Vibration-powered sensor harvests structural shakes, stores data for later readout

Wire- and battery-free embedded sensors could one day keep tabs on structural health of buildings and bridges

By John German

Civil engineers assessing the health of a structure following an earthquake, storm, bomb blast, or other insult need to know how severely structural elements have been stressed. A beam or buttress strained beyond its tolerance limits might be dangerous.

In a project initiated by Sandia's Architectural Surety® program, Labs researchers have demonstrated the key components of a self-contained microsensor system that powers itself by converting mechanical energy from the subtle vibrations of structures into electrical power that drives the system.

It uses this vibe-power to take simple sensor measurements, then stores the data in a memory device that can be read from outside the structure — through concrete, steel, and other building materials — with a commercial radiofrequency (RF) tag reader used by trucking and warehousing operations to track tagged inventories.

No batteries, no wires

Because the sensor system requires no hookups to batteries or wires, it could be embedded into a structure during construction and forgotten until a need arises to assess the health of the structure.

"If you bend a beam to a certain point, the next time you bend it, it is going to break," says Kent Pfeifer (1744), who conceived the device and demonstrated its feasibility along with colleagues Sarah Leming, Art Rumpf (both 1744), and Robert Waldschmidt (former contractor). "This technique could lead to self-powered sensor packs that can take a variety of measurements over a long period of time and store them until needed."

The system's power plant is a swath of piezoelectric material attached to a structural element, such as a beam. (A piezoelectric material produces electricity when subjected to stress or strain. The strain changes the electromagnetic alignments of vibrating crystals in the material — the same natural vibrations that keep time in a quartz crystal watch — to produce a net electrical charge.)

VIBE POWER — Kent Pfeifer and his team have demonstrated the feasibility of a wireless, battery-free sensor and data-storage device powered by the subtle vibrations of structures, such as buildings and bridges. (Photo by Randy Montoya)

Each time the beam bends from a load on the structure (for instance, when a tall building sways in the wind or a truck traverses a bridge), the piezoelectric ceramic generates a tiny parcel of charge — about 100 microcoulombs is all — which is stored temporarily in the system's capacitance bank.

(Continued on page 4)

Sandia LabNews

Vol. 53, No. 8 April 19, 2002

Sandia National Laboratories

Managed by Lockheed Martin for the National Nuclear Security Administration

Sandia Habitat house

Sandians gathered last Saturday on Albuquerque's West Side to break ground for the latest Habitat for Humanity project. The home, being built for and with Martha Rodriguez and her sons, represents the third collaboration between Sandia and Lockheed Martin to help provide modern, roomy housing for families in the community. Read about it in Bill Murphy's story on **page 12.**

LDRD Grand Challenge focuses on developing networked sensor systems to fight terrorism

By Chris Miller

Developing networked arrays of sensors, both fixed and mobile, that sense, decide, act, and communicate collectively and autonomously to thwart terrorism is one big hairy audacious goal.

It's also the objective of hundreds of Sandians over the next few years to deploy such a system, beginning in a desert environment to identify and track large objects such as missile launchers, and progressing to an urban environment in which hundreds of sensors work together to identify and track people.

The program stems from a substantial late-start Laboratory Directed Research and Development (LDRD) Grand Challenge that Mission Council approved in February, with work beginning April 1. Approximately $2.5 million of this fiscal year's $83 million LDRD monies are being redirected to the program.

The program employs many of Sandia's strengths in sensor technologies, power sources, computing, robotics, and systems integration.

"The goal is to deploy technology to fight the current war on terrorism, rather than to develop something for the war we may fight five to 10 years from now," says Dave Nokes (5900), who heads up the cross-laboratory team to develop the technology. "I don't think there's anyplace else in the country that has the breadth of technology that can be brought to bear on this problem."

In a recent memo to Sandia executive management, Deputy Director Joan Woodard said the program technologies will have applications to homeland security and combating terrorism, and that they eventually will be transferred to the private sector for other uses.

"It is my intent to create focus and continued momentum in the Lab to meet the urgent national security needs," she said.

Impetus for the sensor program stems from a special study completed in February that was conducted by Sandia's Advanced Concepts Group under the direction of VP and Senior Scientist Gerry Yonas (see "Advanced Concepts Group explores terror's components" on page 6). The study team, which drew on the expertise of dozens of Sandians from throughout the Labs, adopted the "Big, Hairy, Audacious Goal (BHAG)" concept advocated by James Collins and Jerry Porras in their book *Built to Last: Successful Habits of Visionary Companies*.

Sandians Jim Woodard (5922) and Fred Mendenhall (5902), who head the program steering group, recently presented to Mission Council

(Continued on page 6)

Labs hosts 12th annual International Arms Control Conference

This week some 275 ambassadors, policymakers, academicians, and other experts representing the United Nations, NATO, and 35 countries are gathered in Albuquerque for the 12th Annual International Arms Control Conference, hosted by National Security & Arms Control Div. 5000.

The three-day conference (April 18-20), themed "Implications of 9/11 on National Security and the Path Forward to Peace," will feature keynote addresses by international luminaries in arms control. Panels of distinguished government officials and foreign affairs experts from around the world will discuss the following topics:

(Continued on page 4)

What's what

One of the fun things about this column-writing job is reading the stuff that comes in from readers, which I think of as column-oids. One such fell over the e-transom after last time's note about the sterling silver telephone dialer — the bit from the movie *Breakfast at Tiffany's* recalling the era of rotary-dial phones.

Paul Brannan (5849) e-mailed that "you might like to know that dial phones are alive and well and living at Sandia. In the high bay of Bldg. 820 there is one such animal. It was installed in 1980 when the building was built and like that stupid pink bunny, it just keeps on working. I know, since I called out on it just the other day. It took a lot longer to dial but it did the trick."

Also weighing in with praise for rotary-dial phones was Will Keener (12640), who bragged about the phone of that persuasion in his bedroom. Knowing Will, though, I suspect the major attraction of his old phone is that keeping it's better than going out and getting a new one. Coughing up a few bucks for a new one has nothing to do with it, I'm sure; he just likes the old dialer.

* * *

I'm not a golfer, but several of our merry band of wordsmiths are, and at an after-work gathering a few days ago, talk turned to a recent acquisition one of them had made. It's a golf cart — with remote control. Not the kind you ride on, the kind that you put your golf bag on and pull along as you walk the course. But there's no pulling with this one: It's self-propelled and remotely controlled. And when you reach your ball and select a club, you whip out the remote control gadget and send the cart scurrying out of the way. Except if you're last in order to address your ball. If that's the case, you deploy the leather-covered seat on the cart and rest comfortably while you wait.

Fresh air. Exercise. Robotics.

* * *

While sitting with some friends after work recently, a disembodied voice summoned "All staff to Happy Hour . . . All staff to Happy Hour!" We were all happy to hear this because we had always thought of Happy Hour as a pleasant, wind-down *time*. How wonderful to know now that there is a whole *place* called Happy Hour.

* * *

And an observation about the 'Donut Fridays' we all enjoy. There may be more to this happy custom than we think. Maybe just enjoying a couple of donuts is our bodies' way of telling us we need that sugar boost at the end of a week's work. Or maybe not.

But that's my take on it, and I'm sticking with it.

* * *

Ever think about how much we use numbers in our everyday speech? The most recent to enter the vernacular are 24/7 and, sadly, 9/11. But have you run across 41 and 43? Know their meaning?

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

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 subsidiary of Lockheed Martin Corporation and a prime contractor to the US Department of Energy.

Ken Frazier, Editor 505/844-6210
Bill Murphy, Writer. 505/845-0845
Chris Burroughs, Writer. 505/844-0948
Randy Montoya, Photographer 505/844-5605
Nancy Garcia, California site contact. 925/294-2932

Contributors: Janet Carpenter (844-7841), John German (844-5199), Neal Singer (845-7078), Larry Perrine (845-8511), Howard Kercheval (columnist, 844-7842), Will Keener (844-1690), Iris Aboytes (Milepost photos, 844-2282), Rod Geer (844-6601), Michelle Fleming (Ads, 844-4902).

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

Published on alternate Fridays by Media Relations and Communications Dept. 12640, MS 0165

LOCKHEED MARTIN

Recent Patents

Jonathan Weiss (1739): Fiber Optic Refractive Index Monitor.

Stanley Atcitty, Paul Butler (both 2522), Garth Corey (6251), and Philip Symons: Optimal Management of Batteries in Electric Systems.

Daniel Barnette (9224): Method of Grid Generation.

Brian Dwyer, Stephen Dwyer (both 6131), and Willis Stewart: Method and Apparatus for Constructing an Underground Barrier Wall Structure.

James Fleming (1749) and Shawn-Yu Lin (1743): Method to Fabricate Layered Material Compositions.

Barry Spletzer (15211), Diane Callow (15272), Lisa Marron (15211), and Jonathan Salton (15212): Method and Apparatus for Extracting Water from Air.

Take Note

The local alumni clubs of The Big Ten Universities invite everyone to a scholarship fund-raising event, "An Evening with the Stars," on May 18 from 6 to 10 p.m. at the Lodestar Astronomy Center (New Mexico Museum of Natural History and Science, 1801 Mountain Road). The event offers motion simulation rides, telescope viewing of the planets (weather permitting), speakers, dinner, and lots of school cheer. Proceeds will be used to benefit New Mexico students at Big Ten universities. Tickets are $20 for adults, $10 for children under 10, and children under 5 are free. For more information, contact Tracy Woolever (3133) at 844-6034.

Ruby Lathon receives NSBE Golden Torch Award at convention

Ruby Lathon of Systems Reliability Dept. 15312 was awarded the Technologist of the Year Golden Torch Award at the National Society of Black Engineers' (NSBE) 28th Annual National Convention in Orlando, Fla., March 27-31.

The National Society of Black Engineers' Golden Torch Award recognizes community and technical excellence in leadership among institutions, companies, and individuals. These awards are given to individuals and companies that best exemplify the ideals of NSBE as reflected in the mission: To increase the numbers of culturally responsible Black engineers who exceed academically, succeed professionally, and positively impact the community.

The Technologist of the Year Award is a professional award granted to NSBE Alumni Extension members and chapters. Ruby serves as vice president of the local NSBE Alumni Extension Chapter. Chapter members nominated Ruby for the award.

"My management has been very supportive of my involvement with NSBE and were more than happy to write letters of recommendation for this award," Ruby tells the *Lab News*. "I was quite honored to receive a national award from among many outstanding individuals."

Bill Breiland, Larry Bruskas receive FLC tech transfer award

William Breiland (1126) and Larry Bruskas (formally 1126, now 5712) have been named recipients of the 2002 Federal Laboratories Consortium Award for Excellence in Technology Transfer. The award was one of 26 handed out this year.

Scientists and engineers from more than 650 federal government laboratories and research centers compete annually for this award. Bill and Larry's entry was for the development and commercialization of the Monogrow/Thermogrow/AADVISOR in-situ diagnostic system for thin film processing. This system uses optical probes to measure thin film growth rate and wafer surface temperature during the growth of compound semiconductor device structures.

The technology has been licensed to Thermo-Oriel, Emcore, and k-Space Associates.

The award will be formally presented as part of the yearly meeting for the FLC on May 8 in Little Rock, Ark.

Upgrade of water mains and valves may discolor water; no worry, says Facilities group

If you see the water in your building discolored a bit, don't worry.

As part of its continuing efforts to upgrade the utility infrastructure and ensure adequate fire protection across the Labs, Facilities Management and Operations Center 10800 (FMOC) will be replacing and servicing many of the water mains and valves throughout the Sandia/Albuquerque site this spring and summer.

The FMOC is using the same practices as the City of Albuquerque. As each section is completed, the work may dislodge very fine silt and rust that lines the older pipes, and thus may discolor the water in your building. This water, they emphasize, is not hazardous — it remains treated and sanitary. They ask you not to call Telecon if this happens — just run the water for a few minutes until it clears up. Custodians and building managers will be walking through their buildings during these periods to check for brown water and flush out any they find, but if you get there first you can do it yourself.

Call your building manager — http://fac-prod.sandia.gov/bldgmgr/listbldg.idc — if you have any questions.

Theorists calculate that nanotube transistors will have more functionality at reduced size

By Nancy Garcia

Francois Leonard, a theoretical physicist in Thin-Film and Interface Science Dept. 8721, and his IBM collaborator have discovered one more reason to further develop nanotube transistors.

Over a two-year effort to understand and model these new-material laboratory curiosities, they found these transistors work differently from conventional devices and, in fact, offer an additional way to switch the transistor on and off.

The promise of more functionality at a reduced size, Francois says, "is a further motivation to try to make nanotube transistors even smaller."

Their findings, published in *Physical Review Letters*, also offer a new approach to modeling that will be of interest for predicting performance of nanoscale devices in general.

Sandia CaliforniaNews

Conventional devices can be switched off by raising voltage at a gate between two electrodes. The research team shortened the conventional distance between electrodes some 100 times, to just 10 nanometers. They modeled a device in which the electrodes were linked by a strong, thin filament of graphite-like carbon, rolled into a nanotube no more than two nanometers in diameter.

The new model revealed that increasing voltage at the gate first turns off the transistor as in a conventional device, then switches it back on again. This occurs because some electrons tunnel through a quantum state and move across the gap via gated resonant tunneling — which becomes the added functionality possible at this smaller scale. Increasing the voltage even more then creates a negative differential resistance, turning the circuit off again.

"The reduced dimension actually gives you additional functionality. By controlling the gate voltage, we can make electrons pass through just one (quantum) level."

"The reduced dimension actually gives you additional functionality," Francois says, comparing the phenomenon to a quantum dot. "By controlling the gate voltage, we can make electrons pass through just one (quantum) level." Furthermore, unlike silicon, devices made with nanotubes would not need to be "doped" with impurities. The work involved new ideas in how to calculate current in a device in which electrons move in single file. "How do you calculate current when devices are governed by single electrons?" Francois asked.

Existing modeling tools were not adapted to the problem because they were more statistical in nature, essentially allowing behavior to be predicted by averaging the flow of many electrons.

Francois' co-author is Jerry Tersoff of IBM's T.J. Watson Research Center, a fellow theoretical physicist. The calculations, which took a couple of years to develop, were presented last spring at the San Francisco meeting of the Materials Research Society and are the subject of an invited talk at the International Conference on Computational Nanoscience and Nanotechnology this month.

Carbon nanotubes were first discovered in the laboratory about 10 years ago and are novel materials for several reasons. They are very strong and can be made in long filaments. Depending on their atomic structure the material can behave either electronically like a metal or a semiconducting material. The first nano- tube transistor was demonstrated in the lab more than three years ago. However, creating just one transistor takes some time, so potentially packing more circuits into small spaces with these materials is still very exploratory.

On the other hand, Francois says, since nanotube transistors have been demonstrated, using them in practical devices "is not that farfetched — it is a matter of time and effort."

Physicist champion of high science standards in Kansas speaking

Adrian Melott, professor of physics and astronomy at the University of Kansas and a Fellow of the American Physical Society (APS), will speak in Albuquerque April 22 on the topic "Intelligent Design is Creationism in a Cheap Tuxedo."

Melott, a founding board member of Kansas Citizens for Science, is coming to Albuquerque to accept APS's Joseph A. Burton Forum Award during the spring APS meeting April 20-23 at the Albuquerque Convention Center for his efforts that led to reinstating quality science education standards in Kansas.

His Burton Forum Award citation reads:

"For his outstanding efforts in helping to restore evolution and cosmology to their proper place in the K-12 scientific curriculum. As both a distinguished cosmologist and a respected member of the clergy, he played a key role in helping the people of Kansas reverse their State Board of Education's anti-science action."

Melott's public talk is sponsored by three science organizations founded or currently led by Sandians: the Coalition for Excellence in Science and Math Education (CESE), New Mexicans for Science and Reason, and the New Mexico Academy of Science. It will take place Monday, April 22, at 7:30 p.m. in the University of New Mexico Law School building, room 2402.

For further information, contact Marilyn Savitt-Kring of CESE at mmkring@juno.com.

Take Note

Retiring and not seen in *Lab News* pictures: **Roy Hamil** (15300), 21 years; **Keith Johnstone** (12334), 31 years; **Ted Montoya** (14192), 34 years; **Ursula Rounds** (5744), 17 years; **Jesus Sanchez** (15309), 33 years; **Robert Walko** (15336), 27 years; **Roger Breeding** (12334), 15 years.

Feedback

Cell phones in Limited Area remain restricted

Q: *Not being able to carry a cell phone — as Sandians are to a large degree prohibited from doing during working hours — is a huge inconvenience in today's culture, sometimes depriving us of critical safety options, such as when a Sandian (or family member) has an accident and needs help. I'm thinking of the Sandian on a bike who can't bring a phone in the tech area so has to leave it at home, or someone walking to the car in the dark. I have heard that in some places, notably concert performances in Europe, cell phone jamming devices are used to prevent the interruption of the program. My question is wouldn't it be more effective in terms of security to use cellular jamming technology in areas where classified is discussed than to simply make a rule against cell phones which can simply be ignored by those who seek to compromise our security? In addition, a person who is authorized and well-meaning can still forget his/her phone is on, creating a security problem.*

If cell phones were jammed in select areas dealing with classified, Sandians could carry their phones as they wish with no danger of a security breach. Since we are, in fact, a technology lab dealing with cutting-edge science, why can't we use this technological solution to both increase our security and restore to Sandians a right that others take for granted?

A: First, anyone may turn on and use a cell phone to report a 911 emergency (dial 844-0911) in Sandia/New Mexico). There are many options for a family member to get in touch with a Sandian to request help, not the least of which is calling your department manager, who should best be able to set in motion the forces to track you down wherever you are located. One-way and one-and-half-way pagers are allowed in the Limited Areas. As for bike riders at Sandia/New Mexico, the current policy allows a bike rider to bring a personally owned cell phone into the Limited Area, as long as the cell phone is registered with Dept. 3112, remains in a locked bike bag, outside of the building, and is turned off the entire time it is in a Limited Area, unless reporting a 911 emergency.

Your second question about cell phone jamming devices requires a bit more of a technical discussion than is possible in a Feedback response. Currently, cell phone jamming devices are not legal in the United States, and therefore their use at Sandia would not be allowed. In the future, if the use of these types of devices becomes legal, the Sandia Technical Surveillance Counter-Measures (TSCM) Program would evaluate the possible use of the jamming devices at that time.

Let's keep in mind that cell phones have the potential to be more that just a "convenience." The technology that enables the manufacturers to pack more and more neat features into them also has vulnerabilities that can be exploited by people who are targeting us for their own ends. TSCM has produced a video regarding some of the vulnerabilities that cell phones have, and it is available over the Sandia Internal Web at www.irn.sandia.gov/iss/tscm_training_info.htm.

Finally, carrying a cell phone into the Limited Areas at Sandia is a privilege, not a right. As a privilege, it is always subject to DOE policy and review, as well as Sandia's own internal policies, control, and review. We are doing all our best to maintain the security and safety of Sandia, to control technology vulnerabilities and protect our people and the nation's assets. If you have further questions, please contact Paul Linke, project leader for Technical Surveillance Counter-Measures, 844-4047.

— Al West (3100)

Vibration

(Continued from page 1)

This stored charge is sufficient to power the microsensor system for a fraction of a second, long enough to take a simple reading.

Later, if strains on the piezoelectric exceed a predetermined threshold — as the result of a significant insult on the structure, for instance — the system's low-power microprocessor could turn on, command the sensor to take a measurement, commit the reading to the RF tag's flash memory, and quickly shut down into its power-conserving sleep mode.

To retrieve the stored data, a structural engineer can point a commercial hand-held tag reader at the structure near the embedded microsensor system. The embedded tag's resonant circuit harvests RF energy from the hand-held reader through changes in the circuit's impedance, making it possible for the hand reader to power the tag's response remotely.

VIBRATION SENSOR team members include (from left) Sarah Leming, Kent Pfeifer, and Art Rumpf (all 1744). Robert Waldschmidt (former contractor) is not shown. (Photo by Randy Montoya)

Uses not yet explored

So far the Sandia team has demonstrated a system that powers a microprocessor generated from vibration only and illustrated an approach for storing and retrieving sensor data taken by such a system, says Kent.

"There's still more to be done," he says, including integrating and testing a complete self-powered microsensor system. "But we've shown that this is a viable approach to monitoring critical infrastructures."

"A finished device could provide thermal measurements, stress measurements, deflection and strain measurements, or other information that could be stored over time in a database or captured immediately after an event to help plan an evacuation of a tall building, for instance," says Rudy Matalucci, Architectural Surety® program manager. "It would be a great way to monitor performance and health of high rises, bridges, dams, tunnels, and other infrastructures."

Wireless microsystems might initially be employed in structures to predict fatigue or failure of key structural elements, keep track of the number of stress cycles a bridge endures as heavy trucks cross it, or determine the integrity of key structures such as hospitals or emergency command centers following a disaster.

The technique might also be used in any application where a self-contained, no-maintenance monitoring capability is needed over a long period of time, says Kent.

Stacks of piezoelectric generators might make higher-power applications possible, perhaps continuously powering embedded clocks.

"I'm sure we haven't thought of all the possible applications," adds Kent. "This has never been done before."

The system's development was funded through the Laboratory Directed Research and Development program and Sandia's MESA Institute.

Arms control

(Continued from page 1)

- US and Russian Federation Relations: A New Framework?
- Future of Arms Control Treaties and Agreements
- Implications of Informal Agreements
- Bioterrorism: From Theory to Reality
- Geopolitics from Central Asia to the Middle East

Al Zelicoff (5320) will deliver the opening session's keynote address, titled "After the Fall: The Next Protocol for the Biological Weapons Convention." Al, a physician and physicist, is a member of the US delegation to the Biological Weapons Convention and a vocal authority on bioweapons nonproliferation and early detection of infectious disease outbreaks.

Other keynote speakers include John Wolf, Assistant Secretary (designate), Bureau of Nonproliferation, US Department of State; Bruno Tertrais, Foundation pour la Recherche Strategique, France; and Liu Jieyi, Director General, Department of Arms Control and Disarmament, Ministry of Foreign Affairs, People's Republic of China.

"This conference brings together key leaders and policymakers in the arms control and nonproliferation communities to discuss issues that are of concern to nations around the world," says conference chairman Jim Brown (5302). "Previous conferences have allowed for a creative exchange of ideas and have resulted in valuable relationships among some of the world's top arms control and nonproliferation experts."

For highlights from the conference, look for an article in a future issue of the *Lab News*.

— John German

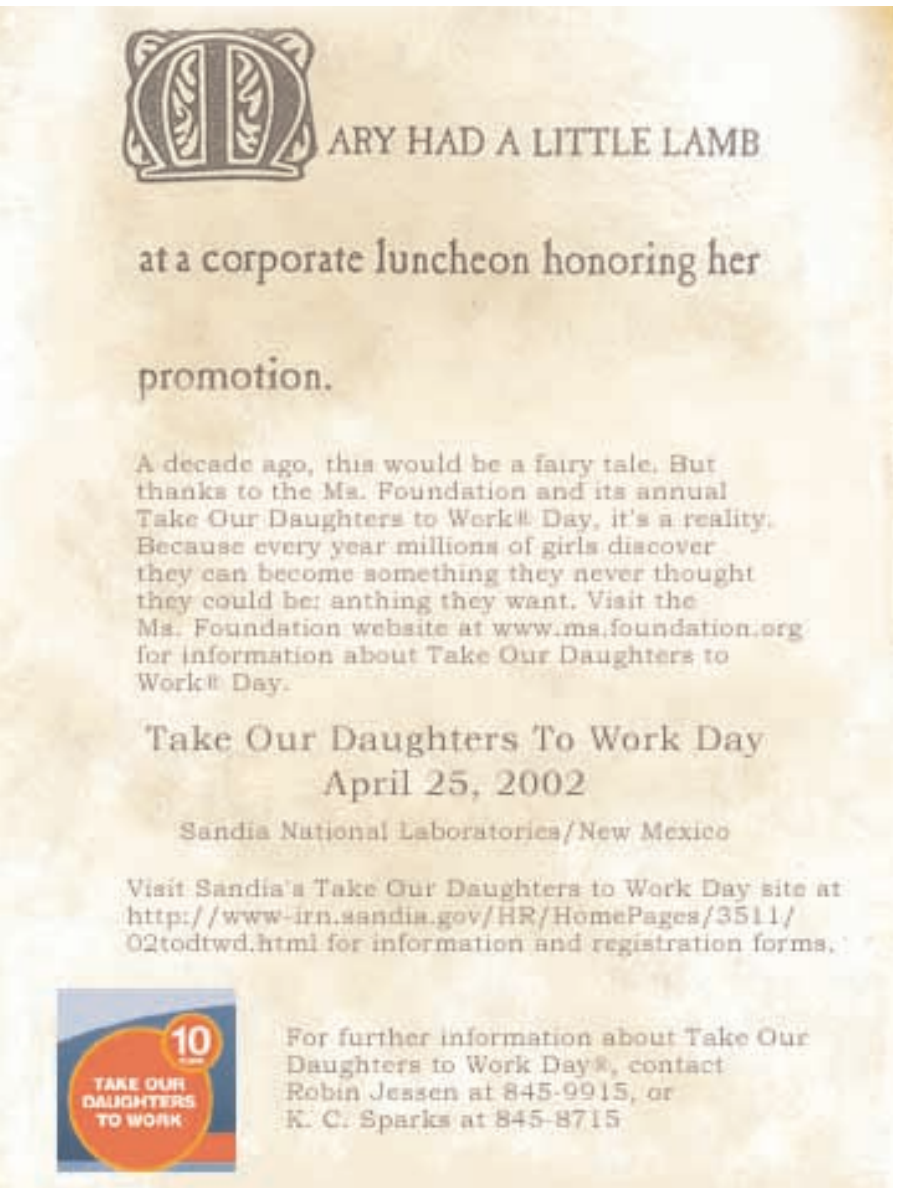
Feedback

Readers ask questions about Take Our Daughters to Work Day, frequent flyer miles

***Q**: Take Our Daughters to Work Day is usually held in late April and we typically start hearing information about it in late March. My daughter has been looking forward to this day for a couple years and is finally old enough to participate. However, I have heard nothing about TODTWD this year. When will it be held? Are there any changes due to the enhanced security?*

A: The Women's Program Committee is sponsoring Take Our Daughters to Work Day (TODTWD) on April 25. [See ad at right.] The registration form and participant information are now available on the TODTWD home page on the web at http://www-irn.sandia.gov/HR/HomePages/3511/02todtwd.html. Watch for a teaser on the Tech Web home page soon. Both Kirtland AFB Security and Sandia Security have approved holding the event. Participants must be escorted by their TODTWD sponsors. Any future changes to Kirtland or Sandia security that might impact the activity will be announced in the *Sandia Daily News* and posted on the TODTWD web site.

— Don Blanton (3000)



***Q**: Ever since Sandians traveling on business have been permitted to keep their frequent flyer miles, there has been a rash of ads in the* Lab News *to sell Southwest trip and drink coupons at $250 and up per round trip. It would appear that frequent fliers are double-dipping. Just how ethical is this?*

A: Thanks to Camille Gibson from Treasury and Travel Services, research into the rules of the Southwest Airlines Rapid Rewards Program at http://www.southwest.com/rapid_rewards/rules_and_regs.html revealed the following statement:

"Rapid Rewards Award Tickets are transferable; however, the Award Tickets have no cash value and are void if sold, purchased, brokered, or bartered. Any violation of Rapid Rewards rules and regulations, including those related to Award Ticket use, will result in cancellation of your account and awards.

— Jerry Hands (12810), Deputy Director, Ethics and Business Conduct Office

With its 'unique philosophy' of results-based R&D, Sandia delivers, Robinson says in Senate testimony

In a written statement submitted to the Senate Armed Services Committee Strategic Subcommittee, Labs Director C. Paul Robinson explained how Sandia's "unique philosophy of research and development—which derives from its heritage of 50 years under industrial management" has enabled it to deliver "significant results for its sponsors."

Sandia, he added in language echoing the Labs vision statement, is a science and engineering laboratory with "a focus on developing technical solutions to the most challenging problems that threaten peace and freedom."

C. PAUL ROBINSON

Paul and the two other National Nuclear Security Administration (NNSA) lab directors were invited by the subcommittee to submit statements as the Senate begins shaping the FY03-and-beyond budgeting requirements.

In his statement, dated April 10, Paul provided a broad overview of Sandia's recent accomplishments in nuclear weapons work and other national security programs, including contributions to homeland security and the war on terrorism. He also discussed issues of concern to Sandia in fiscal year 2003 and addressed in detail Sandia's responsibilities in NNSA's stockpile stewardship and nonproliferation missions. He touched briefly on NNSA Administrator John Gordon's governance initiative for improving the NNSA/contractor relationship.

Notable achievements in weapons work

Among weapons accomplishments, Paul began by noting that the Labs completed work to qualify the B61-11 earth penetrator. He also noted key work in the W87, W76, and B83 weapons. He lauded advancements over the past year in the science and engineering disciplines that underpin successes in directed stockpile work, notably, achievements in rad-hard microelectronics, aboveground experimental physics, and advanced simulation and computation.

"Preventing the proliferation of nuclear materials or weapons to dangerous regimes or terror groups has become a matter of great urgency," he said. He then addressed how Sandia is contributing to nonproliferation efforts, citing several programs being coordinated with Russia's nuclear weapons program. He also noted progress in nuclear detonation detection technologies to enhance the ability to detect atmospheric nuclear events.

In response to the Sept. 11 attack on the US, Paul wrote, Sandians responded with "newfound resolve on both a personal and professional level." As a result of the Labs' strategic planning efforts and the foresight of many Labs sponsors, "Sandia was in a position to immediately address some urgent needs." Examples: Chem-bio foam, K-9 video monitoring equipment, theater-based unattended ground sensors and synthetic aperture radar imaging tools (used on the Predator unmanned aerial vehicle), water and utility risk-assessment techniques, and a variety of sensors and bomb detection and disablement technologies.

"In summary, I do not expect the Nuclear Posture Review to materially impact the workload of Sandia in stockpile stewardship in the next several years."

Substantial workload in core mission

Paul told lawmakers that in addition to devoting considerable resources to post-9/11 issues, "Sandia is very busy with work for its core mission responsibilities in nuclear weapon stockpile stewardship. We have a substantial workload of life extension programs for stockpiled systems that require refurbishment or complete redesign of electronic subsystems and other components. In addition, the responsibility for stockpile certification as weapons age is an ongoing challenge that engages our science and engineering campaigns." He noted that these demands, and other vital areas of need in the nuclear weapons arena "will demand their share of resources from a program that I described last year as 'wound too tight.' "

"In an effort to relax this tension," Paul said, "the Defense Programs laboratories worked closely with NNSA during the last several months to create a multiyear plan to prioritize and integrate programmatic needs within a defensible appropriations profile. The funding levels of the multiyear estimates in that plan reflect our consensus estimate of resource requirements under the guidance provided by Presidential directives, DoD requirements, and the recent Nuclear Posture Review. The plan is a significant milestone inasmuch as NNSA has for the first time outlined a multiyear planning basis agreement with the Administration. With careful management, we believe that NNSA's major deliverables can be completed within the Future-Years National Security Plan schedule and budget profile.

"The fiscal year 2003 budget request," Paul said, "is generally consistent with NNSA's Future-Years National Security Plan, and it should provide adequate resources for Sandia National Laboratories to meet its mission obligations as currently defined." In discussing future resource needs, Paul called specific attention to four initiatives: the Microsystems and Engineering Sciences Application (MESA) complex; the refurbishment of NNSA's Z Accelerator; a joint Air Force/NNSA initiative in advanced physical security research and development for nuclear weapons; and the problem of cyber security against sophisticated network attacks. He discussed each of these initiatives in some detail.

Noting the recent release of the congressionally requested Nuclear Posture Review, Paul said, "The full implications of the NPR will not be known until the final configuration and schedule for the nation's nuclear arsenal is worked out. However, the NPR calls for sustaining a responsive nuclear force and maintaining a robust and responsive nuclear weapons infrastructure for the long term. It is clear that any savings that may result from the NPR will not be realized for many years." He explained why, even with a significant reduction in operationally deployed weapons (with others kept in a "responsive force" reserve), maintenance requirements will continue to be substantially the same as if all the weapons were, in fact, operationally deployed.

"In summary, I do not expect the Nuclear Posture Review to materially impact the workload of Sandia in stockpile stewardship in the next several years," he said.

He then outlined — in some detail — the expansive scope of work across a broad range of disciplines entailed in maintaining a viable, safe, and secure nuclear stockpile.

Initiative aims to fix governance flaws

Paul briefly discussed what he called the "very important initiative" undertaken by Gordon to redesign the NNSA contractor relationship through a new approach to governance.

"The goal," he said, "is to implement a simpler, less adversarial contracting model capitalizing on the private-sector expertise of the management and operating contractors while increasing contractor accountability for performance and responsiveness to NNSA requirements. The current governance structure for the NNSA laboratories is broken. I doubt that any of my lab director colleagues would disagree that the current governance regime unreasonably constrains us from exercising prudent management authority and bold leadership in accordance with best industrial practices; and yet, that kind of leadership was precisely what the federal government bargained for under the original GOCO (government- owned, contractor-operated) contracting model. . . . we should all be concerned that the current laboratory governance regime fails to encourage management initiative for superior performance beyond mere compliance with an array of bureaucratic prescriptions. . . . The first phase of this [governance] initiative will attempt to reduce contractual prescriptions that exceed those mandated by law and regulation. The second phase will design and demonstrate a new governance model, conducted as a pilot program at Sandia. If the subsequent appraisal of the pilot phase is positive, the new model would likely be implemented at other NNSA laboratories and plants."

Paul concluded by asserting that under the "businesslike leadership" of Gordon, NNSA has made "significant progress" during the past year in its organizational effectiveness. "The agency is now functioning with evident coordination and teamwork, attributes which will likely be strengthened even more as the Administrator's organizational and operational plans are implemented. To assure continued success, however, the agency needs long-term support from Congress and sustained resources to meet the formidable requirements of stockpile stewardship in the years ahead."

For Paul's complete written testimony, much more detailed than the highlights offered here, download the entire document at http://www.sandia.gov/testimony/test_hom.html. — *Bill Murphy*

Russian, US nuclear weapons officials meet to discuss future cooperation in modern security environment

A delegation of top-level officials from the Russian nuclear weapons establishments this week met in northern New Mexico with their US counterparts, including senior National Nuclear Security Administration (NNSA) officials and directors from the three NNSA weapons labs.

Collaborations between the labs and institutes began ten years ago. Much progress has been made, and many changes have occurred in the countries and laboratories since then. An informal Lab Directors meeting was held in November 1999 to discuss the collective experiences in the collaborations and to explore future directions.

Since 1999, the international security landscape has continued to evolve, and cooperation between the two countries in areas such as combating terrorism and proliferation has assumed even greater importance. High-level policymakers from both countries deemed it appropriate for the Lab Directors to evaluate the nature and scope of the collaborations and to determine how best to structure future collaborations.

The intention of the meeting is to discuss the current status of cooperation between the laboratories and to set the direction for the next several years.

US participants in the meeting included NNSA Administrator John Gordon, Deputy NNSA Administrators Linton Brooks and Everet Beckner, Los Alamos National Laboratory Director John Browne, Sandia Director Paul Robinson and Lawrence Livermore National Laboratory Director Bruce Tarter.

Russian participants included, from the Ministry of Atomic Energy, Lev D. Ryabev and Natalya A. Klishina; from the All Russian Scientific Research Institute of Automatics (VNIIA), Yuri N. Barmakov and German A. Smirnov; from the Russian Federal Nuclear Center (RFNC) – All Russian Scientific-Research Institute of Experimental Physics (VNIIEF), Rady I. Ilkaev and Vladimir G. Rogachev; and from the Russian Federal Nuclear Center (RFNC) – All Russian Scientific-Research Institute of Technical Physics (VNIITF), Georgy Rykovanov and Evgeny N. Avrorin.

Advanced Concepts Group explores terror's components

TALON, IRIS, FACETS, DICTUM: Analysis, solutions offered for US security

By Neal Singer

The terrorist threat may be spread across America, but researchers in Sandia's Advanced Concepts Group view it less as a wraith passing through keyholes than in simple physical terms: Fanatics breed in certain environments; the environment can be changed. Fanatics need material, these can be made hard to acquire. The material has to travel; checkpoints around the world can be established. Agents can be located, dissuaded, arrested, or, in worst cases, killed.

Through a February talk at Sandia by Sandia Principal Scientist and VP Gerry Yonas and through interviews with the *Lab News*, the Yonas-led Advanced Concepts Group — which has redirected its energies to come up with a coherent plan to analyze and combat terrorism — discussed its schematization of the elements of terror and possible methods to combat each element.

Playing with fire

While terrorism's threat may never be ultimately eliminated, the idea, say Gerry and ACG member John Whitley (16000), is to reduce the problem technically and emotionally to the routine preventive measures currently employed to deal with fire.

Says Gerry, "At the turn of the 19th century, people lived in fear of fire. Loss of life was enormous. The question for us is how a society learned to live with unremitting terror by making investments in technology."

Today, he says, water sprinkler systems are routinely installed in public buildings. So are heat detection sensors and fire alarms.

"If you could see through the walls around you, you would probably see materials that meet fire code protection levels. We have fire drills. We have three different kinds of fire extinguishers.

"We're not terrified, we're vigilant. Yet the problem is still real: yearly in the USA, fire kills 4,000 people a year and 89,000 fireman are injured."

Says John, "As we moved into the industrial age, technological advances led to major improvements in fire-fighting machinery. Created were steam-driven fire pumps, fire hoses, fire nozzles, fire engineers, central fire alarms, advanced communication systems. We have personal, affordable smoke detectors.

"But the threat has advanced as well. The threat from candles is nearly gone, but electrical circuits and appliances required new measures.

"Like fire, terrorism will not be a static threat. We can count on them using our very defensive responses to create new threats."

The only effective response, he says, "is a dynamic system that can reevaluate and update both the threat and our vulnerabilities and respond accordingly."

"What the ACG is doing," says Gerry, "is trying to put together big goals that will restore the sense of safety and security available to the public before Sept. 11. We want to turn terrorism into a psychosocial problem similar to fire."

Developing targets

Ubiquitous, persistent observation of terrorist locations, combined with precision interdiction, is the portion of the program called TALON, for target acquisition, location, observation, and neutralization. The effort is currently led by Ron Pate (16000).

"Precision weapons without current, precise knowledge of target locations are pretty useless," says Gerry. The ACG advocates networking small gadgets that can sense, decide, act, and communicate. These might involve a small device with components that include a global positioning locator, sensor, RF communicator, and a small computer. These relatively inexpensive devices would be widely distributed and in contact with each other, to give a comprehensive picture of enemy movements.

"What the ACG is doing is trying to put together big goals that will restore the sense of safety and security available to the public before Sept. 11. We want to turn terrorism into a psychosocial problem similar to fire." — VP Gerry Yonas

Sandia's Mission Council has added approximately $2.5 million Grand Challenge dollars to an effort led by Dave Nokes (5900) to locate and track mobile targets.

Friendly yet secure borders

Borders must be highly permeable to trade, yet opaque to enemy transmission of goods or personnel. This effort is currently led by Tom Karas (16000).

One problem is that "we now screen only two percent of cargo passing through ports," says Rebecca Horton, who originally headed the "Smart, Secure Borders" section of the program. The problem the group faces is clear: how to augment the flow of trade and legitimate visitors while diminishing the number of harmful materials and agents.

Statistics demonstrate the size of the problem: In 1999, the US was entered by 475 million people, 125 million vehicles, and 5 million maritime 40-foot containers. Meanwhile, 2.7 million undocumented immigrants are believed to enter the US yearly. Total annual US cocaine consumption can fit in 15 forty-foot containers.

Solving the problem, says Rebecca, requires not only better gadgets but also a different mindset. "Instead of a border, a zone," she says, where worldwide systems track the flow of goods. Cooperation from other countries should be as seamless as possible. Is a ship taking an unusually long time to complete a voyage? Stopping at a port not generally essential to its route? "We can't claim to stop everything, but we can reduce 'noise' to improve our probabilities of detection," she says.

Robust infrastructure

A way to minimize damage from future terrorist attacks is to create a smarter, more durable infrastructure. This effort, investigated by a team led by Rick Craft, studies damage-resistant systems for better static defense, and "aware, intelligent" systems that prevent or mitigate damage and also help rescue personnel and restore services. Finally, rapidly deployable services are needed to help a damaged area recover and sustain itself until more permanent facilities are brought in or built.

Intelligent systems demonstrate awareness of themselves, of the situation they are in, and of humans in the area. Extensive instrumentation and communication should lead to integrated emergency response.

The goal, says Rick, is to build things in ways that "resist failing catastrophically, minimize losses in the face of attack, and are designed to counter threats from intelligent, active agents."

The formal name of the group is IRIS, for intelligent robust infrastructure systems. This effort is currently on hold but may be reactivated as need and funds arise.

Coordinating response:

A fractal approach to integrating security is headed by John Whitley. Groups that remain autonomous yet integrate data may include law enforcement, intelligence, public health, first responders, scene commanders, local governments, and private citizens. Information gathered by individuals and small or large groups should be collected in non-hierarchical fashion for easy integration and "or rapid understanding of intrinsically foggy situations," says Whitley.

The fractal architecture — small patterns that repeat larger patterns — means that larger and smaller groups will store information in a format that permits easy sharing via automated Internet components throughout the integrated system. This will permit collating video images of people entering airports, for example, with background data gathered by other groups on that individual. Collating data in a semi-automatic fashion can generate alarms when individuals exceed certain parameters, because all linked groups are immediately made aware of massing data. The system would work not only by collating a visual image of a person entering an airport with his license to learn to fly a plane, but also alert firemen in a burning building that a second plane in the area is also off course.

The group is called FACETS (fractal approach for clarifying and enabling timely support.)

Social setting in host country

To prevent terrorism, says Gerry, gadgets ultimately won't do the trick. They can minimize damage but not the intent to cause it. "We need to know not only what motivates terrorists," he says, "but what might demotivate them."

Understanding terrorists and the setting they come from in order to influence their culture, monitor their activities, detach those loosely affiliated, and deter those committed to terror are the goals of another ACG subgroup. Led by Ben Wu (16000), this group (DICTUM, for dynamic, integrated capability for threat understanding and management) suggests integrating sociology, group theory, biology, and biosciences, as well as factoring in gang theory and the effects of racism. From these, establish norms of behavior and a massive database that analyzes phone call connections, meetings, travel patterns, and banking transactions among suspected or identified members of terrorist networks. Software tools like Vx Insight for pattern recognition would identify and track suspicious behavior.

The work would complement attempts at Defense Advanced Research Projects Agency to work with neurosciences to develop models of learning, and the Defense Threat Reduction Agency's exploration with Hollywood and the artificial intelligence community for creative, highly computerized scenarios to address similar goals as DICTUM.

Overall coordinator of the subgroups is Judy Moore (16000).

Grand Challenge

(Continued from page 1)

a plan to develop and demonstrate the technology.

The program will employ both internal and external advisory boards to help guide the work. In addition to Jim and Fred, the LDRD proposal steering group included Art Ratzel (9110), Regan Stinnett (1903), Mark Ladd (15351), Stephen Martin (1707), Rush Robinett (15211), Larry Ellis (6502), David Keese (15404), Clyde Layne (9815), Terry Stalker (15351), Paul Yarrington (9230), Jim Crowther (9813), and Russ Skocypec (15310).

Joan said other topics for possible LDRD Grand Challenges that could start within the next six months have also been identified. They include airport security, nonlethal weapons, buried targets, stealth delivery of anything anywhere, and possible infrastructure-related topics.

"Based on these explorations, teams may be created to more formally define possible projects," Joan said.

Unique back-support system being miniaturized at Sandia

Bladders perform like assisted power steering

By Neal Singer

A unique cushion designed to relieve the lower back pains of office workers, motorists, and truck drivers — as well as quadrapalegics and others immobilized by reason of occupation or health — is under development at Sandia.

The already-patented device does not support the spine with pressure achieved by pressing the back against a pre-formed semi-rigid foam shape — the commonly used method.

Rather, in a process that resembles assisted power steering in a car, 16 pre-formed inflatable bladders aid muscles in the back intended by nature to support the spine. There is no direct contact between chair back and spine.

"A prototype enabled a man with degenerative joint disease who couldn't drive five hours to drive across the US and back," says Robert Felton, president of the Los Angeles medical company Numotech that built the prototype and will market the finished device.

The electronic work at Sandia is intended to improve reliability of the prototype device. A second goal is to shrink its pumps, batteries, and circuits from an auxiliary box currently a foot square and four inches deep to one-third that size.

"We want to integrate the electronics to make them flush with the chair back for office workers," says Sandia project lead Mark Vaughn (15252).

The work is being done in conjunction with a Russian manufacturing corporation, Spektr-Conversion, and New York investment banking house M.R. Beal.

The device, says Felton, "should significantly reduce the amount of drugs needed for pain management." The back cushion is expected to be on the market in little more than a year and should be available at a price in the range of $500-$700, he says.

How it works

Almost all back-support systems attempt to relieve the intradisk pressure believed to be the source of lower back pain. The method commonly used is to superimpose order on the disks by means of semi-rigid molding in a support backing.

The patented system under development aligns the spine in a more comfortable way. The bladders can be inflated and deflated in groupings to achieve levels of support that vary with the needs of individuals. The entire apparatus adjusts forward and back from the action of a single large bladder. A concave depression, achieved by side bladders, holds the back straight regardless of side movements of the vehicle or chair. A series of rocker switches adjust inner contours to each individual's geometry.

The device is the second product arranged for manufacture in Russia by Numotech. A two-year design for manufacturability with Spektr-Conversion was signed a year ago for a wheelchair seat cushion designed to improve blood circulation for paraplegics and the formerly bedridden in hospitals.

Numotech cooperates with DOE through a program called the Russian Transition Initiative to achieve non-proliferation of nuclear arms. The project provides work for competent scientists who otherwise could be hired by unfriendly countries to make nuclear weapons. Spektr-Conversion consists of former workers from Russian nuclear lab Chelyabinsk-70.

Though national defense goals are involved, the projects are no sham. Commercially viable products and profits are expected. The cheapness of the labor market in Russia is also a factor. Labor costs are reduced by a factor of 10 in the former USSR, says Mark.

MARK VAUGHN with a prototype of a unique back-support system. A close cousin of the microprocessor-controlled "self-squirming" wheelchair seat designed to alleviate potentially deadly pressure sores, the high-tech back support is intended to reduce lower back pain. (Photo by Bill Doty)

The back-support device is also the third medical assistive device on which Sandia has worked jointly with Numotech. The first, called the Numobag, uses a slight increase in oxygen concentration to heal potentially lethal sores faster than they would on their own, thus decreasing mortality and drains on medical resources. The process, called topical hyperbaric oxygen therapy, uses inexpensive plastic bags and an inexpensive metering system to contain and monitor concentrations of oxygen around the patient's affected part. The Numobag is now being tested in Veterans Administration hospitals and has been FDA-approved. Jan. 1, 2003, is the target date for that product's general market availability.

Sandia report chronicles ongoing commitment to environment

Sandia's commitment to the environment and the Labs' recent successes are on display in a new publication — *Sandia National Laboratories Environmental Report 2001*. The report highlights Labs' activities in environmental restoration, waste management, new technology development, pollution prevention, and environmental monitoring.

"We understand that protecting our beautiful environment is Sandia's responsibility to future generations."

"This is something several large companies do as a kind of report card to the community," says Will Keener (12640), who edited the report. Sandia has done environmental reports covering specific aspects of Sandia's work, but not the full scope of activities.

"We have been aiming toward this for the past several years," Will says. Management and subject matter experts from a number of organizations supported the creation of the first-time document.

"We understand that protecting our beautiful environment is Sandia's responsibility to future generations," Sandia President C. Paul Robinson writes in the introduction.

The 24-page full-color report looks at trends in energy and water conservation, recycling, and handling of hazardous wastes at Sandia/New Mexico. A section addresses sustainable design and "green" building techniques.

The report is posted on Sandia's external website at: http://www.sandia.gov/News.htm. Select it under the "Periodicals" list. If you'd like to have a hard copy, contact Michelle Fleming (12640) at 844-4902 or meflemi@sandia.gov.

TVC's annual symposium is 'the Big Show' for New Mexico technology innovators

Ninth Equity Capital Symposium is set for May 15-16 at the Hyatt in Albuquerque

By Bill Murphy

For hi-tech trend watchers, entrepreneurial scorekeepers, state economic development wonks, and lovers of innovation, inspiration, and go-for-it-induced perspiration, the annual Technology Ventures Corporation (TVC) Equity Capital Symposium has become the must-see show of the year in New Mexico.

TVC, launched by Lockheed Martin in 1993 to help move technologies with commercial potential out of the national laboratories and into the marketplace, has become one of the most successful enterprises of its kind in the nation. Its reputation as the premier showcase in New Mexico for presenting technology-rich opportunities for investors has only grown over the years; the symposium never fails to attract venture and equity capital investors from across the country, anxious to see what's going on the New Mexico technology front.

Now in its ninth year, the TVC Symposium will be held this year on May 15-16 at the Hyatt Regency Hotel in downtown Albuquerque.

Here's how the process works: Beginning several months before the symposium (i.e., in late fall of the preceding year) TVC issues calls for presenters — technology-based businesses seeking equity investment for start-up expenses or as funding for expansion, additional R&D, marketing, or some other business-driven need. The potential presenting companies, many of which will have already received TVC assistance, go through something very like an audition. The screening is tough. TVC rigorously upholds the high standards among presenting companies that have successfully attracted potential investors since 1994. Once the presenters are chosen, TVC's experts work with them the way a good coach works with a champion athlete; everything is aimed at having the presenters at the very peak of their game when symposium time arrives.

To date, 31 of the 95 Equity Capital Symposium presenting companies — and others assisted by TVC over the years — have received equity investment funding, totaling $310 million.

To date, 31 of the 95 Equity Capital Symposium presenting companies — and others assisted by TVC over the years — have received equity investment funding, totaling $310 million. Those companies have in turn converted capital investment into more than 5,000 technology-based jobs. That's an astonishing achievement for TVC, especially considering that prior to the advent of TVC, venture capitalists considered New Mexico to be fly-over country.

In the early years the symposiums relied heavily on technologies — and entrepreneurs — drawn directly from Sandia, Los Alamos National Laboratory, and the state's other federal and university R&D facilities. This year, by contrast there is just one Sandia-derived technology. On the face of it, that could seem something of a letdown, but in fact it is testimony to the success TVC has had in helping broaden the technology R&D base in the region.

"We're pleased to see technologies from a wide range of sources this year," says TVC Business Operations Director Randy Wilson. "It demonstrates the great wealth of innovative resources beyond the national labs. Still, we at TVC see our labs as the primary source for new innovation at this time and we certainly intend to continue our successful efforts to work with Sandia spin-out companies."

About that Sandia technology: It's called "haptics," a software technology that adds the sense of touch to the human-computer interface. Using haptics technology, a computer user can feel the fuzz on a peach (if so inclined), or, more to the point, actually manipulate objects in 3-D models just as though she were working with the objects in "real" 3-D space. The Labs' haptics technology has been licensed to Novint Technologies, which, in its symposium "sales pitch" to venture capitalists is seeking equity funding to complete its product development and commercial rollout.

Novint is one of 16 presenting companies that will be addressing venture and equity capitalists beginning at 8 a.m. on Thursday, May 16. Presentations are scheduled to run through noon. In addition to the presentations, the symposium will feature a dinner the evening before with guest speaker Steve Johns, Senior Vice President, Corporate & Business Development, Ardesta, LLC, a venture capital firm, and a May 16 luncheon, featuring keynote speaker Patrick Von Bargen, Executive Director, National Commission on Entrepreneurship. All events are at the Hyatt.

For registration information, call TVC at 505-246-2882.

Symposium presenters represent diversity of state's high-tech sector

Here are brief summaries of presenting companies at the ninth Equity Capital Symposium:

• **Affiliated Plasma Jet Technologies** (APJeT) manufactures plasma sources that operate at atmospheric pressure yet provide many of the same benefits as vacuum-based plasma currently used in making chips. By eliminating the need for vacuum operation, customers enjoy higher tool throughput, lower capital equipment costs, improved process capability, and greater reliability.

• **Assuratech** has developed analytic, software simulation systems that enable insurers and reinsurers to protect themselves against catastrophic losses to their capital base.

• **Athena Feminine Technologies, Inc.** develops patented, wireless technology health care products that rehabilitate and detect physiological changes in a woman's vaginal environment. The company has successfully built and tested its first product, the Athena Pelvic Muscle Trainer (PMT), which uses an FDA-approved protocol treatment that applies a mild electrical stimulus to rehabilitate the pelvic floor muscles.

• **CommodiCast** finds profits in volatile markets. Based on complexity science, CommodiCast's proprietary systems, optimized for two markets, extract and interpret key patterns from massive data flows, identifying and acting on profitable market conditions while simultaneously managing risks. The company says these systems have consistently outperformed market indexes and the majority of professional money managers.

• **Cytoprint** has developed proprietary image analysis technology that provides a fundamentally new way to observe and classify the response of living cells to disease and pharmacologically active compounds. The ability to observe these cellular biological processes is critically important in drug discovery.

• **En Garde Systems** is introducing a SiNic (Secure Intelligent Network Interface Card) that dramatically improves network security while reducing the complexity and total cost of ownership.

• **Global Haptics Inc.** (GHI) was formed in 2000 to develop, manufacture, and market a family of revolutionary new 3D computer I/O devices. These patented devices have the potential to ultimately become the preferred choice by users of 3D applications, from consumers to design professionals.

• **Intellite** uses patented MEMS technology to create low-cost systems that enhance laser control. Intellite's system allows manufacturers to reduce their fabrication cost by correcting for optical distortions due to environmental conditions, performance drift, and manufacturing deficiencies.

• **LAB-CT's** micro fluidic optical wave guide technology aims to revolutionize DNA analysis and position the company as the market leader in DNA sequencing, mutation analysis, and fingerprinting. The company's ultra-fast DNA analysis systems, exclusively licensed from Los Alamos National Laboratory, enable rapid advances in disease detection, pathogen identification, forensics, drug discovery, and pesticides development at reduced cost.

• **Metallicum** produces nanostructured metals and alloys that have strength, fatigue, and other properties up to three times greater than conventional materials. The company products are targeted to a $7 billion market for vascular stents, dental implants, and orthopedic devices, and address problems with implant lifetime and failure.

• **Novint Technologies** is a haptic (touch) software company that uses exclusively licensed technology developed at Sandia to train doctors and dentists in medical procedures. Novint's products allow doctors to use their sense of touch through a haptic device that can accurately simulate real-life medical and dental procedures. For example, a surgeon can realistically feel a scalpel cutting through virtual tissue.

• **Ovidium** will develop a family of all-optical, or photonic, switching products used to direct communication traffic within and across telecommunications networks.

• **Progressive Language, Inc.** (PLI) has created a new language learning technology. By implementing a patent-pending learning methodology and language analysis software, PLI produces daily video-based immersion programs that are streamed via the Internet to the three highest growth segments: children, standardized test takers, and business professionals.

• **Resolution Sciences Corporation** has developed a revolutionary approach for precision 3D microscopy of unprecedented volumes of biological and manufactured materials. This conceptual breakthrough eliminates the need for glass microscope slides, reducing the technical labor needed to produce micron-scale 3D data and giving pharmaceutical researchers and other groups access to accurate digital 3D replicas of their materials for the first time.

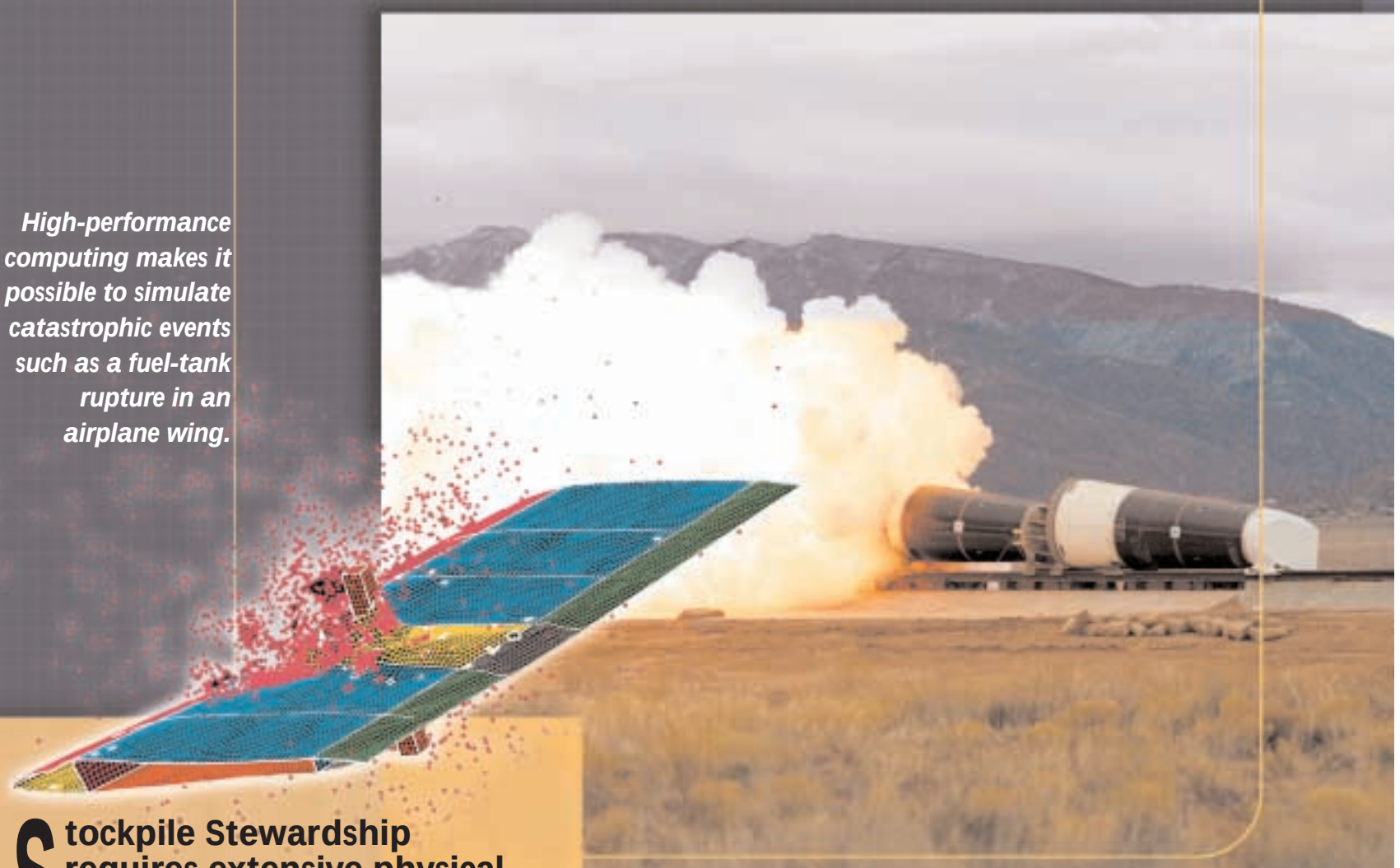
• **Software Innovations** (SII) produces software security architecture, design, and products. SII is introducing a newly designed software product called the Enterprise Security System (ESS). SII has embodied its expertise into a cross-platform product that brings together authentication, authorization, administration, encryption, single sign-on, attack detection, integration, and SII's own Portrait Services© in a single easy-to-use interface.

• **Surfect Technologies, Inc.** provides engineered coated metallic powder micro-compositions for portable energy storage and generation devices. Surfect's materials offer increased energy density, high cycle rates, and reduced cost for batteries in the "4C's" market (communication devices, computers, cameras, and cordless power tools).

SANDIA NATIONAL LABORATORIES

Computing for insight and validation testing

High-performance computing makes it possible to simulate catastrophic events such as a fuel-tank rupture in an airplane wing.



Stockpile Stewardship requires extensive physical testing facilities and immense computational capabilities.

Testing facilities, such as our Z machine, help us to understand the science of nuclear weapons without nuclear testing. We use supercomputers to model conditions that can happen to our arsenal over its lifetime, including the effects of aging and a weapon's response to a variety of accidents involving such conditions as intense heat and extreme shock. We validate these models in our test facilities.

Our facilities and capabilities also help us to solve other global security and scientific challenges, from assessing and countering threats to the nation's cybersecurity, to manipulating molecular-level structure for improved materials.

Sandia has used a two-mile-long sled track for acceleration and impact testing of weapons.

Third in a series of 10 posters on "Stockpile Stewardship: Strength Through Science" prepared by Public Relations & Communications Center 12600 in cooperation with the Nuclear Weapons Strategic Business Unit. All 10 posters are on display in the Bldg. 800 corridor.

Mileposts

New Mexico photos by Iris Aboytes
California photos by Lynda Hadley

Fred Anderson
30 2612

Raymond Berg
30 2662

Daniel Luna
30 15414

Peter Esherick
25 1744

Mary Ann Seiler
25 10263

Mary Tidwell
25 10852

Albert Villareal
25 3124

Marion Wilde
25 5933

Mary Phillips
20 10511

Matthew Sena
20 2345

Recent Retiree

Lana Everett
20 12610

A matter of quality: Group completes Labs' assessment, faces new challenges

Under the leadership of the Quality Assurance Working Group (QAWG), Sandia has completed a corporate management assessment of the Labs. Executive VP Joan Woodard has reviewed the results with office of Kirtland Site Operations Director Mike Zamorski.

The management assessment took a year to complete (Oct. 10, 2000-Sept. 30, 2001). "The massive amount of work and coordination would not have been possible without the strong support and hard work of each QAWG member," says Executive Director Les Shephard (12100).

QAWG is a cross-functional team of Sandia Division representatives, including California, responsible for implementing Sandia's Quality Assurance Program in their division. Under the provisions of Sandia's Quality Assurance Program (QAP), each division evaluated all work it performs.

The QAP establishes guidelines for three levels of formality — low, medium, and high — for grading the application of the quality assurance criteria. Formality is commensurate with the importance of the work, the associated risks, and customer requirements. Each division VP met with Joan to describe the techniques their division used to perform their management assessment, and the results,

A phased approach was used. In the spring and summer of 2000, pilots were run to test and refine plans. The first phase then ran from May to September 2000, when all divisions identified their high-formality-level scope of work. From September until December 2000, self-assessments of those high areas were performed.

Results were reported to Sandia executive management and DOE at the end of December 2000. From then through September 2001, the remaining low and medium formality level work was assessed. Each division QAWG member was able to work with individual managers and members of the laboratory in grading their activities.

"Each division then shared the results of their assessment with other divisions," says Ken Hanks, Manager of Quality Program Office Dept. 12142. "This helped us identify common areas were we could work together to improve laboratory operations."

Ken says some of the common areas identified that needed attention were issues management, records management, management assessment, procurement, and the corporate quality program.

Now that the management assessment has been accomplished and common areas identified, the next step is to identify owners to take corrective actions, share lessons learned and best management practices, and develop metrics and trends about Sandia's management system effectiveness. With the wealth of self-assessment experience gained from this exercise, Ken says, the line organizations have now established a baseline.

"They are in a position to begin measuring and continually improving their processes through self-assessment, issues reporting, and lessons-learned sharing as we move into this new era of self-governance with pride," he says.

Bess Campbell-Domme, Division 1000 QAWG representative, says, "The real advantage of the approach taken by QAWG has been the focus on the business operations and the push to integrate quality requirements into existing systems. Everyone recognized early on that quality and quality assurance had to be part of 'how we do business,' not an isolated program. Implementation of the Corporate Quality Program has built on many of the grass roots quality initiatives throughout the Labs and brought the lessons from those efforts to help form a cohesive, corporate-level effort."

One example of the efforts being made in integration is the teaming between QAWG and the Line Integration Working Group, which focuses on ES&H and Security matters. The two teams worked together to assure a single management philosophy, based on lessons-learned Integrated Safety Management System (ISMS) implementation.

Quality New Mexico recently recognized Sandia and the members of the QAWG for their work on Sandia's Quality Assurance Program and for establishing a commitment to performance excellence. New Mexico Gov. Gary Johnson recognized them along with other recipients in March during the annual Quality New Mexico Conference and New Mexico Quality Awards Ceremony.

To learn more about Sandia's Quality Management Program, consult the Quality Assurance Program Home page at http://www.irn.sandia.gov/organization/div12000/ctr12100/Quality. Each division representative is listed, along with Quality Program Office members, including Ken Hanks, QPO Manager, at 845-9948.

Sandia Classified Ads

MISCELLANEOUS

BALTIC AMBER NECKLACE, 14-in., w/matching bracelet, no silver parts, pure amber beads, $100 OBO. Wagner, 823-9323.

DAY BED, w/bedspread, pillows, & shams, wooden arms, used once, $125 OBO. Hole, 255-1444.

AIR PURIFIER, Sharper Image Ionic Breeze, like new, originally $300, asking $95; 4 pool cues, $50. Gomez, 291-1062.

COMPUTER MONITOR, Gateway Vivitron, excellent condition, $100 OBO. Hamilton, 858-1371.

SURGE PROTECTOR, Panamax 1000, for home audio/video equipment, 8 outlets, trigger, panel lights, manual, life warranty, originally $450, asking $210 OBO. Dybwad, 296-9047.

TWIN BED, light oak laminate frame, 3 drawers underneath, w/mattress, excellent condition, $140. Klavetter, 299-4299.

'99 F350 TAILGATE, $500; rear bumper, $125, should fit any Ford F series pickup after '98, check to make sure. Ramsey, 265-0428.

MACINTOSH POWERBOOK, 1400 series, includes power adapter & carrying case, $500. Green, 242-4385.

'97 SORREL GELDING, breeding stock appy sired by AQHA Hazard County Dam APHA, Daisy Doc Bar, currently holds 13.5 halter points, big & athletic, good team roping prospect, $2,100 OBO. Keyworth, 281-2362.

PUPPIES, blue healer, pure breed, no papers, 4 available, $100 ea. Lovato, 319-3603.

RABBIT CAGES: luxurious, $50; adequate, $25; minimum, $10; some accessories free. Hobbs, 856-9630.

"MOTHER OF THE BRIDE" DRESSES: 2-pc. jade (10); 2-pc. champaign (10); 1-pc. black (12); 1-pc. navy (10); 2-pc. silver(ish) (10). Morales, 249-8800, leave message.

COFFEE TABLE, beautiful oak, brand new, $60. Morrison, 323-9088.

RYOBI TILLER, hand-carry type, good condition, $95; McCullough electric chainsaw, 3.5-hp, good condition, $50. Lucero, 298-1524.

HUGE GARAGE SALE, by MOMS® Club of Paradise Hills, to benefit children in community, Sat., April 20, 7:30 a.m. to 12:30 p.m., 10300 Rio Los Pinos Drive. Denman, 792-0394.

YARD SALE, Sat., April 20, child clothes, toys, more, Los Lunas; kittens to loving home, pair, will separate if necessary. Pino, 866-5309.

OVERARM SAW, Craftsman 10-in., $150; 5-hp chipper/shredder, $200; 20-gal., 5-cfm air compressor, $100; 2-ton HD floor jack, $50. Adams, 881-4351.

FOUR-POSTER QUEEN-SIZE BED, Americana style, dark maple-stained birch, w/2-year-old Sealy pillow-top mattress & box spring, $600 both, or $350 ea.; matching mirror, $175. Hoyal, 823-1421.

HOME GYM, Marcy by IMPEX APEX, includes chair & column along w/pull bars & weights, $200. Mills, 899-2570.

'93 NUWAY UTILITY TRAILER, 4' x 8', new tires & spare, steel ramp/gate, detachable side walls, $350. Browning, 315-7744.

BEDROOM SET: 2 twin beds, complete w/mattress, end table, bureau, lamp, $375. Sansone, 296-7945.

ENTERTAINMENT CENTER, oak, accommodates 27-in. TV, $50. Bradley, 281-7086.

SOUTHWEST AIRLINE TICKET, expires Aug. 2, 2002, $300. Keener, 298-0892.

GARAGE DOOR OPENER, Stanley Pro-7200, 1/3-hp, 3 remotes, $30. Holmes, 292-0898.

GUINEA PIGS, 2 adorable young females, cage & starter supplies included. Smith, 296-1908.

ALFALFA HAY, $5/bale; 2-horse trailer, W&W, tandem axel, electric brakes, $1,000 OBO. Furry, 281-1024.

ALTO SAX, Vito, appraised $500, asking $300; unicycle trainer, $75; RV cover, 30 to 33 ft., $90. Reynolds, 281-4985.

PC MONITOR, HP, 15-in., 2001 model, like new, $60. Marquez, 344-8455.

BUILDING OR REMODELING, large quantity of electrical, plumbing & heating materials, very reasonably priced. Miller, 299-6067.

COMPUTER HARDWARE, 32MB AGP card, UDMA cards, software, Windows 95, 98, 98SE, Millennium, all best offer. Cocain, 281-2282.

HANDHELD PDA, Palm m100, $50; Epson 1440x750 dpi, color inkjet printer, $95. Hale, 298-1545.

JIGSAW, Craftsman (old cast iron); jointer/planer (4-in. spare blades), both w/stands, $50 ea. firm. Cancilla, 298-8741.

GAS LAWNMOWER, 3 yrs. old, 3.75-hp, Briggs & Stratton, 22-in. cuts, excellent condition, includes grass bag, $80. Widmer, 296-6911.

COMPUTER MONITOR, 15-in. Proview, used very little, like new, $15. Sinton, 828-9672.

BOSTON ACOUSTICS CR9 SPEAKERS, pair, 42-20,000 Hz, 15-150W, 8 ohms, 8-in. base/1-in. tweeter, $200. Marbach, 292-8207.

COMPUTER DESK & HUTCH, 5-ft., oak, $350. Jones 293-1583.

MANTIS TILLER, $195; lawn dethatcher attachment, $70; compost tumbler drum, $150; propane-fired weed burner, $30. Lagasse, 298-0977.

DINING TABLE, Danish-style rosewood, w/6 chairs & 2 20-in.-wide leaves, $1,000. Hubbard, 291-8463, after 4 p.m.

GENERATOR, Coleman, 5,000W, 10-hp, $200; Ryobi gas weed whacker, $25. Lenberg, 238-0362.

WEBER BARBECUE, stereo entertainment center, 2 sets of speakers, walnut stereo cabinet, old copper tub. Reed, 821-7782.

GOLF CLUBS, women's RH, 1,3,5 woods, 3-pw irons, putter, bag, like new. Spray, 821-5877.

SOUTHWEST AIRLINE TICKETS, 2 roundtrip, expires April 2003, $300 ea. Chavez, 831-5069.

SECTIONAL SOFA: 5-pc. Flexsteel, 2 recliners, 1 corner, 1 sofa bed (double), 1 single, excellent condition, mauve, $800 OBO. Witek, 296-5198.

BIKE RACK, Yakima, 4 ea., Copperhead racks, rain gutter towers, 78-in. bars, locking cores, $375. Smith, 856-9176.

TRAILER HITCH, for full-size Dodge Ram pickup, will fit '94-'02, $175. Barreras, 246-8285, ask for Manuel.

RADIAL ARM SAW, 10-in., Sears Craftsman, excellent condition, $180; electric bed, new $600, asking, $250. Henfling, 869-4119.

ELECTRIC FANS, 2, on pedestals, $15 ea.; 2 wind turbines for venting attic, 12-in., $8 ea. Brannon, 296-6674.

COMBO DESK/COMPUTER DESK, w/hutch, new, custom, knotty pine, lots of storage, ideal for home office. Levan, 293-0079.

SOUTHWEST AIRLINE TICKET, one roundtrip, expires 7/26/02, $300. Croessmann, 281-2014.

TELEVISION, 27-in. & matching stand, $150 OBO; wicker storage unit, $25. Kincaid, 296-6014.

BEARDED DRAGON, sub-adult, female, $60; used 50-gal. or bigger aquarium wanted. McCrory, 401-4412.

USB SCANNER, $25; Epson color printer, parallel port, $30, both work fine. Roseth, 856-6964.

SOUTHWEST AIRLINE VOUCHER, roundtrip, expires 3/28/03, $300. Benjamin, 869-9922.

TRANSPORTATION

'80 TOYOTA PICKUP, 3/4-ton, 4-spd., 137K miles, good condition, $1,900 OBO. Gallagher, 265-0299.

'01 CORVETTE, 6-spd., pewter, removable roof, 12-CD changer, 15K miles, $40,000. Little, 883-9329

'96 FORD F150, 4x4, long bed, 5.0L, AC, Pioneer AM/FM/cassette, blue, 97K miles, great condition, $7,850 firm. Rondelli, 362-2112.

'97 CHEVY S-10 BLAZER, 4WD, loaded, white, 79K miles, excellent condition, $12,500. Thomas, 237-0467.

'98 CHEVROLET ASTRO VAN, V6, front & rear AC, PS, AT, AM/FM/cassette, 45,900 miles, $12,200 negotiable. Smith, 294-5192.

How to submit classified ads

DEADLINE: Friday noon before week of publication unless changed by holiday. Submit by one of these methods:

- **E-MAIL: Michelle Fleming (classads@sandia. gov)**
- **FAX: 844-0645**
- **MAIL: MS 0165 (Dept. 12640)**
- **DELIVER: Bldg. 811 Lobby**
- **INTERNAL WEB: On Internal Web homepage, click on News Center, then on Lab News frame, and then on the very top of Lab News homepage "Submit a Classified Ad." If you have questions, call Michelle at 844-4902. Because of space constraints, ads will be printed on a first-come basis.**

Ad rules

1. Limit 18 words, including last name and home phone (We will edit longer ads).
2. Include organization and full name with the ad submission.
3. Submit the ad in writing. No phone-ins.
4. Type or print ad legibly; use accepted abbreviations.
5. **One ad per issue.**
6. We will not run the same ad more than twice.
7. No "for rent" ads except for employees on temporary assignment.
8. No commercial ads.
9. For active and retired Sandians and DOE employees.
10. Housing listed for sale is available without regard to race, creed, color, or national origin.
11. Work Wanted ads limited to student-aged children of employees.
12. **We reserve the right not to publish an ad.**

'98 JEEP CHEROKEE, 4WD, V6, 5-spd., power options, cruise, tint, luggage rack, new tires, 49K miles, 1 owner, garaged, excellent condition, $12,000. Clark, 294-4238.

'89 LINCOLN TOWN CAR, Signature Series, 135K miles, looks & runs great, $3,200. Smith, 281-9360.

'93 BUICK REGAL, all power, silver, needs some work, 100K miles, $1,500. St. Clair, 821-0077.

'63 STUDEBAKER LARK, "Wagonaire" stationwagon, white, drive or restore, runs well, glass all good, $700 OBO. Strong, 861-3725.

'94 MAZDA MIATA, AC, CD, new top, tires, brakes, battery, exceptional care, 112K miles, $6,000. Cunningham, 892-0436.

'90 FORD BRONCO XLT, 351-V8, AT, full-size, white, rebuilt transmission, looks/runs terrific, 92K miles, $5,500. Crosby, 260-1070.

'86 CHEVY SUBURBAN, Silverado pkg., 4WD, new 350 engine, AT, fully loaded, rear AC, & 3rd seat, $3,000 OBO. Tilley, 292-3581.

'90 SUBARU LEGACY, 4-dr., AT, PW, PL, PW, PM, one owner, w/all receipts, 167K miles, $2,500. Rasmussen, 266-1097.

'00 PONTIAC SUNFIRE, red, 2-dr., AT/OD, CD, warranty, 27K miles, excellent condition, $8,200 OBO. Sperli, 888-1941.

'85 CHEVY, 3/4-ton, 4x4, 50K miles on newer engine, new clutch, mechanically sound, $3,250. Muirhead, 281-2925.

'98 GMC SUBURBAN, very nice & clean, 86K miles, $19,999. McCubbins, 505-577-7883.

'89 FIREBIRD, T-top, fuel-injected V6, 4-spd.manual, new exhaust, tires, $3,000. Quinby, 292-1954, ask for Ken.

'98 CHEVROLET C1500, Z71, 4WD pickup, 5700 V8, X-cab, maroon, liner, tonneau, loaded, 26K miles, $19,000. Easterling, 298-7083.

'93 GMC CONVERSION VAN, wheel-chair accessible, Braun lift & tie-downs for passenger, 83K miles, $9,600 OBO. Eatough, 792-4803.

'92 OLD CUTLASS CIERA, 4-dr., white, fully loaded, great shape throughout, $1,750. Saiz, 792-8098 or 459-2451.

'86 TOYOTA PICKUP, long bed, 4-cyl., 5-spd., new clutch, looks & runs well, $2,000. Davis, 323-2877.

'74 VW BUG, green, AM/FM/CD, Michelin tires, disc brakes, great condition, $2,250. Sanchez, 897-7156.

'94 VOLVO 850 TURBO SEDAN, AT, all power, moon roof, leather, climate control, must see, $7,900. Jacobs, 301-6440.

'60 DODGE PICKUP, stepside, fully restored, 318 w/torqueflite, runs great, needs tires & exhaust system to be finished, $5,000. Pantuso, 865-1597.

'91 SUBURBAN, 4x4, 350 engine, AC, PW, PL, red/white, tow package, excellent condition, 140K miles, $5,200. Reese, 281-6658.

'88 GMC S15 PICKUP, 5-spd., good condition, clean, good on gas & very reliable, great vehicle for 1st time driver, $1,500 OBO. McCoy, 898-7188, ask for Butch, after 5 p.m.

'94 FORD ASPIRE, AT, radio, cassette, no AC, 63K miles, good condition, runs well, 35-mpg, $1,700. Hays, 836-2099.

'98 MAZDA PICKUP, B2500 SE Cab-Plus2D, 5-spd., green, matching shell, 58K miles, excellent condition, must sell, $8,000. Neidel, 873-4903.

'95 HONDA CIVIC LX, 5-spd., PW, PL, PM, cruise, white, 40-mpg, 57K miles, $6,900. Hales, 797-0765.

RECREATIONAL

WOMEN'S MOUTAIN BIKE, Diamondback, red, 26-in., 21-spd., women's seat, new tires, 4 yrs. old, $150 OBO. Case, 293-5466.

'00 HONDA CBR, 600cc, silver/red, recent maintenance, only 4,500 miles, superb condition, tank bra & custom cover included, $6,800. DeBassige, 332-8218 or 710-3775.

'01 SUZUKI 250GZ STREET BIKE, deep green, 300 miles, perfect beginner's bike, paid $3,300, asking, $2,850. Kranz, 822-0174.

'98 FLEETWOOD PROWLER, 26H w/super slide-out, equalizer hitch, stabilizer & brake controller, like new, $12,000. Hamberg, 857-9662.

CATAMARAN SAILBOAT, Supercat 17 by Boston Whaler, ready to sail, w/trailer, extras, $3,000 OBO. Penn, 883-4195.

FISH & SKI BOAT, 16-ft., Glastron, 100-hp Johnson motor, must see, $2,200. Gabaldon, 831-9012.

SUNFISH SAILBOAT, on trailer, $400 OBO; two 10-spd., bicycles, make offer. Shead, 839-9316.

BOY'S BIKE, 12-in., goat-head-tolerant tires, $25. Navratil, 293-5527.

AIRCRAFT SHARES @ 1N1; 1/3 65 Mooney, nice IFR, $18,000; 1/4 47 Piper PA-12, 150-hp, $12,000. Shapnek, 281-5913.

SAILBOAT, Robroy, 23-ft. yawl, green hull, teak & bronze, 7.5-hp inboard, tandem trailer, excellent condition, $12,000. Errett, 856-1592.

MOUNTAIN BIKE, boys 21-in., 18-spd., $50 OBO; youth golf clubs w/bag, $50 OBO. Biringer, 821-8741.

'99 YAMAHA BIG BEAR ATV, 350, 4x4, hardly used, like new, garage-kept, 5-spd., reverse, new winch & snowplow, $3,950 OBO. Avila, 281-1200.

SANDRAIL, complete frame w/VW motor, both needing some work, $600. Ziska, 221-8971.

REAL ESTATE

5-ACRES in East Mountains, view, privately gated community w/ available utilities & phone, great water & neighbors, $62,000, includes road & water memberships. Smith, 281-5096 or 286-8558.

2-1/2 ACRES, East Mountains, 2 adjoining lots, for development/investment, nice homes in area, $35,000 ea. Denney, 299-8595.

2/3-BDR. TOWNHOME, large kitchen, 2 baths, 1,795 sq. ft., 2-car garage, 2 balconies w/mountain & city views, beautiful yard, NE, near Montgomery & Eubank, FSBO $158,000. Sanchez, 228-2569.

2-BDR. HOME, 1 bath, wood stove, well-maintained, east of New Coors, north of Central, $79,000. Cordova, 319-1179.

2-BDR. MOBILE HOME, in 4 Hills Mobile Home Park, many amenities, close to Eubank gate, $22,000. Lucero, 299-6842.

3/4-ACRES in Bosque Farms, zoned R-1, also has mature trees, $62,500. Gutierrez, 869-3823.

3-BDR. HOME, 2 baths, 2-car garage w/work area, covered redwood deck, on 1.3 acres in Tijeras, $265,000. Lewis, 286-2393, http://www.fsbore.com/eastmtn/18101.htm

3-BDR. HOME, 1-3/4 baths, 1,527 sq. ft., hardwood floors, open floor plan, landscaping front & back, close to KAFB, $114,900. Loehman, 265-3179.

2-BDR. MOBILE HOME, 2 baths, '75 Lancer, on senior citizens park, 14' x 80', carport, excellent condition. McMurtrey, 881-0390, after 10 a.m.

3-BDR. HOME, remodeled, in established SE neighborhood, large back yard, covered patio & garage, $115,000. de la Fe, 459-4685.

3-BDR. HOME, 2 baths, 2,000 sq. ft., sunroom, huge garage, storage, updated older home, walk to UNM/Nob Hill, 10 min. to base, $155,900. Everett, 268-7818.

WANTED

TEMPORARY HOUSING, 2 male Sandia co-op students, August through mid December 2002, furnished please. Williams, 844-3352.

SOUTHWEST RAPID REWARD TICKETS, donated to Madison Middle School Destination Imagination Team, going to Knoxville, Tenn., for world finals, tax deductible. Current, 823-1163.

GOOD HOME, for black cat, 3-yr.-old female (Morticia), affectionate. Bell, 268-2744.

SUMMER ROOMMATE, nice house, nice roomies, 13 minutes from Sandia, $315/mo., utilities included. Cook, 459-9292.

M800 STYLEWRITER, in good working condition. Sparling, 281-7267.

ATV, off-road 4-wheeler, 250, 300 or 400, Honda, Yamaha, Kawasaki, doesn't matter. Garcia, 292-6930.

CRIB, high chair, need mid-June, reasonable please, this is for visiting toddler. Kyle, 828-1074.

FOOSBALL or air hockey table, for youth Sunday school rec. room. Sotelo, 298-0358.

HOUSEKEEPER/NANNY, part-time, some driving needed, good rates. Change, 821-7089.

FEMALE HOUSEMATE, condo, quiet location, garage included, $430/mo. Hayes, 299-1200.

WORK WANTED

HOUSESITTING, summer co-op student w/wife & 1 yr. old, will care for your house & lawn this summer. Greenwood, 869-0153.

LOST & FOUND

FOUND: '63-'66 Corvette Convertible (gun-metal gray/silver) road racing picture, taken at the UNM Pit parking lot, driver has on an open face gold helmet, looks like 70's era. Tibbetts, 844-5244.

FOUND: full-face winter ski mask, in front of Bldg. 820, next to bike rack. Sotelo, 298-0358.

SHARE-A-RIDE

EAST MOUNTAIN VANPOOL, $35/mo. max, no need to drive, Frost Rd., N-14, Tijeras. Burns, 281-3922 or Brocato, 286-8031.

Sandia volunteers, Lockheed Martin financial support make 'dream come true' for Albuquerque family

Labs, Lockheed Martin pool efforts for third Habitat for Humanity project in City

To the accompaniment of old timey music, newfangled power tools, and timeless volunteerism, Sandians gathered last Saturday on the City's near West Side to break ground for the Labs' latest Habitat for Humanity project.

The home, being built for and with Martha Rodriguez and her sons (Ruben and Jonathan), represents the third collaboration between Sandia and Lockheed Martin to help provide modern, roomy housing for families in the community. This time, Lockheed Martin is providing $40,000 in cash donations for building materials. Sandia, as usual, is tapping into its deep pool of committed volunteers, all with the aim of getting Martha and her boys into their new home before summer.

For this house, Sandia retirees Irv Hall, Duane Hughes, and Larry Lane are serving as co-job captains. They'll be the guys on the spot, making sure Sandia volunteers know what to do. Since his retirement, Irv has made Habitat a central part of his life; he donated the bulk of the money for the last Sandia project and has traveled around the world working on other Habitat projects. Dave Mann, Habitat's construction manager, calls Irv "Mr. Habitat — that's what he is to me. He's my hero."

Michelle Iwig-Harmon, president of the local chapter of Habitat for Humanity, says her group always loves working with Sandians.

"Oh, you [Sandians] are a tremendous bunch of volunteers. You build these houses faster than anyone else. You're very motivated and very on-schedule. We just love to have you guys come out."

In formal remarks, Iwig-Harmon said that Habitat is "a global family" from many different cultures, speaking many different languages, but with the same intent, the same mission: that "every man, woman, and child deserves a simple, affordable, decent home in which to live and grow."

Sandia volunteer coordinator Darlene Leonard (12650) organized the groundbreaking ceremony for the Rodriguez family home. She can sign you up today to get involved in Habitat or other volunteer opportunities. Call her at 844-8024.

— Bill Murphy

Photos by Walter Dickenman