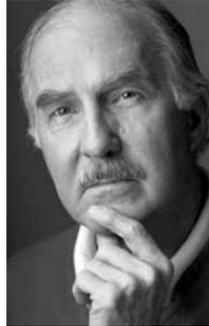
And about that training, which seems to be increasing all the time.

A young intern was heard wondering recently why the majority of his time here during the summer has so far been spent on training – not on work.

He's supposed to be working 10 to 20 hours a week, and has more than once had to rearrange his work schedule to accommodate his training schedule.

No wonder he's wondering about that.

– Howard Kercheval (844-7842, MS 0165, [hckerch@sandia.gov](mailto:hckerch@sandia.gov))



HOWARD KERCHEVAL

## Sandia's Weapons Evaluation Test Laboratory receives green building certification

By Chris Burroughs

Sandia's Weapons Evaluation Test Laboratory (WETL) at the Pantex Plant near Amarillo, Texas, has received the Leadership in Energy and Environmental Design (LEED) building certification. The award is given by the US Green Building Council (USGBC).

"This is a significant award," says G. David Jones, manager of Stockpile Evaluation III Dept. 2953, the department that operates WETL. "It shows that our building is environmentally friendly, not only in the way it



THE FRONT OF THE WETL building is designed for easy viewing. The building received the Leadership in Energy and Environmental Design (LEED) building certification given by the US Green Building Council (USGBC).

was constructed, but also in how we've maintained it to meet clean environment standards since it was built."

USGBC awards certification only after a facility meets stringent requirements that include building design, efficient utility use, and maintenance activity – down to the types of cleaning materials used.

The \$22 million state-of-the-art facility, designed to conduct systems-level nonnuclear tests on nuclear weapons and components, opened in October 2004, replacing a 40-year-old laboratory at the site. It houses more than \$90 million worth of testing equipment and consists of modern offices and lab facilities for about 20 staff members, a state-of-the-art video conference room, transition high-bay work space, and sufficient dock space for receiving and shipping. The architect for the project was Hays, Seay, Mattern & Mattern Inc. of Roanoke, Va.

WETL, which is operated by Sandia for the NNSA, is programmatically associated with NNSA's Stockpile Stewardship program. Its mission is to support the timely evaluation of the "state of health" of the US stockpile through subsystem level testing in a laboratory environment in accordance with predefined test plans.

LEED is the nationally accepted benchmark for the design, construction, and operation of high-performance green buildings. According to USGBC, LEED gives building owners and operators the tools they need to have an immediate and measurable impact on their building's performance. LEED promises a whole-building approach to sustainability by recognizing performance in five key areas of human and environmental health, including sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality.

## Take Note

Retiring and not seen in *Lab News* pictures: **William R. Anderson** (2541), 25 years; and **Theta Jean Williams** (2453), 31 years.

## Sympathy

To Carol Ashby (11501) on the loss of her mother in Minnesota, June 13.

\* \* \*

To Susie Maldonado (00215) and Gil Maldonado (ret.) on the loss of Susie's sister, Carmen Lucero, on May 26; Gil's brother, Roy, on June 1, and Gil's sister, Sophie Dominguez on June 15.

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# Mr. Allen, Ms. Berry, and Mr. Johnson go to Washington

## Sandians in D.C. fill vital roles, ranging from protecting the warfighter to protecting the homeland

By Patti Koning

One way Sandia helps secure a peaceful and free world is by loaning some of its most valuable resources — people — to serve the nation's government in Washington, D.C. Since 9/11, more Sandians than ever have been working in D.C. in capacities ranging from congressional staff to intelligence.

"We see these temporary assignments as part of our role of providing exceptional service in the national interest," says Div. 8000 VP Paul Hommert. "We assess each situation independently. In these assignments we truly look for win-win situations where the individual, Sandia, and the D.C. organization benefit."

### Countering IEDs

Nina Berry (8961) is in her second year as a member of the Joint IED Defeat Organization (JIEDDO). She serves as a science and technology advisor to a prevent/predict team in developing technology to send to the field in Iraq and Afghanistan.

Last year JIEDDO reviewed some 1,000 proposals to assess the feasibility of the proposed technology for use in the field. Among other requirements, JIEDDO only invests in technology that can be ready within six to 18 months.

"The enemy is constantly adapting," says Nina.

Nina joined JIEDDO after first working on a task force of DOE laboratories that was studying the IED issue. Part of her motivation, she says, is personal. She has a cousin in the Marine Reserves and another in the Army Reserves.

"They kept asking what I could do, with all the resources at Sandia," she says. "Their stories rang in my ears as a cry for help."

That personal connection with the soldiers fighting overseas continues. Nina says she's never been so close to the customer, as many of her colleagues frequently travel back and forth from the battlefield.

As for how much success JIEDDO is having, she believes her work has benefited the warfighter but that it is an ongoing process.

"It's more satisfying if you don't watch television," she says. "When I watch the news I just want to go back to work. But we do hear success stories."

Nina is the sole representative from DOE in JIEDDO. In fact, she is the liaison between JIEDDO and the national labs. In applying for the job, she sold JIEDDO on her multidisciplinary background



MATTHEW ALLEN (8132) is one of several Sandians filling critical roles in Washington, D.C. Matthew is a congressional fellow for the House Homeland Security Committee.

— she has a BS and MS in computer science and a PhD in industrial engineering.

Nina encourages her colleagues in New Mexico and California to put forward any ideas that could help with assessing IED threats.

"JIEDDO is willing to listen," she says. "DoD is increasingly turning to the national labs to develop partnerships."

### Congressional intern

Matthew Allen (8132) is also working in Washington, but in a much different capacity than Nina. He's serving as an American Society of Mechanical Engineers congressional fellow with the US House of Representatives' Homeland Security (HS) Committee.

When Congress is in session, Matthew spends his days attending hearings and meetings to mark up legislation. If you watch C-SPAN enough, you might just catch sight of him in the background when Rep. Peter King, R-N.Y., the ranking Republican on the HS committee, is on the floor.

When Congress is in recess, he spends his days in briefings with private companies and concerned parties. The topics range from a meeting with organizations representing the families of 9/11 victims to a company producing a drug for exposure to radioactive cesium (dirty bomb) that needs to modify its government contract.

Recent legislative activity has covered the BioShield program, stockpiling certain pharma-

ceutical medications, and authorization for a new national biological and agricultural defense facility. A current hot-button issue is regulation of fertilizer. This might seem to belong in the agriculture subcommittee, except that the substance in question is ammonium nitrate, the chemical compound used in the Oklahoma City bombing and the bombings of US embassies in Africa.

Being on "the Hill" is beneficial to both Sandia and Congress. According to Matthew, the Hill is always in need of qualified technical expertise and scientists can greatly benefit from seeing the policy side of scientific decision making. It's also been an education in politics for this nuclear physicist.

"When I showed up as the Nuclear Fellow on the committee, I was hoping to avoid any political decision making and be used solely as a technical resource. I quickly discovered being apolitical in Washington is simply not possible," he says. "The old saying, 'Never confuse what you know to be right with what you know will work' is easy to see firsthand when working on the Hill."

Matthew is the first Sandian to serve as a congressional staffer on the HS committee. At 32, he's considered one of the younger guys at Sandia, but on the Hill he's the "old man" among the staffers, whose average age is 26. He says another surprise about working in D.C. is how much of the legislative process is completed at the staff level.

### Transforming intelligence community

Michael Johnson (8960) is also living and working in Washington, but don't expect to see him on C-SPAN. He's working in the Office of the Director of National Intelligence (ODNI) as a deputy to the chief information officer.

Mike McConnell, the director of national intelligence, has authority over the entire intelligence community (IC), which includes the CIA and organizations within the FBI, DOE, DHS, State Department, Drug Enforcement Administration, Treasury Department, National Security Agency, and the intelligence branches of the armed services, among other agencies.

Michael is the IC's deputy information sharing executive. His main responsibility is to coordinate and lead the intelligence community's transformation from a "need to know" approach to achieve a "responsibility to provide" model. He explains that this is a cultural shift for IC, moving from the Cold War era requirements to those of the modern age of stateless terrorism — a shift that is, he says, overdue. The goal is to improve the nation's collective intelligence capability to provide relevant, timely, and accurate information to those who need it.

In his day-to-day work, Michael travels around the Washington area meeting with and getting feedback from intelligence community agency executives and staff regarding information-sharing transformation through governance, policy, technology, culture, and economics. He also represents the community through a number of forums, such as the Intelligence Community Information Sharing Steering Committee and the Information Sharing Council.

Many IC staff members at the lower levels have embraced the culture shift because it makes their jobs easier. Michael cites "Intellipedia," a Wikipedia-like tool for the intelligence community, as evidence of transformation in intelligence analytics and information sharing.

"Most people at the top and bottom of the intelligence community have bought into this concept," says Michael. "Working through the culture — uniform guidance, common mission awareness, and incentives — to enable the middle layers to change, that's the challenge."

Michael says Sandia's long-standing contributions to the intelligence community, including loaning valuable staff, reflects well on the national laboratories.

Nina, Matthew, and Michael are just a few of the Sandians on assignment in and around the nation's capital. John Howard (8960) is also in ODNI and John Vitko (8001) is on assignment with DHS.

## Sandia California News

### Rep. Ellen Tauscher chairs Strategic Forces Subcommittee

In the 110th Congress, Rep. Ellen Tauscher, D-Calif., took over leadership of the Strategic Forces Subcommittee of the House Armed Services Committee that oversees Sandia and other national laboratories.

Tauscher is in her sixth term representing the 10th District of California, which encompasses Livermore. She is the first woman to chair an Armed Services subcommittee.

The committee has jurisdiction over Strategic Forces (except deep strike systems), space programs, ballistic missile defense, intelligence policy, and national programs, and DOE



REP. ELLEN TAUSCHER

national security programs (except nonproliferation programs).

"Ellen is a strong and insightful leader," says Karen Scott (12122), California Site Government Relations manager. "She has made it her business to understand our challenges and assets. We look forward to continuing the strong relationship with our congresswoman."

At a visit to Sandia/California to celebrate a milestone in the EUVL (extreme ultraviolet lithography) program, Tauscher noted that as the only member of Congress with two national laboratories in her district, she savors her role "representing the smartest people in the world."

Tauscher has served on the subcommittee since first being elected to Congress in 1996. She also serves on the House Committee on Transportation and Infrastructure.

# Aircraft

(Continued from page 1)

Among the defects commonly encountered are fatigue damage, hidden cracks in hard-to-reach locations, disbanded joints, erosion, impact damage, and corrosion.

Besides aircraft, SHM techniques could monitor the structural well-being of spacecraft, weapons, rail cars, bridges, oil recovery equipment, buildings, armored vehicles, ships, wind turbines, nuclear power plants, and fuel tanks in hydrogen vehicles.

“Any structure that operates in a fatigue environment with cyclical stresses or other structurally degrading environment could benefit from frequent sensor monitoring rather than relying only on scheduled inspections,” he says.

## Extension of NDI

Sandia’s SHM work is an extension of its Airworthiness Assurance Program, which for years has focused on development and evaluation of nondestructive inspection (NDI) technologies that aid human inspectors as they go over an aircraft frame or fuselage skin inch by inch looking for the consequences of aging.

Boeing’s recent incorporation of an in situ, or permanently mounted, crack-detection sensor into its NDI standard practices manual for Boeing airframes is the first time a manufacturer has adopted SHM techniques — evidence that the industry is ready to consider new ways of ensuring the safety of aircraft beyond NDI-assisted human inspection, says Dennis.

Several commercial airlines are considering applications, including Delta and Northwest, which have petitioned the Federal Aviation Administration to use embedded crack detection sensors to address specific maintenance requirements.

“When we set out to do NDI, in the back of our minds we knew that eventually we wanted to create smart structures that ‘phone home’ when

repairs are needed or when the remaining fatigue life drops below acceptable levels,” Dennis says. “This is a huge step in the evolution of NDI.”

## Growing demand

The Sandia team already has developed or evaluated several types of inexpensive, reliable sensors that can be retrofitted into aircraft structures to detect cracks, corrosion, and other flaws (see “In situ monitoring with CVM sensors” at right).

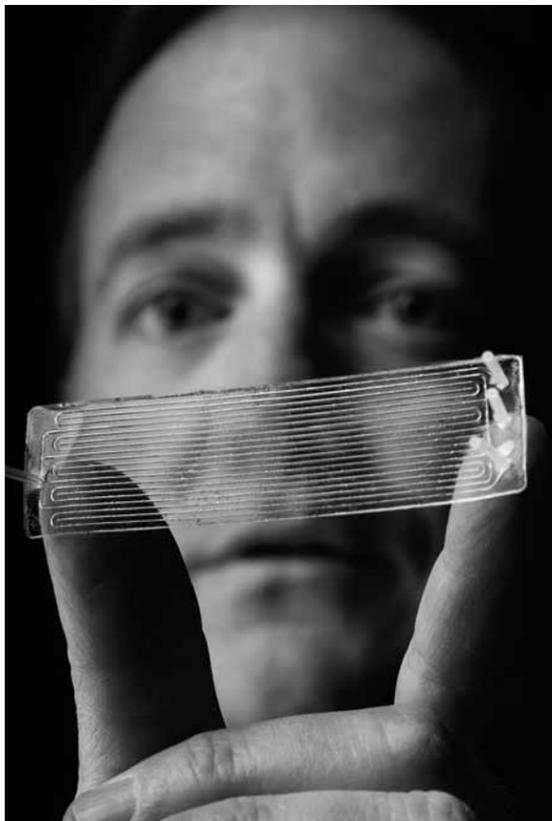
In the future, members of a ground crew might plug a diagnostic system or a laptop into a port on the aircraft and download structural health data collected during flight. Ultimately an integrated network of sensors could monitor not only structural materials but also the health of electronics, hydraulics, avionics, and other systems.

Sandia is part of a group Dennis and other industry partners formed in November 2006 — the Aerospace Industry Steering Committee for Structural Health Monitoring — to address the growing demand for standardized SHM procedures and certification requirements. The international group includes manufacturers, regulators, government agencies, the military, and universities.

The Sandia team also continues to seek acceptance for SHM outside the aerospace industry. In a Laboratory Directed Research and Development (LDRD) effort, SHM principles are being applied to monitoring bridges, buildings, and other civil infrastructures. The work has produced a mountable eddy-current sensor that uses electromagnetic waves to detect deep subsurface cracks in metal structures.

Another program with Syncrude Canada Ltd. is studying the application of SHM sensors for real-time health monitoring of mining and oil-recovery equipment.

“In other words, there is recognition that SHM’s time has come, an opinion you would not have heard from many people a few years ago,” says Dennis.



**STICKY SENSOR** — Dennis Roach with a Comparative Vacuum Monitoring (CVM) sensor showing galleries etched into the sensor’s underside. Any crack in the material under the sticky sensor breaches the galleries and the resulting change in air pressure is monitored.

(Photo by Randy Montoya)

## In situ monitoring with CVM sensors

Sandia has developed or evaluated several types of inexpensive, reliable sensors that can be retrofitted into aircraft structures for structural health monitoring (SHM).

One promising sensor, a Comparative Vacuum Monitoring (CVM) sensor, is a self-adhesive rubber patch, ranging from dime- to credit-card-sized. The rubber’s underside is laser-etched with rows of tiny, interconnected channels or galleries, to which air pressure is applied. Any propagating crack in the material under the sensor breaches the galleries, and the resulting change in pressure is monitored.

The system can be set up to alarm or signal a remote site. The sensors — manufactured by Structural Monitoring Systems Inc. (SMS) of Australia — are inexpensive, reliable, durable, and easy to apply, says Dennis. More important, they provide equal or better sensitivity than is achievable with conventional inspection methods, he says.

The Sandia team first conducted laboratory evaluations of CVM sensors on different materials with a variety of thicknesses and structural shapes. Field evaluations of 22 CVM sensors on three commercial aircraft — a Northwest 757 and 767 and a Delta DC-9 — beginning in April 2005 helped validate the lab tests.

As a result of the work, Boeing recently included CVM technology in the Boeing Common Methods NDI Manual, which allows airlines to work with Boeing and the FAA to seek certification of the sensors for specific applications on specific aircraft.

This recognition of in situ crack detection as an allowable inspection method is an aviation industry first, says Dennis.

The approval is the culmination of a comprehensive, two-year validation program by Sandia in cooperation with the FAA, Boeing, SMS, a number of US airlines, and the University of Arizona. Work on specific applications for Southwest, Northwest, and Delta Airlines is underway.

Sandia also is developing or evaluating a variety of other sensor systems — or miniaturizing technologies into mountable sensors — that can detect cracks, corrosion, and other flaws in structural elements.

Technologies being considered include flexible eddy-current arrays, capacitive micro-machined ultrasonic transducers, piezoelectric transducers that can interrogate materials over long distances, acoustic emission sensors, embedded fiber optics, nickel strip magnetostrictive sensors, and conducting paint whose resistance changes when cracks form underneath.

# Journal honors Jim Miller

(Continued from page 1)

“Jim is an intellectual leader and a guiding force for Sandia’s energy science program and the Combustion Research Facility,” says Terry Michalske, director of Biological and Energy Sciences Center 8300. “His Festschrift is a fitting recognition of his contributions to the international scientific community.”

## Difficult to overestimate Jim’s impact

The introduction to this issue begins by stating that “Jim Miller is one of the most influential combustion modelers in the world; it is difficult to overestimate the impact that Jim Miller’s work has had on the combustion community. But because of the rigor and detail of his chemistry contributions, his remarkable influence spreads beyond the sphere of combustion to the heart of fundamental gas-phase chemical reaction theory.”

The cover (see image at right) includes a montage of images representing the impact of Jim’s work on physical chemistry and combustion. A representation of the propargyl radical, whose reactions are key to soot formation in hydrocarbon flames, and images of sooting flames

are superimposed on figures taken from several of Jim’s publications.

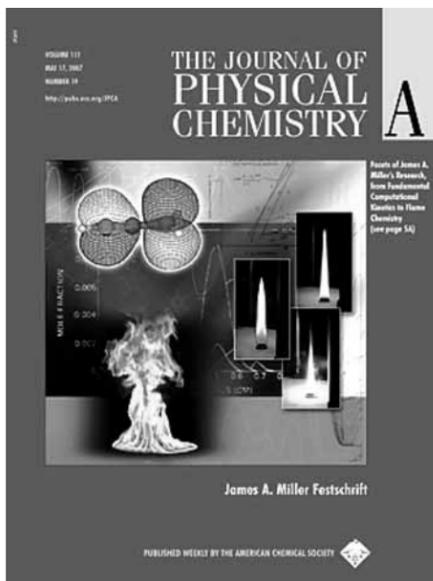
The issue also includes an essay by Jim, titled “My Life and Career (So Far) in Combustion Chemistry.” In the essay he describes his early life, noting that he was one of the first baby boomers — born nine months after his father returned home from World War II.

Jim’s father and grandfather worked as coal miners. As a child he was not particularly drawn to science and was the first on either side of his family to attend college. He earned a BS in engineering from the University of Cincinnati and a MEng and PhD from Cornell.

Jim began working at Sandia in the spring of 1974 and helped open the Combustion Research Facility in 1980. Among the many achievements in his career, the development of CHEMKIN™ is especially notable. It is the de facto standard software for modeling chemical kinetics in combustion.

Currently Jim is working with Stephen Klippenstein of Argonne National Laboratory and a former Sandian to develop and implement a theoretical apparatus for studying chemical reactions involving multiple, interconnected potential wells. Such reactions are of paramount importance in the formation of aromatic compounds, polycyclic aromatic compounds (PAH), and soot in flames of aliphatic (non-cyclic) fuels.

To learn more about Jim’s long and influential career, visit <http://pubs.acs.org/journals/jpcafh>.



# Revamped Campus Executive program stresses research, talent, advocacy at targeted schools

By Julie Hall

In the decade since it was first launched, the Campus Executive program has been reevaluated every few years, undergoing tweaks here and there to keep it aligned with Sandia's mission needs. The latest analysis — taking place over the past year — has led to a more structured and formalized program that seeks to more effectively leverage Sandia's research investments in a focused set of schools and enhance the Labs' ability to achieve its mission work and secure a highly qualified science and engineering workforce of the future, says Marie Garcia (1012).

The Campus Executive program and related university partnerships strategy serve as Sandia's roadmap for partnering with universities. These partnerships are carried out in myriad ways, from research collaborations and graduate research programs to campus recruiting visits and education programs for staff such as One Year On Campus, she says.

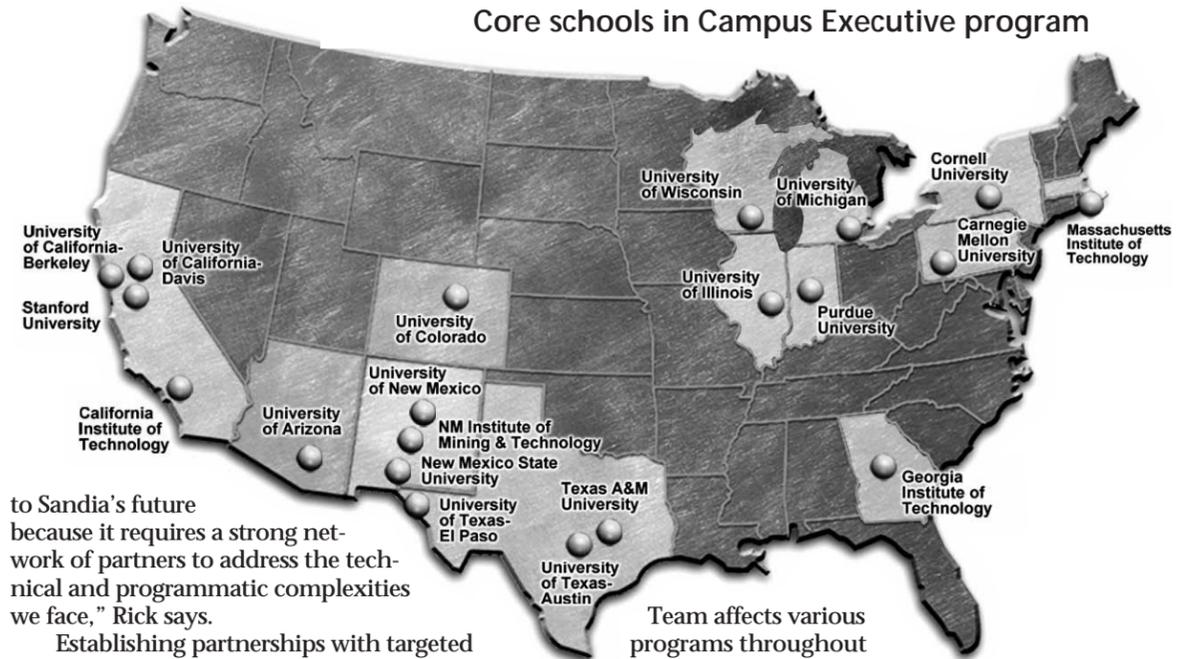
"The other weapons labs have a tight coupling with a university system by virtue of their longtime management and operating relationship," Marie says. "Our program seeks to establish enduring partnerships with a focused set of universities to nurture talent, collaborative research, and national advocacy."

## A three-pronged strategy

Changes to the program and an overview of Sandia's university partnerships strategy were presented to Campus Executives May 30 at a meeting hosted by Div. 1000 VP Rick Stulen, who's responsible for the program.

The university partnerships strategy is based on a foundation of research — conducting world-class R&D to support mission needs that emphasizes partnering to solve problems that neither institution would be able to solve alone. The second "leg" of the tripartite strategy focuses on talent — retaining and developing the "best and brightest" in addition to the traditional recruiting role. New to the university partnerships strategy is the third leg, a focus on advocacy — building relationships of mutual benefit with targeted universities, Marie says.

"Building national constituencies is important



Core schools in Campus Executive program

to Sandia's future because it requires a strong network of partners to address the technical and programmatic complexities we face," Rick says.

Establishing partnerships with targeted schools that address each of these three objectives enhances Sandia's ability to meet research needs critical to its future and ensure a pipeline of qualified scientific and engineering talent, Rick says.

## List of 20 schools

The list of Campus Executive schools has been pared to a core of 20 (see map), down from as many as 30 in recent years, says Wendy Cieslak, senior manager, ST&E Strategic Initiatives. However, Sandia executives will continue to cultivate relationships with additional schools to meet mission needs. Criteria used to identify these universities included academic quality as measured by a number of nationally recognized indices for Sandia's top hiring fields, including *US News & World Report*, the National Science Foundation, and the International Science Index; Sandia's research investment at universities; the number of hires Sandia has made in key disciplines; and diversity, she says.

Each university is coupled with a research focus area (for example, computer science and robotics at Carnegie Mellon), representing a melding of the university's research competencies and Sandia's needs.

Approval of the list by the Laboratory Leadership

Team affects various programs throughout Sandia in addition to the Campus Executive program, says Marie. For example, the Laboratory Directed Research and Development program will provide funding to promote research interactions with Campus Executive schools, university education under Corporate Learning and Professional Development will focus on these schools (see *Lab News*, March 16, 2007), as will staffing, recruiting, university relations, and student internships activities, she says.

A Campus Executive is assigned to each school. The executive is expected to appoint a deputy and a team of other Sandians — such as principal investigators, alumni, staffing specialists, and recruiters — who will develop and implement an action plan for that school. Potential activities included in the plans are collaborative research, a technical speakers program, and staff and faculty exchanges. The goal is to build relationships of mutual benefit at multiple levels within the university from the students and faculty on up to the executive administrative level, Marie says.

For more information about the Campus Executive program and to view presentations from the May 30 strategy meeting, visit <http://ln.sandia.gov/campusexecs>.

# Security audit

(Continued from page 1)

showed significant improvement, and the inspectors specifically cited Sandia's Contractor Assurance Program for Security as a model for the entire complex.

In previous similar inspections in 2003 and 2005, issues were identified that prompted Safeguards & Security to start a multiyear recovery program. A path forward was developed in conjunction with the SSO that formalized processes and procedures necessary to ensure effective protection program implementation.

## At the 'results' stage

Mike says Sandia and SSO worked toward a shared philosophy of "approach, deployment, and results." The OIO final inspection report validated this approach, stating, "During the past two years Sandia has achieved significant success in addressing safeguards and security program weaknesses and in instituting management reforms and process improvements aimed at strengthening asset protection levels." This is clear evidence that Sandia has arrived at the "results" stage, says Mike.

The positive OIO rating was made possible by the collective and coordinated efforts of many, Terri says, citing the auditors' executive summary comment: "The general levels of security-related knowledge among the site population and the swift response to issues identified during this inspection also reflect management's support for

the safeguards and security program and the recognition of that support by laboratory employees."

Dori Ellis, acting VP for Infrastructure Operations Div. 4000, thanked all safeguards and security professionals, members of the Sandia workforce, laboratory leadership, and SSO for their collective contributions to the green audit rating.

## Seeking continual improvement

A lot of the credit for this success, Mike says, can be attributed to the vision and leadership of Ron Detry, former VP for Security and Information.

"He spearheaded the effort to create a single integrated safeguards and security program at all sites and advocated line engagement and ownership in this key area," Mike says. "Ron counted on a cadre of security professionals who dug in their heels, started and stayed with a program that resulted in the Effective Performance rating received this year, a testament to their dedication and tenacity."

Jo Loftis, SSO's assistant manager for Safeguards and Security, says her team and Sandia's safeguard and security team, while proud of this accomplishment, have already begun efforts to sustain the green-level performance and seek opportunities for continual improvement.

The goal, Jo says, remains effective and efficient protection in support of Sandia's mission. To that end, Jo says, this summer, there will be a "security sustainment summit" (S<sup>3</sup>) to formulate a strategy for maintaining the momentum and sustaining the positive work recognized during the OIO inspection. Attending will be members of the line, management, security professionals, and representatives from SSO.

"Our laboratory has committed itself to excellence in its operations. The recent result on our independent security evaluation is an indication that we keep our commitments and that we can excel. I had the pleasure of representing each of you at the close-out summary and of receiving comments from the oversight team management and the NNSA leadership. Without exception, we were viewed as having done an exceptional job. Your dedication, professionalism, and hard work made this possible. You are a terrific team. You have allowed us to send a clear signal that security is important to us and we do it well — very well. Please accept my deepest gratitude for a job well done. Exceptional Service in the National Interest . . . well done!"

— Labs Director Tom Hunter

"Both audits went well, and I couldn't be more pleased. Our team worked closely with Sandia to ensure a positive outcome. The exemplary work can be credited to a solid focus on security by both the site office and Sandia. The security staff of both organizations, under the leadership of SSO's Safeguards & Security Assistant Manager Jo Loftis and Sandia's Safeguards & Security Director Mike Hazen, deserve the credit as well the laboratory staff who help maintain the security posture that led to such a positive review."

— Sandia Site Office Manager Patty Wagner

# R&D 100

Story by Neal Singer • Award covers designed by Steven Pope

Sandia researchers and their collaborators have received five R&D 100 Awards, presented by R&D Magazine to recognize what its judges deem to be the 100 most technologically significant products introduced into the marketplace over the past year.

The valued awards have been referred to as the Nobel prizes of applied research or the Oscars of invention.

Including these five, Sandia has accumulated 80 R&D 100 Awards since 1976.

"Once again, DOE's labs are at the cutting edge of innovation with new technology developments to enhance America's economic and national security," DOE Secretary Samuel Bodman said. "My heartiest congratulations to the DOE researchers and scientists who have won R&D Magazine's prestigious awards this year."

"The R&D 100 Awards are an important metric of Sandia's success in impacting the nation through our discovery and innovation," says Sandia Chief Technology Officer Rick Stulen. "They also serve a key role in demonstrating to industry that Sandia is an eager partner in technology maturation."

## Novint Falcon and Novint/Sandia 3D-Touch Software (joint)

Novint Falcon and Novint/Sandia 3D-Touch Software (joint), is a controller that makes interactive 3-D touch possible in high-fidelity for consumer computing applications.

Founded by former Sandian Tom Anderson, and jointly submitted for R&D 100 consideration by Nathan Golden (10104) and industrial partners, Novint's software is largely based on technology originally developed at Sandia and exclusively licensed to Novint for commercialization.

Haptics is the science and art of providing touch sensations with computer-generated environments so that when virtual objects are touched, they seem real and tangible. While the current primary focus of the commercial technology is computer games, there are more serious uses in which the technique could make inroads. An example might be a medical training simulator in which a doctor can feel a scalpel cut through virtual skin, feel a needle push through virtual tissue, or feel a drill passing through virtual bone. All of these types of interactions would be felt almost indistinguishably from the real-life interactions the simulator emulates.

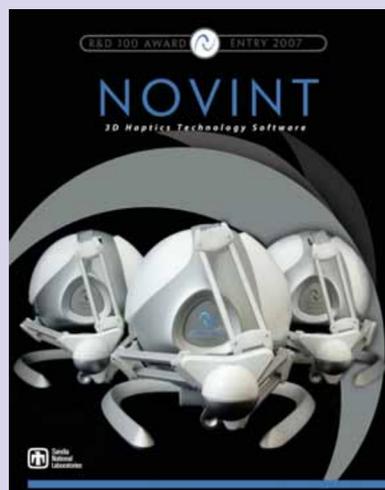
As the handgrip is moved, the computer keeps track of a 3-D cursor. When the 3-D cursor

touches a virtual object, the computer registers contact with that object and updates currents to motors in the device to create an appropriate force to the device's handle, which the user feels. The computer updates the position of the device, and updates the currents to the motors a thousand times a second (i.e., at a 1 kilohertz rate),

providing a very realistic sense of touch. Three electrical motors are connected to the three arms extending out of the device, with one motor connected to each arm. The three arms are connected to the device's handle. At any given cycle, or 1/1000th of a second, the device can create a force on the handle in any direction of any magnitude, up to the maximum force.

Haptics is applicable across nearly all areas of computing including video games, medical training, scientific visualization, CAD/CAM, computer animation, engineering design and analysis, architectural layout, virtual toys, remote vehicle and robot control, automotive design, art, medical rehabilitation, and interfaces for the blind, to name a few. The word 'haptics' derives from the Greek "haptikos," meaning to grasp, touch, or perceive.

Funding sources for the work include LDRD and DOE Defense Programs.

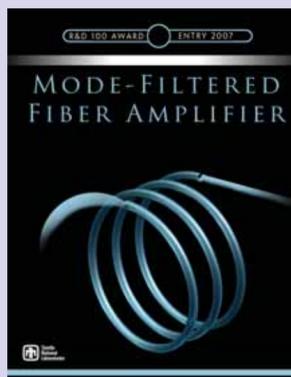


# Sandia achieves five 2007 awards

## Mode-Filtered Fiber Amplifier

**Mode-Filtered Fiber Amplifier:** The capability of coiled fibers to dramatically increase the useful power produced by fiber lasers has led to fabrication of high-power, high-beam-quality lasers that are compact, rugged, and extremely efficient. Prior to this breakthrough, fiber lasers were thought to be restricted by fundamental physical limitations of the fiber to low output powers and pulse energies. Specifically, the small, single-mode fiber core (typically less than 10 microns in diameter) was unable to generate or transmit high optical powers without being damaged or inciting parasitic nonlinear processes. Increasing the core size increased the laser power, but only at the expense of beam quality, a tradeoff that was prohibitive for most applications.

In 2000, Sandia and Naval Research Laboratory researchers demonstrated that bend loss from a coiled, large-core (multimode) fiber can act as a kind of distributed filter, suppressing all but the desired fundamental mode. Breaking the single-mode limit allowed fiber lasers to be scaled in power by a factor of more than 100, allowing these uniquely practical sources to dis-



place conventional solid-state lasers in numerous applications and enabling entirely new applications. The discovery, which defied the conventional wisdom of the time,

earned a patent in 2002 for Jeff Koplow and Dahv Klner (both 8368), and Lew Goldberg, the inventors listed on the current R&D 100 Award. The technique has become the de facto world-wide standard for power scaling of fiber lasers. The first commercial license for the invention was granted in 2005, and the first commercial products were offered by coapplicants Nufern and Liekki in 2006. Three other companies have licensed and commercialized the invention.

The mode-filtered fiber laser has high electrical efficiency and optical gain, low waste-heat generation, broad wavelength coverage, and diffraction-limited beam quality (the theoretical limit) that is insensitive to vibrations, thermal fluctuations, and optical power level. All this, notes Dahv, "in a package an order of magnitude smaller than traditional solid-state laser sources." Funding sources for the work include LDRD, DoD's Air Force Research Laboratory, and the National Science Foundation.

## ElectroNeedle™ Biomedical Sensor Array

**The ElectroNeedle™ Biomedical Sensor Array** is a device that, when pressed against the skin, can make rapid diagnostic measurements in a point-of-care setting.

The ElectroNeedle patch (*Lab News*, July 22, 2005) can detect and identify biological markers just beneath the skin's surface. Because the electrochemical analysis is accomplished in situ, the need to withdraw body fluid is eliminated. The height of the needles, adjustable during microfabrication, allows the biological recognition layer to be placed in intimate contact with the appropriate tissue beneath the skin's surface. For example, interstitial fluid in the epidermal layers of skin may be accessed for the measurement of small molecules such as glucose, while blood in the deeper dermal layers can be accessed for the measurement of larger molecules such as proteins.

By combining electrochemical measurement techniques with well-defined recognition chemistries and an easy-to-use sensor, a range of biologically important species can be detected. Potential biomarkers and bioagents include carbohydrates, electrolytes, lipids, enzymes, toxins, proteins, viruses, and bacteria in a patient's blood or interstitial cellular fluid. This will provide a painless and rapid measurement of biologically relevant molecules without having to extract fluids for later analysis.

ElectroNeedle arrays are produced using standard microfabrication techniques — pho-

tolithography, etch, and thin-film deposition — permitting low-cost, batch production of these devices when commercialized. What makes the microfabrication unique is the

microneedle material, a commercially available glass wafer — Foturan® — that can be photo-patterned and etched to make hollow microscopic needle structures that are then filled with metal to form the sensing electrodes. These microneedles are sharp enough to be inserted into the skin but rugged enough not to bend or break. Because the metal microneedle passes all the way through

the glass substrate, electrical connections are made to the back of the substrate and do not interfere with the sensing needle tip.

With one patent granted and three pending, the application was submitted by Steve Casalnuovo (1714) for principal developers that include David Ingersoll (2546), Chris Applett (1815), Stanley Kravitz (ret.), Jeb Flemming (former Sandian), Colin Buckley (former student intern), and Carrie Schmidt (1723). The work has been funded by Sandia's LDRD program.



## ArcSafe® with Pulsed Arrested Spark Discharge (PASD)

**ArcSafe® with Pulsed Arrested Spark Discharge (PASD)** is a patented electrical wiring diagnostic tool effective in

detecting and then locating wiring insulation defects in complex wiring systems, including commercial and military aircraft.

PASD sends a high-voltage but extremely short-duration pulse along wires to encourage a spark breakdown at the slightest break in insulation. This causes a momentary short circuit and reflection of energy back to sensors to locate the defect, serving as a warning before a short might appear under normal operating conditions.

Because the spark is so brief, it has about the same energy as a spark generated by walking

across synthetic carpet and causes no damage to the wiring system being tested.

Development of PASD was sponsored by the Federal Aviation Administration (FAA) and has been incorporated into a portable diagnostic system by Astronics Advanced Electronics Systems Inc., a leading developer of aircraft electronics and diagnostics.

Says project lead Larry Schneider (1650), "PASD shows tremendous promise as the world's only effective diagnostic capable of detecting and accurately locating such hard-to-find insulation defects as breached insulation, chafing, and insulation cracks."

Funding sources for this project include the DOE Nuclear Energy program, FAA, and DoD.



## Self-assembling process for fabricating tailored thin films

**Self-Assembling Process for Fabricating Tailored Thin Films** involved development of a simple soft coating process that forms optical, electrical, and magnetic thin films from self-assembled nanoparticles.

Led by Hongyou Fan (1815-1), with Bruce Burckel (1815), Jeff Brinker (1002), and Earl Stromberg of Lockheed Martin Aeronautics, the researchers developed a wet-solution-based process employing self-assembly to create engineered nanocomposite thin films with tunable properties by varying particle composition, sizes, shapes, and particle packing density and geometry.

"Our nanoparticle surface chemistry enables dispersal in readily available commercial solvents, allowing easy and rapid production of films through spin, dip, or spray coating under ambient conditions," says Hongyou.

With the addition of secondary organic polymers or inorganic components, the nanoparticles self-assemble into ordered arrays embedded in a matrix of the secondary component that provides additional function and robustness in mechanical stability, and durability.

"The result," says Hongyou, "is an ordered, high-density nanocomposite film where the constituent materials are controllably incorporated on the nanometer scale."

Semiconductor, metallic, and/or magnetic

nanoparticles can be added to optimize optical, electrical, and/or magnetic properties.

For example, a film can be deposited and its index of refraction tuned by changing its nanoparticle composition, concentration, or both to exactly match the required index of refraction of a surface, yielding an optimal single-layer anti-reflective coating on optical glasses as well as on high-index substrates, such as germanium windows.

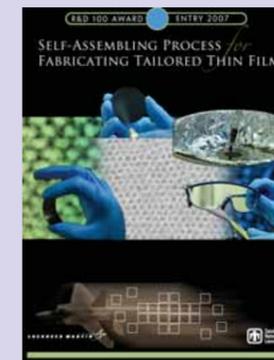
Furthermore, the added flexibility and control over thin-film properties opens the door for engineered thin films with multiple functions. For example, nanoparticle optical films can be made hydrophobic to avoid fogging and icing problems that deteriorate optical performance of the devices.

"The broad reach of this rapid self-assembly process, delivering performance across multiple markets, at radically lower cost, in an environmentally friendly manner, warrants serious consideration as a top innovation in this decade," says Walt Werner, a principal engineer for Lockheed Martin (Maritime Systems and Sensors).

This work leveraged the fundamental research of DOE's Basic Energy Sciences program and LDRD aimed at developing multifunctional nanomaterials for microelectronics and optics as well as structure/property investigations of self-assembled nanomaterials.

The work is an extension of work on nanoparticle self-assembly published in *Science* in 2004 (*Lab News*, April 30, 2004) led by Jeff Brinker, Hongyou Fan, and students and faculty from UNM.

Funding sources for the work have included LDRD and DOE's Basic Energy Sciences program.



# Sandia parents find productivity in flexibility

*Working flexible schedules allows parents to maintain a healthy work/life balance*

By Jacqueline Cieslak

Amy Tapia (3652) is a part-time Sandian and a full-time parent. With two kids and a working husband, Amy went part time seven years ago so she could pick her children up from school every day.

“When they started not being somewhere all day long, that was when I needed to go part-time,” she says. “It’s given us a little bit of a calmer lifestyle, and it’s given us time to talk after school.”

Amy describes a “window of time” right after school when her kids are willing to talk about their day, and she says working part-time has allowed her to be there to listen. She says the flexibility has also allowed her to focus on her job without worrying that she should be focusing on her family.

With 287 Sandians (3.5 percent) currently working part time, Amy is far from alone in capi-

*“I know there are a lot of concerns about negative impacts, but I just haven’t seen any of them.”*

Gary McGovney, part-timer

talizing on the Labs’ flexible employment opportunities. According to Valerie Mascarenas (3500), subject-matter expert for the part-time employment CPR, childcare is one of the most commonly cited purposes for requesting part-time employment.

“Often they do it initially upon returning from maternity leave, because they want to phase into coming back,” Valerie says.

Established in 1989 and revised in 2003, Sandia’s current part-time policy allows employees, with management approval, to work a minimum of 20 hours to a maximum of 36 hours a week with prorated benefits.

Gary McGovney (2622) has had a lot of experience with part-time employment, as he worked part time for a few years when his daughter was born in 1996, and again now, as his wife is traveling more for work. His wife, Liz Holm (1814), also worked part time when their daughter was first born, allowing the couple to overlap their schedules so that their daughter never needed another caretaker.

“It’s not that it would have been terrible to have someone else with her two days a week, but



SANDIA MOTHER Lozanne Chavez (5634) telecommutes to work every day. Above, Lozanne helps her youngest daughter on the computer, while her two sons play on the computer next to her. (Photos by Randy Montoya)

it’s been fantastic to always have a parent taking care of her,” Gary says. In 1996, the HR policy on part-time employment was still rather obscure, and even more so for two parents both wanting to work part time. However, even then, Gary says management and coworker support was abundant.

“I know there are a lot of concerns about negative impacts, but I just haven’t seen any of them,” he says. In fact, far from negative effects, many who have worked part time say that, although they may be at the Labs less, they find themselves doing more work while they’re there.

“You end up really not doing less work, you just kind of cut out the extraneous things,” Gary says. Amy agrees, saying, “You just do not have that extra time during the day, so you get there and know what has to get done.”

Gary’s manager in 1996, Mike Mundt

(12335), says not all jobs can be done part-time, and therefore it has to be a careful call on the part of the manager before an employee can go part-time.

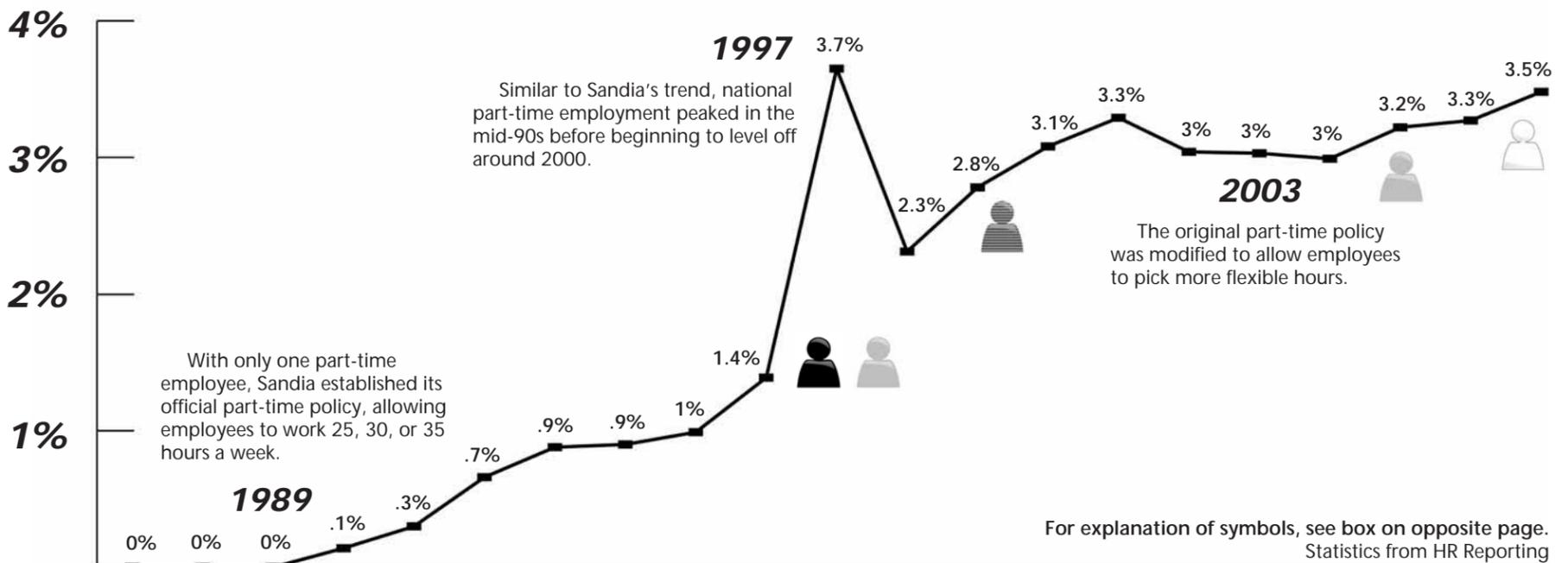
“See, it’s a judgment call,” he says. “One manager may be able to make it work. Another may say it’s not worth the effort. There’s some give and take, but in an organization as big as Sandia, we can figure out how to make it work.”

It’s not just part-time employment the Labs can handle — other options such as the 9/80 schedule, flexible work schedules, and telecommuting (all contingent upon management approval) are available for those not wanting to go all the way to part time.

Lozanne Chavez (5634) is one of 177 employees (2 percent) currently telecommuting

*(Continued on next page)*

## Part-time employment at Sandia over the last 20 years by percent



## Flexibility works

*(Continued from page preceding page)*

to work at Sandia. With five kids ages 4 through 12 and a working husband, Lozanne never would have been able to maintain a full-time schedule without the telecommuting option.

"When you've got project requirements, deadlines, and the kids have homework, it gets a little stressful," she says with a laugh. Lozanne started telecommuting eight years ago when her third child was born, and since then, has also been able to complete her master's degree. She currently works from home four days a week, coming in only on Tuesdays.

As for her career, she says everything has probably slowed down.

"When you're not here, people tend to forget about you, but I'm not disappointed," she says. "I think the benefit of being home with my kids outweighs that."

Like some of the parents working part time, Lozanne says that if there is any difference in productivity between her work now and her work before she began telecommuting, it's a slight increase.

"The difference now is that there's no way to get away from my work, so Sandia probably gets more out of me working from home," she says.

Nationally, many organizations are now accommodating workers like Lozanne who are seeking flexible employment. According to the US Department of Labor, the peak of this trend was the mid-90s, when about 19 percent of the labor force worked part time. Of that 19 percent, about 18.5 percent were managers and professionals.

***"Having a child just blew away any limitations. I actually got some of my highest ratings then."***

**Sue Collins, part-timer**

If there is one part of the population most affected by this trend, it's working mothers. In 1975, about 39 percent of mothers with children under the age of 6 were in the labor force, while about 62 percent of the same population are in the labor force now. In fact, Sandia's part-time employment policy was established in 1989 because a mother wanted to work part time to raise her daughter.

Since 1989, the reasons for going part time have grown much more diverse. Sue Collins (6006) was one who went part-time for only a few years after her children were born, but she went back to part-time again in 2005 because her hus-



LOZANNE CHAVEZ and her five children, ages 4 through 12, work and study together every day in their home.

band was sent to fight in Afghanistan.

"When your husband's called and sent off, they give you very little notice," she says. "You're under the stress of taking care of your family while every day worrying that your husband's dead or injured. I just needed time to manage all the issues."

Sue, a technical manager at the time, says that being able to spend the extra time with her children while her husband was gone was invaluable. It was a very different situation from when she first worked part time, and the main difference she cites is her productivity.

"Once I had my first child, I felt like I was more productive," she says. "Having a child just blew away any limitations. I actually got some of my highest ratings then."

Of course, not all part-time employees have had the same positive experience. One part-time mother, who asked to remain anonymous, says most of her coworkers don't realize she works part time, as she still works 34 hours per week, and she would like it to remain that way.

"Even though it's an approved policy in the Labs, there are still some who have a bias against it," she says. "Part-timers in many parts of the lab will be treated unfairly in performance reviews just because they are part-timers, regardless of how much they produce or how well they perform overall."

There are other, more commonly cited downsides to working part time as well. Lori Parrott (12140) has been working part time for about eight years, and says the biggest downside is that she has to make more of an effort to maintain her

social networks at work.

"Sometimes, you feel like you're trying to do two things well, and you think it would be nice to do one thing really well, either working or parenting, but that's the same way all parents feel," Lori says. "I just have a little more flexibility in balancing things."

But overall, Lori says she wouldn't be able to work as hard or enjoy working nearly as much if she weren't able to work flexible hours.

"My choice was, I chose to be a parent, and so I wanted to be really active in my children's lives," she says.

And when it comes down to it, working part time at Sandia is all about choices. Valerie, Sandia's subject-matter expert on part-time employment, says it's at management's discretion for nontraditional work schedules, including part time, to be approved, and up to employees to maintain their work.

"I know I've had some people say to me that they're a little fearful of the possible negative perception of being part time, but my opinion is that the reality of it is just not true," she says. "Part-time employees contribute just as much, because if you're on a limited schedule, you may be working harder to get everything done."

### ***The policy:***

Part-time employment is available to regular, non represented limited term, faculty sabbatical, or postdoctoral on-roll employees. Although part-time employment is not the prevailing method of conducting business at Sandia, part-time employment may be authorized at the department manager's discretion when the needs of the business allow. Sandia employees on part-time status are subject to the same CPRs as other Sandia employees, except as specified in this or other Sandia CPRs. When considering part-time employment, employees are encouraged to explore all appropriate options including paid and unpaid absences.

Part-time status may be terminated prematurely because of the needs of the business at the department manager's discretion.

– Excerpt from CPR300.6.19 Part-Time Employment. The full text is available on Sandia's Internal Web. Questions may be directed to Valerie Mascarenas (3500), subject-matter expert.

### ***Personal experiences through the times***



**Gary McGovney (2622)** went part time to take care of his newborn daughter in 1996. Gary's manager at the time, Mike Mundt (12335), says, "Back in 1996, it wasn't clear just how you went part-time. But as a manager, I saw that the HR policies were really balanced for part-time people in performance review."



**Sue Collins (6006)** went part time as a staff manager when her two daughters were born in 1996 and 1999, and again as a technical manager when her husband went to Afghanistan in 2005. She says there's a misconception that it's not possible to work part time as a manager. "I hear a lot of young women avoid the management track especially for that reason," she says.



**Lozanne Chavez (5634)** began telecommuting full time in 1999 to take care of her three (now five) children. This allowed her to complete her master's in 2005. "The difference is that now there's no way to get away from my work," she says. "Sandia probably gets more out of me working from home."



**Amy Tapia (3652)** is currently working part time to raise her children. She says she plans to eventually go back to full time, because working part time affects her time toward retirement. Since she began working part time, she has been promoted from PMLS to DMLS. "I didn't think my part time status affected my ability to get promoted," she says.

# 'Innovative approaches' by new Truman Fellows will help keep Sandia at 'forefront of science'

**Projects have immediate applicability in renewable energy and sustainable water management**

Researchers Anatole von Lilienfeld-Toal and Darin Desilets have been selected as Sandia's 2007 Truman Fellows. They join six other fellows who have been appointed since the President Harry S. Truman Fellowship in National Security Science and Engineering was established in 2004.

Anatole earned his PhD at the Swiss Federal Institute of Technology in 2005 and subsequently



## President Harry S. Truman Fellowship

in National Security Science and Engineering

held postdoctoral appointments at UCLA and New York University. His research proposal for the Truman Fellowship, "Multiscale schemes for the predictive description and virtual engineering of materials," brings together the collective skills he acquired in the course of the development of multiple length-scale computational tools that may be used in molecular material design.

Darin earned his PhD from the University of Arizona. He has built a new technical field, "cosmic ray metrology," the quantification of cosmic ray flux attenuation at the Earth's surface and its application to understand such things as water balances in soils, global climate change, and earthquake dynamics.

He has demonstrated how this approach can be applied to national security concerns — specifically, how the approach might be used to rapidly track the movement of large numbers of people in urban areas.

"It's been a delight to interview these highly accomplished candidates," says Rick Stulen, Sandia's chief technology officer and VP of Science, Technology, and Research Foundations Div. 1000. "I'm pleased that our selections turn out to cover a breadth of science and technology foundations as well as critical mission areas.

"Darin will bring new approaches to solving mission challenges for the Energy, Resources, and Nonproliferation Strategic Management Unit and the techniques he's developing will likely have applicability much more broadly," Rick says. "Anatole will contribute to advancing computational

Previous Truman Fellowship recipients: Youssef Marzouk (8351), Gregory Nielson (1749-2), Ilke Arslan (8756), David Scrymgeour (1114), Jacques Loui (5345), and Whitney Colella (8367).

TRUMAN FELLOWSHIPS are three-year distinguished postdoc appointments. Candidates are expected to have solved a major scientific or engineering problem in their thesis work or have provided a new approach or insight to a major problem, as evidenced by a recognized impact in their field. The program fosters creativity and stimulates exploration of forefront science and technology and high-risk, potentially high-value R&D. A panel of eight senior scientists and engineers reviews and ranks each application and interviews finalists. Sandia's University Research Office and Human Resources/University Partnerships teamed more than three years ago to create the new postdoctoral position and guide the processes necessary to implement the prestigious position.

materials science by tackling the holy grail of predicting materials' structure and properties from scalable atomistic approaches. These are highly exciting challenges, and both new fellows have proposed innovative approaches that will keep Sandia at the forefront of science."

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Here are brief descriptions provided by Anatole and Darin of the work they hope to accomplish during their three-year fellowships at Sandia:

### Anatole von Lilienfeld-Toal

"I want to use my fellowship to assemble a variety of computational tools, physical theories, and well-controlled assumptions in order to identify chemical compounds of potential interest to Sandia's mission. As the number of potentially stable compounds is mind-bogglingly large, such an endeavor can also be viewed as attempting to optimize or tailor materials to exhibit the



ANATOLE VON LILIENFELD-TOAL

properties that one desires. The crucial ingredient that will allow us to tune chemical composition in a physically sound and unbiased way is to include information that comes from the electronic structure — that is, using quantum mechanical calculations — in the algorithm.

"After having devised and implemented the software, I plan to use it first to design photocatalytic materials that will make it possible to exploit

sunlight for the conversion of carbon dioxide into methane or methanol, of water into molecular hydrogen, or of nitrogen into ammonia.

"I'm very thrilled that Sandia not only gives me the necessary funding but also offers me the important opportunity to interact and gather crucial insights from mathematicians, computer scientists, physicists, materials scientists, chemists, and engineers for paving a scientifically rigorous, and thereby most efficient, way towards renewable energies."

### Darin Desilets

"Explosive growth in water-scarce regions means that accurate knowledge of soil water content and snow pack is more critical than ever to effective water management. Unfortunately, safe and inexpensive methods for monitoring hydrologic variables and properties at an adequately representative scale are lacking.

"Existing technology can be narrowed down to two types: invasive methods, which essentially measure points in the soil, creating the problem of upscaling to the watershed scale; and remote sensing methods, which operate at a kilometer scale where the spatial resolution is too coarse.

"I am working on a method that promises to fill this gap in spatial scales. The method utilizes neutrons that are constantly generated in the ground by cosmic rays, together with the special neutron-moderating properties of the hydrogen contained in water. The method is passive, non-invasive, can measure soil water content or snow, and can be implemented at a commercially viable price. Such a tool could be used to predict flash floods, assess the susceptibility of forests to wildfire, forecast spring snow melt, and more efficiently utilize irrigation water.

"With Sandia's well-regarded reputation in hydrology and remote sensing, and its considerable knowledge and technical expertise with neutron transport problems and radiation detectors, I can think of no better place to advance this method. I am looking forward to the opportunity to work with scientists and engineers from numerous areas of expertise to advance this exciting new technique."



DARIN DESILETS

## Safe at Home™ software builds on Labs' RAMPART™ technology

By Chris Burroughs

Retired Sandian Regina Hunter is launching a new software product, Safe at Home™, based on Sandia-developed RAMPART™.

Safe at Home allows homeowners to assess risks arising from accidents, fire, crime inside or outside the house, hurricane, flood, earthquakes, tornadoes, and winter storms. The software analyzes the risks of death, injury, property and content loss, loss of use of the home, and first-responder delays.

"Safe at Home does not require the user to have any expertise in risk analysis," Regina says. "It asks about 200 questions and takes about half an hour to get results. Users can change their answers and get revised results in real time, allowing them to determine what changes might lessen their risks."

Regina led the development of the parent software, RAMPART, while still working at Sandia. RAMPART software is the first risk-based approach to building management. It is used by the General Services Administration (GSA) to assess the risks of terrorism, natural disasters, and crime to the nearly



REGINA HUNTER

8,000 federal buildings it manages nationwide.

Regina is president of Ducks in a Row Inc., the company launching the new Safe at Home software. Ducks, which has been part of the Sandia RAMPART team since 2004, helped develop version 3.0 of RAMPART and is working on version 4.0, together with Susan Carson (6766), the Sandia principal investigator, and Robert Browitt of Architrave Software.

Sandia awarded a licensing agreement to Ducks in a Row when Regina retired three years ago. She has been developing Safe at Home ever since.

Regina says that in developing Safe at Home, Ducks has improved the databases used in the original RAMPART software in several ways.

"For example, Ducks has invested in substantial upgrades to data used in weighting the various hazards," Regina says. "The new data allow the consequences of all the hazards to be put onto the same scale. Crime data have also been updated."

These improved data will probably also be used in the next version of RAMPART. Using proprietary graphics software, Regina says, Ducks has also created a new and more intuitive presentation of the

risk assessment results and substantially improved the appearance of natural hazard maps included in both RAMPART and Safe at Home. Ducks is providing the graphics software to Architrave for RAMPART version 4.0 development at no charge as part of the team effort.

Safe at Home is part of the Home Safe™ line of software developed by Ducks in a Row. Home Safe is designed to help homeowners manage their risk by providing easy-to-use software that incorporates the fundamental principles of risk analysis without requiring them to learn anything about risk analysis.

Keep it Safe lets homeowners inventory their homes, offices, or collections quickly, to produce a detailed list of valuables for insurers, protecting the financial consequences of the risks analyzed by Safe at Home.

Safe and Sound™, due out early next year, will help homeowners manage their health and safety risks.

"We ask people 'What have you got to lose?'" Regina says. "Usually they don't know. They have little knowledge of the relative probabilities or consequences of manmade or natural hazards, so they tend to worry about the wrong things and invest inappropriately in home safety."



Before Kirtland Air Force Base and Sandia National Laboratories, there was Coyote Springs and Greystone Manor. Greystone Manor was a homestead at Coyote Springs, now home to Sandia's Coyote Canyon test facilities.

Settled by both Hispanic and Anglo homesteaders as early as 1892, settlers continued arriving in the 1910s and 1920s. There were about 30 settlements in the area. The community included a one-room school.

Meliton Chavez and his brother Jose Chavez (Papa Grande) great-grandfather of Larry Moya (2548) owned and operated Greystone Manor. Papa Grande was a tall man with a full beard. He liked to wear a stovepipe hat, similar to that worn by Abraham Lincoln.

The property included an impressive two-level house surrounded by two-story porches on the back and front of the house. Five fireplace chimneys peeked out of its gable roof.

Greystone Manor was 15 to 20 feet from the springs. A 100-foot diameter wading pool fed by Coyote Springs, several guest cottages, and bathhouses, were nearby. The main spring was called "El Ojo (the eye).

Papa Grande would come to Albuquerque to pick up tourists in a horse and buggy or his Model-A Ford. Cottages rented for \$1 a week. "The main tourist draw was the mineral spring known for its supposed healing properties," says Larry.

Early in the century the Chavez family began selling Coyote Springs water to bottlers for 10 cents a bottle. Bottlers claimed that the water cured stomach and liver ailments. In the 1930s, the Albuquerque Ice Co. carbonated the Coyote Springs water, which helped the flavor. Locals made Kool Aid with the water because it would get a fizz. Even with the heavy mineral taste locals liked it as a whiskey chaser.

In addition to the mineral bath and water bottling business, the Chavez family also had some cattle and milk cows and a small herd of goats.



OUTINGS and picnics were enjoyed by guests.



"PAPA GRANDE"  
JOSE CHAVEZ



PAPA GRANDE bringing a tourist to Coyote Springs.

## Coyote Springs and its mysterious healing properties become Sandia test facilities

Story by Iris Aboytes • Photos courtesy of Larry Moya

"Greystone Manor burned in the early 1900s," says Larry, "when my great grandma, Cornella left a candle burning at a shrine in a bedroom. My family built another house and called it Casa Larga (long house.)"

"All my great-great uncles and aunts lived in Coyote Springs except for my grandma and great uncle," says Larry. "They were married and had their own families established in Valencia. My grandma would bring the children, including my mother, to visit by horse and buggy from Valencia. According to my mom, she would bring her own cooking water because she did not like the taste that the spring water gave the food."

Meliton left Coyote Springs to pursue a career in banking in Albuquerque. He was one of the founders of the First National Bank. He and his wife Francisca Armijo y Baca lived in the old Armijo house in Old Town, now known as the Maria Teresa Restaurant. Meliton's daughter Soledad Chacón became the first woman Secretary of State in New Mexico and the first woman

lieutenant governor in the nation due to the death of then-governor Jose Baca.

"My grandfather ran the Coyote Springs resort until his death in 1936. His son ran it until government took it over in the early forties," says Larry. "By 1943, it

became part of Kirtland Air Force Base, and later a Sandia test facility."

"I have pieced most of the details on Coyote Springs together from my grandfather, various relatives, newspaper articles, and Sandia's archives," says Larry.



PAPA GRANDE with his great granddaughters.



ANITA CHAVEZ (Larry's mother) with her cousins.



MISS CHANEY, teacher.



STUDENTS at local school.



PAPA GRANDE introduces springs to tourists.



BLDG. 9071 once belonged to the Chavez family.

