

Inexpensive disposable fiber optics can relay real-time information about well-drilling process

New Sandia-developed technique capturing interest of oil and gas industry

By Chris Burroughs

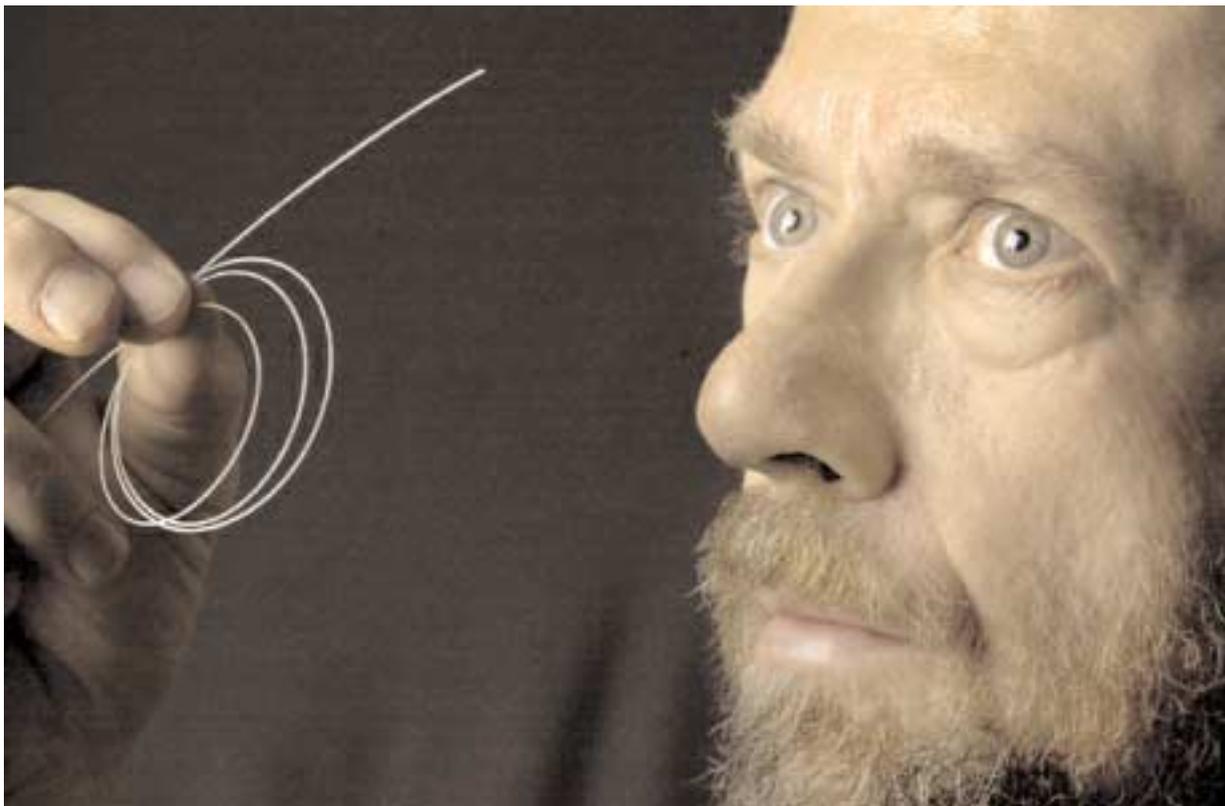
A new technique developed by Sandia researchers using an inexpensive disposable fiber optics telemetry system to relay real-time information about the drilling process is capturing the attention of the oil and gas industry.

"We have come up with a unique system using throwaway fiber optics that relays information about what is going on at the end of the drill string as it is happening," says David Holcomb (6117), Labs researcher who devised the technique. "Information is instantaneously sent to the surface about temperatures, pressure, chemistry, and rock formation — all obtained without stopping the drilling operation."

David conceived the idea of a disposable cable about eight years ago at an oil and gas industry meeting. People there indicated the need for immediate access to information about the drilling process and the formations being drilled. They wanted to obtain data without halting the drilling operation and have it be transmitted to the surface immediately at a rate high enough to support video or televiewer systems.

"Traditionally to gather this type of information, drilling would have to be stopped so that instrumentation could be lowered into the drill hole," David says. "Ceasing the drilling process is

(Continued on page 4)



DISPOSABLE FIBER OPTICS — David Holcomb takes a close look at the disposable fiber optics he has developed to relay information about what is going on at the end of a drill string as it is happening, without stopping the drilling operation. The new technique is capturing the attention of the oil and gas industry. (Photo by Randy Montoya)

Sandians rescue couple

Three members of Sandia's Special Response Team helped rescue a Belen, N.M., couple stranded in the snow in the Gila Wilderness last month. Read about the rescue in Bill Murphy's story on page 7.



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Direct-write: New way to build small, flexible, complex multilayer electronics

Technique uses computer-automated device for precision printing

By Chris Burroughs

Sandia researchers have been working on an innovative way to build multilayer electronic components that are smaller, more flexible, and complex than those produced for standard electronic packaging.

Called "direct-write," it uses a computer-automated device for precision printing of ceramic and metallic slurries on a substrate. The electronics are "drawn" on the base with an ink-filled nozzle, rather than being screen-printed or etched. This allows them to be built using a variety of materials and printed in complicated shapes.

The printing is done using a commercial system, called a Micropen, which is manufactured by OhmCraft, Inc. of Rochester, N.Y. The Sandia group has worked with OhmCraft and several other companies through a program sponsored by the Defense Advanced Research Projects Agency (DARPA) to explore the potential of this approach for depositing a breadth of materials — including conductors, high-value resistors, magnetic materials, and chemically sensitive elements — in precise patterns.

"This new system is extremely valuable for rapid prototyping of electronics and is ideally suited for fabricating highly customized circuits, which are especially appropriate for Sandia technologies."

"This new system is extremely valuable for rapid prototyping of electronics and is ideally suited for fabricating highly customized circuits, which are especially appropriate for Sandia technologies," says Duane Dimos, Manager of Ceramic Materials Dept. 1843. Duane has been involved with the project since its inception four years ago. "Without having to make tooling, such as screens or masks, we can build high-precision electronic parts in a short period of time to let engineers know quickly if their design works."

The system also allows electronics to be constructed in unusual and complex patterns. For

(Continued on page 5)

Pension plan meetings set for next week

In delivering on a commitment made by Executive VP Joan Woodard during the early February State of the Labs address for employees, the Labs next week will conduct several staff briefings on the status of efforts to enhance the Sandia pension plan. (For dates and times, see page 5.)

Ralph Bonner, Director of Financial Systems and Pension Fund Center 10300, will lead the briefings.

The briefing will provide a comprehensive analysis of the differences between the Sandia pension plan and the plan in place at Lawrence Liver-

(Continued on page 5)

Paul Robinson gives written testimony to US Senate

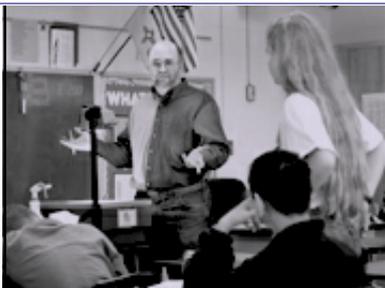
Labs President Paul Robinson gave written testimony to the US Senate last week about Sandia's infrastructure needs, including the planned Microsystems and Engineering Sciences Applications (MESA) complex. Read what he had to say on page 9.

Distributed Information Systems Lab creates distributed computing

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Sandia crystal grower raises junior high math scores

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TVC's 8th annual equity capital symposium to feature start-ups

This & That

Pension tension! – There probably are very few Sandians who haven't heard or read by now that dialogue sessions will be held next week in Albuquerque and Livermore to inform employees about Sandia's pension analysis – comparing our pension plans to the University of California (UC) plan, which covers Los Alamos and Lawrence Livermore national lab employees. See dialogue session announcement on page one.

"A little extra:" All employees will get details soon after the meeting in the *Sandia Daily News*, but retirees can't access it, because it's available only on the Labs' internal Web site. Since retirees are extremely interested in this subject, we're doing "a little extra" after the meetings so folks with Internet access can get information quickly. By Friday afternoon, March 30 (the day after the Livermore meetings), we'll post an Internet special on the *Lab News* Web site for retirees and anyone else who's interested. The URL (as all truly loyal readers with Internet service already know) is <http://www.sandia.gov/LabNews/LabNews.html>. Look for the full story in the April 6 *Lab News*. Don't look for any announcements about pension plan changes at the sessions. They are designed specifically to compare our plans to the UC plan and answer related questions.

* * *

"Telepests" getting worse – Those pesky telemarketers (I actually prefer "telepests") are driving everyone crazy these days with their unwelcome messages on our phones, e-mail, and even our fax machines. Our department's fax machines now routinely get enough faxes a week from these hucksters to consume most of a ream of paper. Not only must we suffer this telecrap, we have to buy the paper it's printed on! We need some laws with teeth against this junk.

By the way, there is a way at Sandia to selectively block incoming junk e-mail messages ("spam" if you prefer) if you keep getting them from the same person or place. I don't have room to explain here, but if you need to do this and don't know how, your computer support person or computer help desk can help you figure it out.

* * *

Phony-baloney "savings" – I'll bet I'm not the only person who hates going through grocery checkout lanes where the clerk is obliged to hand you your receipt and tell you how much you "saved" by shopping there. I have two stock replies when the clerk says, "You saved \$1.46 by shopping with us today." One is, "Wow! We can finally take that vacation to Hawaii this year." The other is, "Oh, thank goodness. Grandma can have her hip operation now." I think they're starting to recognize me where I usually shop because they often shut down their lanes when I approach.

* * *

Warning sign? – *Lab News* photographer/graphics guy Randy Montoya thinks the sign on a construction site fence along Eubank Blvd. near Sam's Club is amusing. It appears to announce a new gas station, but Randy says the sign – "Gas coming soon" – is also very close to the Taco Bell. Yep ... usually about 45 minutes after you eat there.

– Larry Perrine (845-8511, MS 0165, lgperri@sandia.gov)

Tina Nenoff wins a YWCA Women on the Move Award

Recognized for volunteer, professional contributions

Tina Nenoff, principal member of the technical staff in Environmental Monitoring and Characterization Dept. 6233, has received a 2001 Women on the Move Award from YWCA of the Middle Rio Grande. Tina is one of 12 New Mexico women honored by the YWCA during its 17th annual Women on the Move awards banquet on March 1 at the Hyatt Regency hotel in downtown Albuquerque. Women on the Move awards are given by the YWCA to women who are making significant differences in the lives of people, whether through their volunteer work or through their professional work. Recipients represent a wide variety of women in the community, including social workers, Indian leaders, fundraisers,



activists, scientists, engineers, volunteers, educators, and entrepreneurs.

Tina was recognized for her work on numerous projects and collaborations with researchers in industry, academia, and at other national labs. Her research has yielded new



TINA NENOFF

classes of porous materials with important applications in cleaning the environment (see "Molecular traps. . ." *Lab News*, Feb. 9) and new energy-efficient industrial processes that can reduce waste and energy consumption. Tina is active in the community, mentoring female undergraduate science students at UNM through the WISE program (Women in Science and Engineering), and volunteering in New Mexico with the Women's Community Association, St. Martin's Hospitality Center, and the New Mexico Jazz Workshop. She is also an active volunteer with the American Chemical Society as the long-running secretary for the Colloid and Surface Science Division, and in the Materials Research Society with the Public Outreach Subcommittee.

The other four Sandia nominees were Sandra Chavez (2951), Melissa Douglas (1644), Cheryn Lingerfelt (12830), and Julia Phillips (1802).

Sandia has participated in the Women on the Move Awards program since its inception in 1985. The Sandia Women's Program Committee (WPC) continues to sponsor and coordinate this awards program at Sandia/New Mexico. In sponsoring this awards program, the WPC reviews the nominations and selects those to be submitted to the YWCA.

Sympathy

To Ron Price (6850) on the death of his mother, Rosa Lee Price, in Albuquerque, Jan. 19.

To Lupe Raines (1701) on the death of her sister, Clara Gallegos, in Albuquerque, Feb. 16.

To Terri (10262) and Eugene (6525) Roseth on the death of her father and his father-in-law in Corpus Christi, Texas, March 11.

Retiree deaths

Fred V. Wyatt (age 82)Dec. 2
Samuel C. Waldorf (85)Dec. 8
Percy Wyly II (90)Dec. 9
Jose E. Suazo (71)Dec. 11
Eugene W. Cook (72)Dec. 24
Burton S. Hill, Jr. (75)Dec. 25
Edward C. Domme (76)Dec. 26

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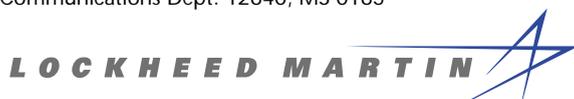
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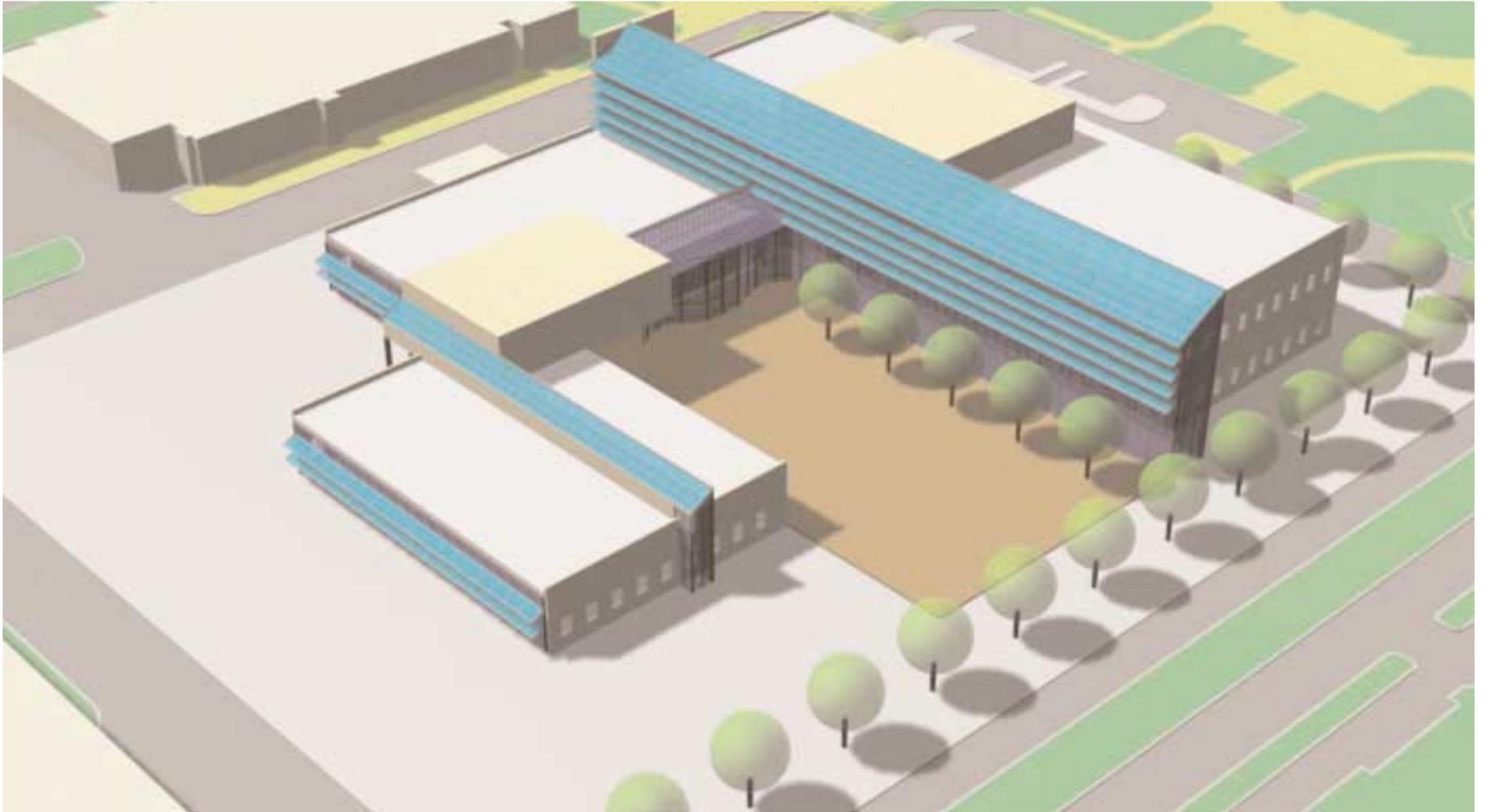
Security considerations behind decision to require TEDS password

Q: *Why in the world does the new TEDS [Training and Employee Development System] require me to remember yet another password and there is no information regarding whether or not it is a good idea to make it the same or different from my Kerberos password? With no hint as to the requirements for the password, I refuse to have another one (just got classified workstation last week and I can't cope). I'll just have my secretary continue to enroll me in classes. This is a really poor concept. Can't they tell who I am? They seem to be able to do it when I take an on-line class.*

A: The decision to require another password for access to TEDS is a requirement related to Corporate Computer Security. The purpose of the new TEDS application software modifications was to allow all Sandians the capability to do their own course registration and enrollment. In order to provide this broader user access, TEDS has been implemented on a nonsecure server. Passwords can be seen in plain text for an instant on a nonsecure server; therefore, it is a security violation to use your Kerberos password on such a server. With reference to on-line courses, these are stored on a secure server; thus, a level of security is provided for the test-out information, etc. — Don Blanton (3000)

New Distributed Information Systems Laboratory to create distributed computing environments

\$35.5 million project will advance information technologies for the DOE weapons complex of the future



ARCHITECT'S DRAWING — This view from the southeast looking northwest toward Post One shows how the DISL complex will fill the footprint of the old Bldg. 913.

By Barry Schrader

A new facility to develop and deploy distributed information systems technologies for the nuclear weapons complex (NWC) is now in design and will be constructed at Sandia/California by 2003.

Design of the new facility, called the Distributed Information Systems Laboratory (DISL), started last November. Construction is scheduled to start in April 2002 at the site where the recently demolished Bldg. 913 once stood.

DISL, a \$35.5 million project sponsored by the Accelerated Strategic Computing Initiative

Sandia California News

(ASCI) program, is needed to help provide more effective distributed and distance computing capabilities for the DOE weapons design community, according to Steve Carpenter (8904), DISL program manager.

"DISL will bring together the technologies needed to develop a distributed information systems infrastructure that will link the nuclear weapons complex of the future," says Steve. He says the facility is part of the ASCI strategy for an integrated approach to modeling and simulation-based stockpile stewardship.

Location at heart of the site

"Many challenges remain in providing a secure distributed computing capability for the DOE complex," says Ken Washington, the DISL program director. "DISL is where we will learn how to solve many of these challenges and future challenges that will arise as the distributed computing fabric of the DOE complex evolves."

Located at the heart of the Sandia/California site, and with portions of the building in both the classified limited area and the unclassified

"Many challenges remain in providing a secure distributed computing capability for the DOE complex. DISL is where we will learn how to solve many of these challenges and future challenges that will arise as the distributed computing fabric of the DOE complex evolves."

property protection area, the facility will be easily accessible to all people on site and to visitors as well.

"The building is planned to function as a central hub for the site," says Steve, "with significant conferencing facilities and an indoor-outdoor break area with coffee and food services for all to use that will help create the interactive and collaborative atmosphere we want to see in DISL."

Adds Ken: "DISL is much more than a building to us. By being at the center of the site, DISL is a bold statement about Sandia's commitment to distance and distributed computing in the DOE complex. A key attribute of DISL is that it will provide offices and labs in both the limited area and the property protection area. The limited-area spaces will enable ASCI-developed technologies to be more readily deployed for weapons design and manufacturing work. The open spaces in DISL will make it easier for us to collaborate with industry and universities on distributed information technology research and development."

Research, develop, and deploy

DISL is being designed to provide collaborative work environments needed to successfully research, develop, and deploy distributed com-

puting and visualization solutions for the NWC. Research in DISL will focus on distributed systems and visualization, networking, information security, and development of collaborative technologies. R&D workspace and laboratories will include specialized networking research labs and a next-generation visualization design center.

A significant part of DISL will also house one or more weapons design project teams, with personnel working in areas such as systems engineering, design definition, gas transfer systems, telemetry and instrumentation, structural and thermal analysis, and surety design. Steve says one of the challenges is to get the right mix of personnel occupied in the weapons design area, both weapons designers and the people who will work with them, to successfully utilize new distributed computing and collaborative technologies.

'Sustainably designed'

"The goal is to enable weapons design teams with state-of-the-art capabilities to ultimately enhance weapons design and manufacturing through deployed ASCI technologies," says Steve.

The architectural firm of Dekker/Perich/Sabatini (D/P/S) of Albuquerque, N.M., was awarded the design contract for DISL for \$1,562,000. The firm has done work for Sandia previously (in Albuquerque) and has experience with other ASCI-sponsored projects. Craig Taylor (8512), the DISL project manager, says, "The design is progressing as expected. D/P/S has done an excellent job of capturing and programming the needs of the occupants."

The 70,400-gross-square-foot-building will be "sustainably designed," according to Craig. He says it is Sandia's intent to design DISL to provide a healthful, resource-efficient, and productive working environment. The design will represent a balance that accommodates human needs without diminishing the health and productivity of natural systems.

Construction is scheduled for completion by October 2003. The facility should be fully occupied and operational by April 2004.

Nelson Bell comes to Labs with international perspective

Nelson Bell (1843), who went from postdoc to MTS in October, comes to Sandia (see "Direct-write" story at right) with an international view of science.

Prior to joining the Labs in 1999, he spent 17 months at the Max Plank Institut für Metallforschung in Stuttgart, Germany. This is one of 50 research institutes throughout Germany that serve a similar function to the national laboratories in the United States.

There he learned that not all the practices of "science" are universal.

"They do many things the same, of course," says the materials engineer. "They read the same journals and follow the scientific process, but I saw some major operational differences."

For one thing, he says, there are no giant government research laboratories like Sandia with 7,000 employees. The 50 research institutes in Germany are relatively small, with between 100 and 150 workers each.

Also, research there is more "vertical." All research proposals and purchasing have to be approved by the head of the institute, who has "a lot of power over everyone's research," Nelson says.

"Here the interaction is much more horizontal," he says. "We work with our peers and our managers, and there is much more room for testing creative ideas."

New PhD graduates at the institutes are generally older than in the United States. All German men have to serve in the national service, an institution similar to the US Peace Corps. So, instead of graduating with a PhD at 25, they may be closer to 30.



NELSON BELL was a postdoc at a laboratory in Germany prior to joining Sandia, where he is a materials engineer working on the direct-write project.

Another major difference is the lack of access for graduate students at the institutes to operate advanced scientific equipment.

"There technicians are assigned to perform the work on advanced equipment," Nelson says. "The scientists and graduate students tell the technicians what they want done. Students, especially, are heavily supervised on advanced technical equipment."

This was quite different from his graduate training where he was "hands on" with materials characterization and processing devices.

Nelson grew up in Augusta, Ga., and was always interested in math and science. By the time he was a senior in high school he was tutoring calculus. He feels lucky to have had a strong technological institution in his home state — Georgia Tech — where he obtained his BS in materials science with a specialty in ceramics. He then went to the University of Florida where he earned his PhD in materials engineering.

It was there he met Wolfgang Sigmund of the Max Plank Institute who was giving a lecture.

"I told him I was interested in doing a postdoc outside the United States," Nelson says. "Five or six e-mails later, I was accepted."

He's still in touch with Sigmund, an expert in ceramic processing, but says he grew particularly close during his time in Europe with the other young non-German scientists who were also working at the institute. They all had a common bond.

When he returned to the United States, he attended an American Ceramics Society annual conference where he met Duane

Dimos (1843) of Sandia. Through him, he became interested in working as a postdoc and eventually an MTS at the Labs.

He's currently developing a laboratory from "ground zero" and developing partnerships with the other researchers.

Nelson says he is really pleased to be working at Sandia, and part of it is patriotism.

"Living in Germany made me realize how much of an American I am and how much I prefer the American mindset and working approach." — Chris Burroughs

Fiber optics

(Continued from page 1)

extremely expensive — as much as \$100,000 to \$200,000 a day for offshore drilling. A better way was needed."

Familiar with disposable fiber developed for the non-line-of-sight missile guidance systems in the 1980s, he realized the technology might be applied to well drilling.

The use of fiber optics telemetry to transmit information from the down-hole end of the drill string while drilling is in process has been of interest to the oil and gas well drilling industry for some time. However, it was considered expensive. A bulky armor was required to protect the delicate optical fiber, and deploying the cable interfered with drilling. David's technique, instead, uses unarmored fiber, protected only by a thin, clear protective plastic coating, similar to that found in missile guidance systems which can deploy miles of fiber from a small spool at missile speeds.

"The key difference from other attempts to insert fiber optic cable in drill pipes is to consider the cable a throwaway item, to be used once and then ground up and flushed out in the drilling mud," David says. "If the cable only has to survive for a few hours and need not be retrieved, it is feasible to use 'unarmored' fiber, which is cheap and can be wound into packages small enough to be inserted into the drill pipe without interfering with operations."

The extreme lightness and compactness of the unarmored optical fiber make it easy to manipulate, compared to the massiveness of a conventional reusable cable. The fiber flows through the drill string with the mud to reach the bottom of the hole, where it instantaneously sends back information to drill operators.

Actual oil and gas drill holes are about eight to ten inches, or larger, in diameter. The pipe (drill string) running down the middle of the hole through which the mud flows is about five inches. To deploy and control the optical fiber in the rapidly moving mud in the drill string, researchers developed a deployment tool. The optical fiber is

wound up like a spool of thread inside the tool, which controls the payout of the fiber into the drill string. The entire deployment tool weighs about 75 pounds; the actual fiber optics being placed into the drill string weigh only about one pound.

David said he and other researchers successfully showed that the disposable fiber optics telemetry system works in tests last September at

"The key difference from other attempts to insert fiber optic cable in drill pipes is to consider the cable a throwaway item, to be used once and then ground up and flushed out in the drilling mud."

the GRI/CatoosaSM Test Facility, Inc., a subsidiary of the Gas Technology Institute (GTI), located in Catoosa, Okla.

"We got the fiber down and the information back all successfully," he says. "While in field tests

Team members

Team members developing the inexpensive disposable fiber optics telemetry system were Robert Hardy and Tim George (6117), Bruce Engler (6116), Ron Jacobson, Joe Henfling, George Staller, David Raymond, and Randy Norman (all 6211). Testing of the deployment tool was facilitated by the staff at the Solar Thermal Test Facility (the Solar Power Tower), who set up a 200-foot-tall test loop inside the tower, allowing researchers to observe and refine operation of the tool before going into the field.

the optical fiber was dropped only 3,000 feet, we see no limitations. The cable could easily reach 10,000 to 20,000 feet."

Researchers had two primary concerns going into the test. They were worried that the abrasive nature of the mud flowing through the drill string would chew up the fiber. They also were concerned that the drag of the mud flow down the drill hole would break the fiber.

Both concerns turned out to be inconsequential.

"The abrasiveness was not a problem," David says. "The fiber doesn't fight. It has a light plastic coat that gives. It doesn't resist abrasive particles."

The second concern, drag, also proved not to be a problem. Laboratory drag measurements over-predicted the drag by a factor of two or three. The researchers aren't quite sure why the inconsistencies between the lab tests and the field tests exist. One possibility might be that the fiber moves to the wall of the drill string, out of the way of the mudflow. The only way to know for sure is to send a camera down with the fiber optics.

Researchers also determined the new system could transmit data at about one megabit per second, five orders of magnitude faster than commercially available MWD (measure while drilling) transmission system, without interfering with the drilling process.

David says that before he could get support to research this new technique of obtaining information in a drill hole, he had to get past the "giggle" factor.

"Everyone thought of the drilling environment as a rough environment that would rapidly chew up the optical fiber," he says. "What we learned is that once the fiber flows with the mud, it's a pretty benign environment."

Early funding came from Sandia's Laboratory Directed Research and Development (LDRD) program. GTI has funded more recent research.

Currently GTI is seeking a partnership from the oil and gas industry to put the new inexpensive disposable fiber optics telemetry system into production.

"There's been a lot of interest," David says. "This could change the future of oil and gas drilling around the world."

Direct-write

(Continued from page 1)

example, a communications chip manufactured in this manner could potentially be small and flexible enough to be fabricated on a soldier's helmet or as an integral part of any odd-shaped object.

Sandia and its DARPA partners have already used the technique to build a number of prototype antennas in unusual shapes for Navy applications, which are currently being tested.

Duane says the technique is similar to one developed by Joe Cesarano (1843) to fabricate free-form ceramics, called robocasting, which relies on robotics for computer-controlled deposition of ceramic slurries — mixtures of ceramic powder, water, and trace amounts of chemical modifiers — through a syringe.

In contrast, this work uses a variety of metallic and ceramic slurries or "inks," to write intricate patterns for precision circuitry. The electronic inks are heated at low temperatures to evaporate any fluids, leaving behind the dried metal or ceramic, and then fired to sinter the powders together.

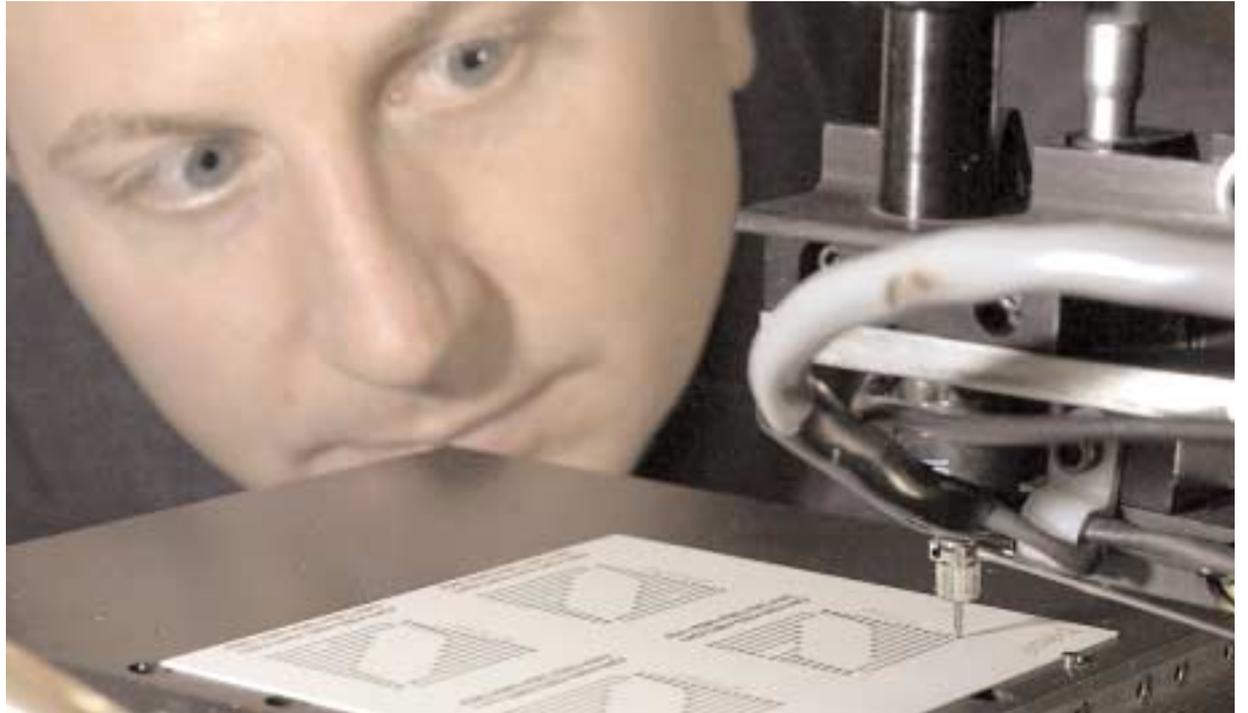
To date, the most complex direct-write components consist of 13 printed layers. Pin Yang (14192) has led the effort to fabricate devices such as integrated RC filters, multilayer voltage transformers, resistor networks, and other components.

Paul Clem (1846), one of the project's leaders, says that two aspects of the direct-write system make it useful. First, the Micropen can deposit fine line traces or areas on nonplanar substrates, and, second, slurries (inks) can be custom-designed for specific needs and specific functional components.

"The Micropen can use nozzle sizes from 2 mils (50 microns) to 100 mils to obtain different print geometries, such as fine line traces or filled dielectric regions," Paul says.

Other inks that have been developed by Sandians include resistors, magnetic materials, and porous chemical sensors.

Chemist Nelson Bell (1843) is studying the area of slurry modification for the project. He says that although a number of commercially available slurries/inks are available and suitable, he is



DIRECT-WRITE APPROACH — Paul Clem (1846) watches as a Micropen deposits ink to write a complex electronics circuit pattern. The system allows for electronics to be "drawn" on the base with an ink-filled nozzle, rather than being etched or screen-printed. (Photo by Randy Montoya)

looking at changes in powder materials, solvents, binders, wetting agents, and drying control agents that can improve the printing and performance of the inks.

"We want to come up with the best possible slurries to avoid clogging the printing tip to control flow and line shape during printing, and shrinking after firing," Nelson says. "All these aspects have to be taken into consideration."

Paul says the current challenge for the research team is working with lower temperatures in the final firing stage. The goal is to put these multilayered electronic components on substrate materials such as plastic that can't withstand high temperatures.

"We have redesigned many of these materials so that we can achieve the same performance by heating the parts up to only 300-400 degrees C instead of 850 degrees C," Paul says. "We should be there soon."

Philip Gallegos, Manager of Electronic Fabrication Dept. 14112, who has several customers interested in exploring this technology, calls this a "very interesting technology."

"We are looking for new ways to apply this technology to fabricate electrical/mechanical prototypes from 3-D model-based design," Phillip says.

Direct-write partners

Among those working on the Micropen printing are Duane Dimos, Manager of Ceramic Materials Dept. 1843; Pin Yang (14192), who coordinates small-lot production and has investigated buried resistor approaches; Paul Clem (1846), who works on electrical performance of the components; and Nelson Bell (1843), who develops slurries and studies their rheology.

Sandia has five partners in the project: Raytheon of St. Petersburg, Fla., which wants to use the technology to build antennas for the Navy; Penn State, which is developing new antenna designs; CMS Technetronics of Stillwater, Okla., which is designing a new version of the direct-writing tool that will have several advanced features; Superior Micropowders of Albuquerque, which is developing powders used in the process; and Computational Fluid Dynamics Research Corp., which models slurry flow and processing.

Sandia is working with these institutions under DARPA program Mesoscopic Integrated Conformal Electronics or MICE. The DARPA MICE program is managed by William Warren, a Sandian (1800) on temporary assignment at the Defense Advanced Research Projects Agency.

Superior Vision Services new administrator of Sandia's vision plan

Effective April 1, the Vision Care Plan will have a new third party administrator, Superior Vision Services, Inc. Superior Vision Services offers an extensive provider panel consisting of ophthalmologists (MD), optometrists (OD), independent opticians, and national and regional optical chains.

Sandia's Vision Care Plan benefits will not change. Eligibility for participants will also remain unchanged. For example, if you will be eligible for an eye exam next Oct. 1, this will still apply to you.

Brochures and ID cards will be mailed to the home addresses of employees and retirees toward the end of this month.

Retirees are not covered under the Vision Care plan. However, they will have access to a discount plan offered by Superior Vision Services.

The current administrator, Cole Managed Vision, will continue to administer the Vision Care Plan through March 31.

Direct-write builds electronics in layers

One promising aspect of the direct-write approach is that the electronic components can be built in layers, creating "thick-film hybrids."

Typically, the first layer consists of a base of "green tape," a type of polymer and ceramic powder cast on a rolling mylar sheet. Holes, called vias, are cut at various points on each sheet to interconnect the layers. The Micropen, following a pattern defined by a computer-automated design (CAD) instruction file, places the "ink" — usually a metal for electronics — on the first layer. The first sheet is then heated at 80 degrees C — just enough to dry off the solvent. A second, third, or fourth printed layer could then be added following the same

process. After all the layers are completed, multiple layers of green tape may be laminated and the entire package fired at 850 degrees C to densify the structure. In this way, the direct write approach can be used in making multilayer packages and structures.

One example of this approach is the printing and integration of buried resistors into low-temperature co-fired ceramic packages.

"With a short turn-around time, we can quickly optimize the processing conditions that give the best electrical performance for these buried components," says Pin Yang (14192), who led this portion of the project. "We believe that the passive component integration is the future for advanced packaging."

Pension plan

(Continued from page 1)

more and Los Alamos national laboratories, the two DOE weapons labs managed by the University of California.

Ralph says the briefings will walk attendees through the UC-Sandia plan comparison by using the example of a "typical" 30-year Sandian who is preparing to retire. It will also explain the various federal laws that apply to pension funds in general and specifically to making changes to pension funds.

The briefings will examine the risk/reward tradeoffs entailed in any changes that may ultimately be made to the Sandia pension plan.

What employees won't hear during the brief-

ings, Ralph says, is anything about a specific proposal on the table with DOE. "That hasn't been decided," he says.

The schedule for pension plan meetings:

New Mexico managers' dialogue session — Monday, March 26, 1-2:30 p.m., Steve Schiff Auditorium (Bldg. 825).

NM Employee dialogue sessions — Monday, March 26, 3-4:30 p.m., and Tuesday, March 27, 9:30-11 a.m. and 2:30-4 p.m., Steve Schiff Auditorium.

California managers' dialogue session — Thursday, March 29, 12:30-2 p.m., Bldg. 912, Rm. 121.

California employee dialogue session — Thursday, March 29, 2:30- 4:30 p.m., Bldg. 904 Auditorium.

Sandia, Ardesta join to commercialize MEMS, microsystems

Sandia grants nonexclusive right to company to make and sell products using SUMMiT

By Chris Burroughs

Sandia and the Ann Arbor, Mich.-based company Ardesta have joined forces through a new partnership agreement to transfer Labs-developed microelectromechanical systems (MEMS) and microsystems technologies to start-up companies in the commercial sector.

As part of the agreement, Ardesta is granted a nonexclusive right and license to make and sell products using Sandia's SUMMiT technology. SUMMiT (for Sandia Ultraplanar Multilevel MEMS Technology) is an advanced five-level polysilicon surface micromachining MEMS technology that produces more reliable and complex devices than previously possible with less advanced techniques (*Lab News*, Sept. 10, 1999).

The agreement also identifies key areas of intellectual property and technology that will be further developed through future cooperative research and development agreements (CRADAs) among Sandia, Ardesta, and companies that Ardesta may form in the process of commercializing MEMS and microsystems. Sandia will become a shareholder in Ardesta and the companies started based on Labs-licensed technology and intellectual property.

"This new partnership is key to the commercialization of MEMS and microsystems devices — something we see as important to our national security mission," says David Williams, Director of Microsystems Science, Technology, and Components Center 1700. "Before we can use MEMS and microsystems in critical weapons systems, it must be shown they are manufac-

turable and reliable. The best way to demonstrate this is to commercialize them and use them in everyday products. Ardesta will help make this happen."

Microsystems are devices smaller than a human hair built on silicon wafers using standard integrated circuit manufacturing. Batch-produced and inexpensive to make, they contain electrical circuitry, optical devices such as

"This new partnership is key to the commercialization of MEMS and microsystems devices — something we see as important to our national security mission."

lasers, and MEMS — tiny machines that can sense their environment and take action.

"MEMS devices, once a research novelty of arrays of spinning gears, are now finding their way into a broad range of commercial applications," says Jerome Jakubczak, Manager of Sandia's MEMS Science and Technology Dept. 1749. "MEMS application areas include ink jet printer heads that dispense carefully controlled amounts of ink onto paper, automotive air bag sensors that reliably deploy a car's critical safety device, projection display devices that visually project information from a computer onto a large screen or wall, and even video games where the player's physical motion becomes part of the game."

Ardesta is an "industry accelerator" dedicated to the development of the microsystems

industry. It invests in start-up and early-stage companies, provides business and technical resources to support these companies, and develops industry-building resources such as publications, Web sites, and trade shows.

Rick Snyder, Ardesta CEO, says the new partnership will allow Sandia and his company to share with one another "what we do best."

"I look forward to working with Sandia to advance the entire industry of microsystems," Snyder says. "Through this alliance we can take intellectual property out of the laboratory and create commercial success much faster than if we were each working independently." Snyder adds that Ardesta is committed to begin the process of evaluating the market demand and feasibility of constructing a microsystems prototyping and fabrication facility in New Mexico within three years.

Ardesta's corporate headquarters will remain in Ann Arbor. Sandia will provide Ardesta with fabrication capability in its Albuquerque facility until Ardesta's fabrication unit is completed.

Also as part of the agreement, within one year Ardesta will develop a design and training center in Albuquerque based on Sandia's SAMPLES™ (Sandia Agile MEMS Prototyping, Layout Tools, Education and Services) prototyping model, which serves as a supporting infrastructure to the SUMMiT process. The ultimate objective of SAMPLES is to help users develop innovative products by leveraging advanced design, fabrication, and characterization technologies originally developed for national laboratory applications.

NASA grants the gallant Galileo spacecraft one last mission extension

The "little spacecraft that could" is going to get some more opportunities.

On March 15, NASA announced that the Galileo spacecraft will be granted one last mission extension, to include five more lengthy orbits of Jupiter and flybys of its moons.

As the NASA announcement said, "The resilient Galileo spacecraft doesn't know when to call it quits. . . Galileo has been orbiting Jupiter for more than five years and survived radiation exposure more than three times what it was built to withstand."

As Sandians were reminded in a Feb. 9 *Lab News* feature, Sandia provided the radiation-hardened chips for Galileo that enabled the spacecraft to withstand Jupiter's intense radiation environment and helped lead to one of the most successful planetary exploration missions ever.

Galileo's original 18-month mission around Jupiter, which began when it went into Jovian orbit in December 1995, has previously been extended twice. The spacecraft has returned an enormous wealth of scientific information, including evidence of a subsurface ocean on Jupiter's moon Europa.

"We're proud that this workhorse of a spacecraft has kept performing well enough that we can ask it to keep serving science a little longer," said Jay Bergstralh, acting director of Solar System Exploration at NASA Headquarters in Washington.

On May 25 Galileo should pass about 76 miles above Callisto, Jupiter's second largest moon. Callisto's gravity will swing Galileo into position for a flyby over both polar regions of the intensely volcanic moon Io in August and October.

Galileo will continue its scientific work in 2002. That November it will swing closer to Jupiter than ever before and dip within about



ARTIST'S IMAGE of Galileo during deployment.

300 miles of the moon Amalthea.

After heading back out into space on its last elongated orbit of Jupiter, Galileo will head back and then in August 2003 make a direct impact into Jupiter's atmosphere and burn up. This final act was approved by the National Academy of Sciences / National Research Council last December.

"Galileo has already succeeded beyond expectations, and we have the opportunity to learn still more in coming months, but it is sad to see the end of the road up ahead," said Eilene Theilig, Galileo project manager at NASA's Jet Propulsion Laboratory in Pasadena, Calif. "Exposure from Jupiter's intense radiation belts has impaired some of Galileo's instruments, but it is still producing valuable scientific results." — Ken Frazier

Micromachine testing efficiency improves at Sandia

A silicon wafer when sliced releases particles, just as a wood plank when sawn releases sawdust. To wafer-fabricated microelectromechanical (MEMS) devices, such particles are the relative size of boulders. They could impede MEMS performance and increase the number of failures per batch, says Sandia researcher Paul Resnick (1746).

For this reason, the usual industry approach has been to wait until after the sawing is finished to dissolve the protective packing layer — called a sacrificial oxide — that immobilizes tiny lever arms and gears.

Yet the simplest and most obvious place to gather failure data that could be used to improve the wafer production process would involve testing the tiny machines *en masse*, immediately after the fabrication process and before the wafers are sliced into individual machines.

Now the first step in evaluating silicon micro-machines while still on the wafer has been taken by researchers at Sandia.

Sandia's new process involves the use of pressurized carbon dioxide while the wafer is still whole. After the sacrificial oxide is dissolved by an acid, Paul, with Peggy Clews and Harold Stewart (all 1746) use CO₂ in liquid form to sweep a solvent from the wafer surface. Then, increased temperature and pressure turn the CO₂ into a supercritical fluid — a fluid that is neither liquid nor gas but has properties similar to both — for drying the fragile structures without damaging them.

Two wafers were released and dried using this process, the first yielding 72 percent and the second yielding 91 percent workable devices on Sandia's SUMMiT Standard Evaluation Circuit.

The eventual goal is to encapsulate the entire uncut wafer with a form-fitting quartz shell. The shell would be hollowed out over each MEMS device to allow each machine to perform. Because the shell would also seal around the borders of the device, the seal would protect the tiny machine from impurities when cut, and also protect it later in its functioning life.

— Neal Singer

Three Sandians are answer to snowbound couple's prayers

By Bill Murphy

Nature has many tricks wherewith she convinces man of his finity — the ceaseless flow of the tides, the fury of the storm, the shock of the earthquake, the long roll of heaven's artillery — but the most tremendous, the most stupefying of all, is the passive phase of the White Silence.

Jack London, *The White Silence*

It could have ended badly. But the woman prayed and prayed. And the man did, too.

Then, look! There! Across the snow! The three guardian angels descended, borne on a white cloud, a flowing snowdrift, and Bear and Eve Feight knew they'd be going home.

Bear and Eve are the Belen, N.M., couple who took a wrong turn into the Gila Wilderness in southwestern New Mexico at just the worst time of year, early February, when clouds are fat with snow and dark, dark, dark. Instead of visiting their daughter in Tucson, they spent a week hunkered down in their white Ford Explorer in temperatures that dropped to well below zero at night, stranded deep in the Gila in that magnificently empty nowhere southeast of Reserve.

They prayed for a miracle, Eve says, and they got one in the form of her "guardian angels." That's what she calls, unabashedly, the three Sandians, Orlando Griego, Daniel Harbour, and Gary Batson, who showed up just when things were looking pretty bad for the Feights.

The three are members of the Labs' highly trained, highly demanding Special Response Team (SRT). These are guys trained to protect the nation's most sensitive assets, and they're very good at what they do. They happened to be on a winter camping/backpacking/snowshoeing expedition into the Gila. For fun. For the challenge. They do it every year. Sure it's tough — that's the idea. "We like to put a stick in the spokes," says Daniel. This year, the three planned a winter climb to the top of the nearly 11,000-foot-high Whitewater Baldy. They were driving in toward Snow Lake as a jumping-off place.

But, Gary says, "We knew the emphasis of our



A VERY SPECIAL RESPONSE — Gary Batson, Daniel Harbour, and Orlando Griego (left to right), members of the Sandia Security Force's Special Response Team, were in the right place at the right time last month when their annual winter camping trip turned into a rescue operation for an elderly Belen, N.M., couple snowbound in the Gila Wilderness. The three are seen here near Tech Area 3; the Manzano Mountains are in the background. (Photo by Randy Montoya)

trip had changed" when they stumbled on the Feights.

Day eight. After staying with their vehicle for a week, Bear and Eve had decided to hike out with their little dog Riley. They didn't get much more than a snowball toss away from the Explorer, though, before Eve realized there was no way she'd be able to manage. The snow was three feet deep; it was crusty. It was cold. She fell. And fell again. And again. She said she had to head back to the car. Bear insisted that he'd go on alone, but for two hours only — no more! — and he promised to turn back at that point regardless of whether he'd found help.

As the couple parted, little Riley started to bark. And Bear saw something strange, out of place, out of whack: a snowdrift *moving* toward him. Huh? Rub the eyes and look again. This snowdrift had chrome wheels.

It was Gary, Daniel, and Orlando, moving ahead slowly downhill in Gary's white F-250 pickup. Gary remembers what Bear said: "Boy, am I glad to see you."

Yeah.

It isn't hard to imagine Eve's relief. Orlando says she told the three Sandians that they were the handsomest men she ever saw — next to Bear, of course. The three men kid each other now, the way guys will, that Eve must have been hallucinating — badly.

Orlando remembers what he was thinking when they came upon Bear and Eve. As an SRT officer, he's trained to assess a situation and draw a pretty good, quick picture of the tactical situation. It's second nature. Instinct, almost. So: He sees tire tracks going in but not coming out. He sees an elderly gentleman standing in the snow. A dog barking. An elderly woman. He sees a car practically buried in drifts. It's obviously been there for a while and isn't going anywhere. All of this he processes instantly.

"And it just sort of washes over you. *Oh my God. 'Are you guys all right?'*"

Incredibly, they were. Eve and Bear made their precious few candy bars and cookies last the week. They drank melted snow. And — Bear knows cold. He's an insulation contractor. Really.

It just so happens he'd tossed a few insulation samples and some plastic sheeting into the back of the Explorer before they left home. (They'd planned to do a little business on the trip.)

When Orlando, Gary, and Dan came to the Explorer, they were pretty impressed with what the Feights had managed to accomplish. "It was amazing. They were really resourceful," Daniel says. "Bear had wrapped plastic around the inside of all

the windows and they'd made a space within a space in the back of the Explorer using the blankets and insulation. It was like a cocoon back there." During daylight, the sun would heat the car; after dark, Bear and Eve would do everything they could to keep as much of the warmth inside as possible.

They tamped an "SOS" in the snow, on the chance that someone might be hunting for them from the air. (The Feight's daughter *had* called in a missing person report, but who knew where to search? Eve and Bear had decided on their itinerary only the morning they left, and then they strayed even from that route into an area where nobody, but nobody, would be looking for them.)

Gary's blunt. The Feights, he says, "are lucky we found them that day." The Sandians almost didn't even go, he says. For one thing, they almost delayed

the trip. And then, when they were getting ready to leave Albuquerque that morning, Gary called the Forest Service for an update on conditions in that part of the Gila. "They advised us not to go." Deep snow and more on the way. "We decided to make the trip anyway," Gary says. "We just loaded up with extra chains and shovels."

The Explorer was too bogged down to move, so the Feights and Riley loaded into Gary's pickup and they headed up the hill, back toward civilization. There were some tense moments even then. The wheels spun. Maybe the Feights exchanged nervous *deja vu-ish* glances. Been there. Done that.

"We assured them we *would* get out," Daniel says. On the way back toward Reserve, they stopped at a pay phone. Eve called her daughter and many a tear flowed . . . at both ends of the line.

Gary says it was a lot more than a two-hour walk — nine or more miles through the snow — to the nearest ranch, even if you knew how to find it. Assuming Bear had kept his promise to Eve, he would have had to head back to the Explorer long before finding any help. A freezing ice and snow storm moved in that afternoon. It probably would have caught Bear out in the open. Could have been bad. But then, the guardian angels came down the hill, through the light, in a moving snowdrift.

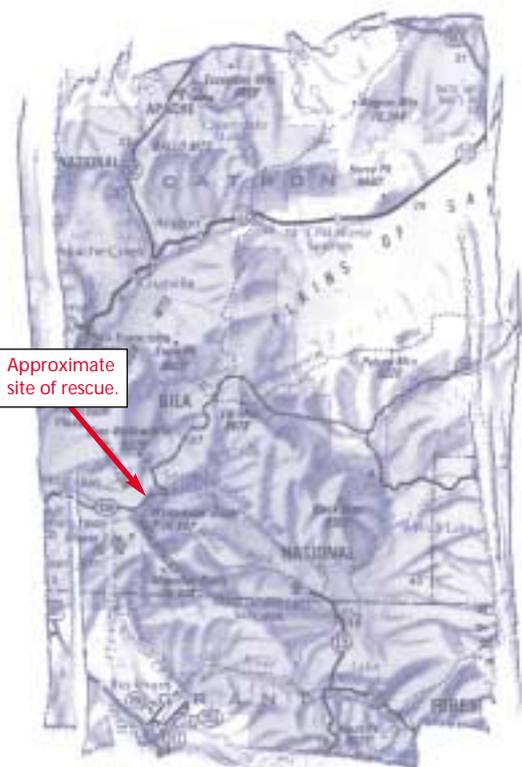
"I think these folks are the heroes," Orlando says now. "Given the circumstances, they did practically everything right. We just did what anybody would do."

Well, maybe. But how many "anybodies" would be miles deep in the Gila in the middle of winter?

The Sandians got Eve and Bear back to Reserve, where they were checked out and given a remarkably clean bill of health. The new friends said goodbye.

"Eve asked us what we were going to do now," Orlando remembers. "We told her we were going to go camping in the Gila, like we planned.

"She laughed and said, 'You guys are crazy.'"



Approximate site of rescue.

RESERVE, N.M., and Gila Wilderness area, where the three Sandia SRT members found stranded couple.



Gary Batson's F-250 pickup in the Gila Wilderness, not far from where Gary, Orlando Griego, and Daniel Harbour came upon the stranded Belen, N.M., couple.

Sandia crystal grower raises junior high math scores

It warms the heart, says unpaid teacher John Reno

By Neal Singer

Sandia physicist and crystal grower John Reno (1123) teaches middle-school math without benefit of a pedagogue's usual carrot-and-stick. In his after-school class every Tuesday at Albuquerque's Hoover Middle School, he neither grades nor takes attendance. Yet 20 students, rarely absent and generally polite, come each week. And the school's standing in February's opening round of a national competition called MathCounts, run by the National Society of Professional Engineers, rose from ninth out of 20 the previous year to fifth in this, John's first year of teaching. The entry group, composed of an individual and a team of four of John's students, will compete in late March for the first time at the state level.

One reason for John's success may be that he understands classroom dynamics.

Before his first meeting, he made sure he would not stumble at the blackboard. He did this by working through at home almost three hundred math problems provided for study by the MathCounts Foundation. In this way, he maintained the respect of his brightest students, who otherwise could have been supercilious towards a teacher they perceived as less intelligent than they are.

Second, he never discounts a creative solution suggested by a student for a problem until he



VOLUNTEER EXTRAORDINAIRE — Sandia physicist and crystal grower John Reno (1123) takes his love for mathematics into the classroom at Hoover Middle School, where he teaches a once-a-week after-school math program. (Photos by Randy Montoya)



JOHN RENO

What John offers his students are problem-solving techniques: how to eliminate what's not important, and how to find patterns. "When they succeed, you see it in their faces," he says. "It warms the heart."

and his class have worked through it. The chilling phrase from teachers with insufficient math background — "That's not the way the book does it" — is absent from his lexicon.

Third, he never hesitates to say an off-the-wall solution is wrong if it proves to be so.

So he maintains respect, encourages creativity, and avoids the role of cheerleader-without-standards.

The bearded, casually dressed Sandian, aided by volunteer assistant Meredith Ward (a high school junior from Eldorado High) occasionally provides brownies, cookies, chips, and other snacks. "That's how you get students to come," he says.

What he offers his students are problem-solving techniques: how to eliminate what's not important, and how to find patterns.

"When they succeed, you see it in their faces," he says. "It warms the heart."

That a physicist with a doctoral degree takes time to work out junior-high-level math problems in advance may seem strange. But the problems are of a higher order than those ordinarily

encountered in Albuquerque junior highs and can be troublesome. (Samples: for what value of x does three to the 14th power equal $1/9$ to the x power? And, suppose $p/q = 3$. What is the value of $2p/(p-q)$?)

John's job growing crystals at Sandia includes formidable challenges, but confines his human interactions to laboratory associates while leaving his bent for teaching untapped. He already had spent several years teaching high school while on the path to achieving his doctorate.

When his two children, Matthew and Beth, both at Hoover, told him of the opening to lead the math club, he applied and was selected for the unpaid job.

For the state championships, he's preparing his team to do "mental math" — solve problems in their heads, with neither calculator nor paper. "How many people still do that, even at Sandia?" he asks. "It's a dying art." But challenges, he says, make teaching interesting.

Feedback

Why aren't there more technical teams included among Sandia President's Quality Award recipients?

Q: I have a concern about the PQA process. Although I've seen in the LLT minutes (I think . . .) that this issue has come up, I'd like to raise this issue directly.

The most recent PQA announcement contained 31 team awards; of those, only three (numbers 347, 43, 33) are, from what I can tell, technical teams. The remaining 28 (more than 90 percent) are for what I'd call "support" or other "nontechnical" functions. While I value the work those 28 teams were rewarded for (indeed, I'd give kudos to the timcard app team), I'm surprised there's so little representation on that list from "technical" teams.

I would guess the following are possible reasons: (1) lack of quality teams in technical areas, (2) lack of quality PQA applications from technical teams, (3) bias toward nontechnical teams in the PQA process.

I trust senior management is on the ball enough that 3 is not the answer. Having led and observed several high-performing teams during my eight years at the Labs, I'd guess that 1 is not the "whole" answer, although I'd assert that it is part of it. That leaves 2.

My personal experience in recent years suggests that 2 is in fact the problem. When I have suggested that we put together a PQA application, I have been told that the PQA process is not worth the effort. That means that either the perceived reward is not significant or the effort required to submit PQA applications is high compared to the reward or in an absolute sense. I think part of my particular experiences also

has to do with a manager who doesn't believe in these type of awards.

I don't know what the answer is (there's probably not one single answer), but I do know that every time I see the PQA announcement and the overwhelming skew toward nontechnical teams, it makes me just a little more cynical.

A: Since the inception of the Sandia President's Quality Award in 1993, approximately 50 percent of all applications were received from administrative programs and teams at Sandia. Applications received from technical teams serving an external customer have ranged from 20 to 40 percent over the eight-year period. The balance of the applications have been received from teams that were a mix of technical and administrative services.

The lack of technical teams participating in the PQA program has been a concern to the PQA team and our executive management for some

"We still have not obtained the level of technical participation we would like to have in the PQA program."

time. Feedback is obtained each year from PQA program participants. A Labs-wide survey was done using Sandia's Internal Web in July 2000 to obtain feedback about the program. Results from those who indicated that they did not participate in the program cited two major reasons. Respondents indicated that they didn't have the time to participate and that there was no real reward and recognition for doing so.

Several activities have been initiated to encourage participation from technical programs: (1) the establishment of PQA representatives in each division in all Sandia organizations; (2) more communication about the program through the *Sandia Daily News*, *Lab News*, and Sandia Video; and (3) the establishment of applicant training sessions that guide applicants through the PQA criteria and produce draft applications.

It is recognized that even with these efforts we still have not effectively obtained the level of technical participation that we would like to have in the PQA program. We are now reassessing the entire PQA program to ensure that it is in full alignment with our corporate quality needs and that it reinforces the quality principles guiding all of our work. It is our desire that changes made as part of this assessment will stimulate both greater corporate-wide participation and participation from technical teams. — Les Shephard, Director of Executive Support Center 12100

Paul Robinson talks up MESA, other infrastructure requirements in Senate Appropriations testimony

Labs President and Director C. Paul Robinson in written US Senate testimony last week described Sandia's planned MESA project, the Microsystems and Engineering Sciences Applications complex, as "the cornerstone of Sandia's initiative to address the need for microelectronic and integrated microsystems to support a certifiable stockpile for the future."

The comments about MESA were part of Paul's written testimony March 13 to the US Senate Appropriations Committee Subcommittee on

Energy and Water Development, which oversees appropriations for the nation's nuclear weapons complex. Paul's comments addressed subjects related to infrastructure issues affecting Sandia specifically and the National Nuclear Security Administration (NNSA) complex generally.

"The infrastructure requirements for NNSA facilities are an important issue that must be properly managed for the benefit of all the vital elements of the NNSA complex," Paul said. "The infrastructure investment decisions we make today

Find the complete text of Paul's latest Senate testimony, as well as other recent Congressional testimony, at http://www.sandia.gov/testimony/test_hom.html.

will determine whether the laboratories and plants can continue to conduct their stockpile stewardship responsibilities effectively in the years ahead."

Paul described in some detail the Corporate Sites Planning Process and the Corporate Sites Planning Council.

"Council approves requested construction projects and associated funding strategies based on a ten-year strategic vision. Sandia's funding sponsors provide final funding approval. The approved list becomes the Investment Funding Profile, which is an essential part of Sandia's Sites Comprehensive Plan."

After reviewing the systematic nature of the Labs' infrastructure planning processes, Paul discussed a number of Sandia's key infrastructure initiatives. He led with MESA, which, he said, "will provide essential facilities and equipment to enable teams of weapon system designers and microsystems specialists to design, integrate, and qualify components and subsystems for nuclear weapon system assemblies."

Paul said Sandia aims to support DOE's Advanced Strategic Computing Initiative (ASCI) with construction of two key facilities at its major laboratory sites. The first is the Distributed Information Systems Laboratory (DISL) at Sandia's site in California (see story on page 3), which will develop a distributed information systems infrastructure required for NNSA Defense Programs' Virtual Enterprise for Stockpile Stewardship and Stockpile Management. The second is the Joint Computational Engineering Laboratory (JCEL) at Sandia/New Mexico. JCEL will be a state-of-the-art facility for research, development, and application of high-performance computational and communications technologies.

Paul also discussed Sandia's plans for refurbishing and upgrading the Z machine, updating and revitalizing various test capabilities, building a new Weapons Test and Evaluation Laboratory (WETL) at the Pantex site in Amarillo, and carrying out general infrastructure maintenance, upgrades, and repair.

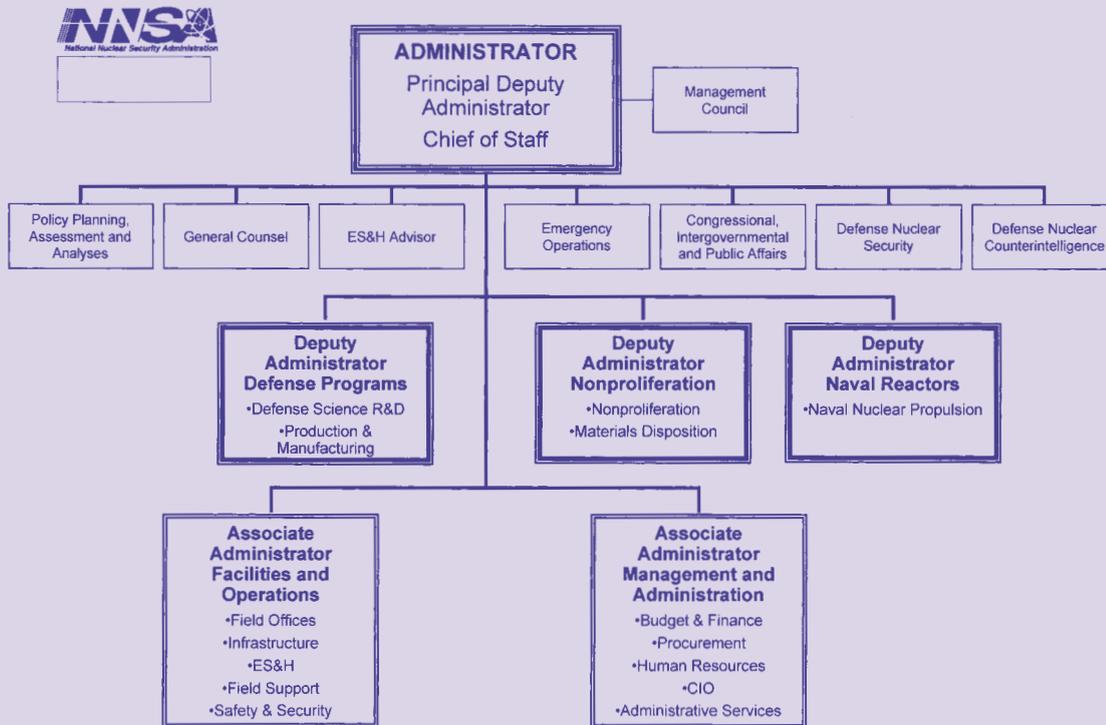
He cited "lack of continuity in investment planning at the Defense Programs level" as a key challenge facing NNSA as it attempts to maintain its complex-wide infrastructure.

"We must find a way," Paul said, "to fund our strategic infrastructure investments at a pace that will bring them into useful service without impacting our ability to perform needed stockpile work, such as weapons engineering, stockpile surveillance and support, maintenance, dismantlement, production support, and especially stockpile life extension programs."

Paul discussed infrastructure challenges related to aging facilities, space management, and the effect of external events on Sandia's infrastructure planning. He also called for more flexibility in infrastructure funding options: "As a multiprogram laboratory, Sandia has many investment issues looming on the horizon, and as we become a more programmatically diversified lab, we will need to explore how new sponsors can assume some ownership for investments required to support emerging programs. Initiatives to increase flexibility for financing investments with multiple funding sources and types of funding would help us more quickly address the infrastructure issue."

Paul concluded by asserting that "NNSA's Facilities and Infrastructure Revitalization Initiative can perform a very important service to the Defense Programs mission if it succeeds in restoring balance in addressing infrastructure needs across the complex. We face several challenges and issues related to infrastructure and infrastructure investment planning, but chief among them is the lack of continuity and predictability in investment planning at the line-item level. NNSA's infrastructure investments must be prudently managed to provide a balanced program supporting the needs of all the sectors of the Defense Programs complex." — *Bill Murphy*

NNSA chief unveils organizational structure



NNSA ORGANIZATIONAL CHANGES — In a talk in connection with the first anniversary of the National Nuclear Security Administration, Gen. John Gordon announced March 14 that the agency will create two new Associate Administrators to realign and separate programmatic and operational functions. The new Associate Administrator for Management and Administration will be responsible for budget, finance, procurement, information, and people; the Associate Administrator for Facilities and Operations will be responsible for stewardship of NNSA facilities. Gordon also issued an organizational chart (see above). His talk was videolinked to Sandia and other NNSA offices and facilities around the country. In an accompanying statement, Gordon said the planned

changes will improve performance of the core mission to strengthen national security and reduce the global threat from weapons of mass destruction through applications of science and technology. "At the one-year mark, we can be proud of the progress we have made," Gordon said. "We have been very deliberative in establishing NNSA. The time has come to step out boldly." NNSA celebrated its one-year anniversary March 1, and has undertaken a sizeable set of operating and restructuring tasks mandated by Congress. The statement also noted that NNSA has revamped its Web site to showcase NNSA people and programs through interconnecting links to its labs and plants. NNSA's home page on the Web is at <http://www.nnsa.doe.gov>.

Introducing students to the world of careers



SCHOOL TO WORLD — Twenty-seven hundred students and adults from 90 schools throughout New Mexico came to the School to World event Saturday, March 17, at the Albuquerque Convention Center to hear first-hand about career opportunities. Sandia partners with business, education, and government to provide the largest career event in the state of New Mexico. More than 400 volunteers, 65 from Sandia, shared their career experiences with students and talked about the importance of school subjects and work skills for future life in the working world. The event is organized by Sandia's Corporate Outreach Dept. 12650. Here, Sandia graphic artist Alice Baltz (9213) shows students how she uses computer technology in her work. (Photo by Bill Doty)

Mileposts

California photos by Lynda Hadley
New Mexico photos by Iris Aboytes



Gerald Hochrein
35 15413



Robert Reese
35 9126



David Huskisson
30 2552



Meg Luther
30 02



John Cerutti
25 7842



Craig Furry
25 2663



Andy Jones
25 15417



Conrad Lucero
25 2955



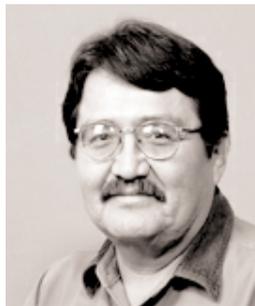
Thomas Lutz
25 6428



Susie Maldonado
25 9800



Gerald Miller
25 2565



Wilfred Mitchell
25 7854



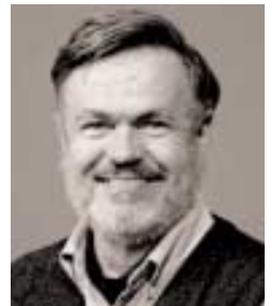
Gilbert Muniz
25 7854



Stephen Sanderson
25 5851



Edward Thalhammer
25 6522



Clifford Wagner
25 2523



Gary Webb
25 5713



Kyle White
25 2348



Victor Yarberry
25 1737



Bruce Bainbridge
20 9117



Richard Chapman
20 6524



Karen Lee Krafcik
20 8729



Jerry Letz
20 7840



Dennis Martin
20 1751



Dwight Newell
20 7140



Michael Quinlan
20 7860



Clinton Shirley
20 2103



Mark Smith
20 1833



Michael Widmer
20 10511



Theodore Wrobel
20 15345



Jeffrey Everts
15 1734



Tan Chang Hu
15 9336



John Hunter
15 1114



James Hutchins
15 9515



Gary Laughlin
15 2564



Shannon Letourneau
15 10263



Ronald Pate
15 15333



Ronald Renzi
15 8120



Geneva Sachs
15 10255



Eric Schindwolf
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Sandia Classified Ads Sandia Classified Ads Sandia Classified Ads Sandia Classified

MISCELLANEOUS

AMERICAN HAVILAND, Gloria pattern, 8-or 16-place setting, plus serving pieces. Eckart, 299-3888.

WOODWORKING MACHINE, multi-purpose, ShopSmith Mark V, jointer, videos, & many extras, great condition, \$800 OBO. Bernard, 281-4462.

CORNER CURIO CABINET, pecan wood, inside light, adjustable glass shelves, solid bottom doors, great condition, \$350. Essenmacher, 865-9640.

TV, CONSOLE, 25-in., great picture, great furniture, \$50. Miller, 821-5935.

FIREPLACE SET, antique brass glass doors & utensil set, w/stand, log holder, \$25. Garrison, 292-8973.

YORK DOUBLE CASSETTE, AM/FM/CD, w/2 19-in. speakers, \$35; antique walnut dining table, claw feet, 37"W x 59"L, \$150. Zamora, 294-3737.

BEDROOM SET, by Thomasville, king-size frame, nighttables, dresser, w/double mirrors, chest, Italian-style, \$1,100 OBO. Wagner, 823-9323.

VACUUM CLEANER, '99 Kirby Micron Magic, hepa filtration, \$535. Luther, 294-2863.

PIANO, Yamaha upright model U1, ebony finish, 3 yrs. old, \$7,200. Scharrer, 856-0960.

CEILING FAN, Hunter Douglas, brass, w/light/dimmer kit, reversible blades, 1.5 yrs. new, complete, excellent condition, cost \$140+, asking \$50. Buteau, 856-7705.

MOVING SALE, Mar. 31, couch-bed, coffee table, bunk beds, toys, & clothing. Cordova, 836-5563.

TWO "F" STYLE MANDOLINS, by Doce, a retired Martin guitar maker, good fret action, good sound quality. \$225 & \$375. Newman, 266-6928.

PC MOTHERBOARD, w/AMD K6-2, 192MB RAM, velocity 4400 video, & creative sound card, \$200. Benecke, 286-2154.

HEALTH RIDER exercise machine, 2 different settings, like new, cost \$500, asking \$150 OBO. Herrick, 831-1220.

FUTON, full-size, wood, great for kids room, \$60. Mares, 844-3454.

BIKE, Huffy, girl's 20-in., 2 yrs. old, excellent condition, \$30. Meeks, 828-9825.

AFRICAN CONGO GRAY, loved family pet, very personable, looking for good home. Coy, 836-4446.

SOFA, loveseat, coffee table, & two end tables in great shape, everything \$300. Linkletter, 352-7330.

LEOPARD-SPOTTED CAT, sweet & affectionate, light gray, w/dark gray spots, neutered, front paws declawed, 1-1/2 yrs. old, w/box, cat tree, cat carrier, cat toys, etc., pictures on dropzone in "kwhite" folder. White, 884-0413.

WETSUIT, woman's Mares Varadero, 3mm, front zipper, size 14/XXL, color black/gray, used only once, asking \$100. Lojek, 898-2979.

ANTIQUE SINGER SEWING MACHINE, '20s, \$150; Craftsman 10-in. electric chain saw, \$25; electric hedge trimmer, \$15. Hartwig, 797-8406.

TROYBUILT ROTOTILLER, 8-hp, new Tecumseh engine & tires, recent tune-up, wrap-around bumper guard, adjustable handlebars, 4-spdl., \$1,599 OBO. Lewis, 298-1296.

FOUR GOODYEAR TIRES, Wrangler, RTS P265 75R16, 6-ply, approximately 35K miles, \$25/tire. Bird, 561-0106, pager.

SOFA SLEEPER, queen, innerspring, excellent condition, \$400; end table, oak, hexagonal, 2-dr., \$25. Benson, 299-3315.

PIANO, Yamaha "YDP-101S" digital, full 88-keys, upright cabinet, programmable, foot pedals, synthesizer, MIDI, perfect, \$800 OBO. Goodson, 286-1267.

SEARS DRILL PRESS, new, \$150; new bench grinder, \$25; baby chair, \$15; child's wagon, \$10; bike, \$10. Axness, 332-9769.

DALLAS COWBOY SEASON SEAT OPTION, until 2008, Section 6, Row 16, \$4,500 OBO. Vieth, 453-8778.

AMD K6-2 500MHZ COMPUTER: removable 20GB HD, 56K modem, CDRW-drive, dual floppies, 17-in. monitor, \$600 OBO. Burstein, 899-8971.

REFRIGERATOR, 18 cu. ft., Kenmore, 8 yrs. old, \$200; car seat, 30+ lbs., \$15; andirons, \$10; queen-size bedspread, SW colors, \$20. McKenna, 298-2467.

BLACK LAB CROSS PUPPIES, will be ready April 15, males & females available, great breed for kids. Page, 832-5576.

LIGHT BAR & BRUSH GUARD, for Ford Ranger, lights & mounting equipment included, \$100. Freymiller, 271-0342.

TWO RIVERDANCE TICKETS, April 15 matinee, Orchestra, Row H, \$100. Pucket, 298-6067.

SW AIRLINES ROUNDTRIP TICKET, expires 8/23/01, good anywhere SW flies, \$290 cash only. Lujan, 822-0205.

THERMAL POOL COVER, w/take up reel, 15.5'W x 45'L, \$100 OBO; mountain bike, boy's 24-in., Diamondback, solid tires, used, but serviceable, \$25; girl's 26-in., 10-spdl. bike, pink/gray, very good condition, \$25. Layne, 857-0989.

RADIAL ARM SAW, Craftsman, 10-in., 2-hp, mint condition (used only on a few small projects), cast-iron arm, includes original manual, dado blade & guard, hold-downs, drill chuck adapter. Owyong, 797-4137.

STATIONARY BIKE, Pro-Form 760, triple action electromagnetic, w/monitors, new, used only for knee therapy, \$150. Pitts, 293-5481.

BICYCLE TRAILER, '91 Burley Lite, non-folding, w/stroller wheel & handle, always kept in shelter. McNamara, 256-7118.

SECTIONAL SOFA, 8-piece, 3 corners, 4 straights, 1 ottoman, cinnamon colored, Monsanto fabric, \$400. Greer, 281-4688.

POWER WHEELCHAIR, Fortress, transportable, w/charger, raised toilet seat, portable toilet seat, w/support arms, \$1,100 OBO. Flack, 864-6145, leave message.

ALUMINUM MINI BLINDS, almond, window size 70" x 43" (2), & 47" x 59", \$15 each; drop-type fertilizer spreader, \$10. Nicolaysen, 275-9657.

AIRLINE TICKETS, anywhere Southwest flies, expiring 8/01, 11/01 & 1/02, \$310. Tapia, 280-8888.

TWO RIVERDANCE TICKETS, Popejoy, Sat. April 14, 2 p.m., \$54.50 each. Cooper, 281-0950.

ENTERTAINMENT CENTER, very nice, solid oak, fits up to 25-in. TV, excellent condition. Romero, 858-0072.

BABY MONITOR, \$20; VCR, Sears, \$50; Kitchenaid portable dishwasher, 4 colored panels can be installed, \$130. Smith, 299-7151.

REFRIGERATOR, GE, 20 yrs. old, \$45; Trek bike, 24-in., 27-spdl., \$90. Smith, 891-2098.

MINIATURE SCHNAUZER, AKC-registered, male, silver, 5 months, house-trained, all shots, approximately 15 lbs. full-grown, accessories included, \$350 OBO. Chavez, 271-5121.

CAR SEAT, Fisher Price, \$20; chest freezer, 10.3 cu. ft., \$95; Sears 10-in. table saw, \$150. Williams, 344-9276.

YOUTH BEDROOM SET, 4-piece, \$80. Davis, 294-4614.

OLYMPIC WEIGHTS, bench, bar, etc., \$200; Craftsman radial arm, w/stand, \$250; table saw, w/stand, \$250; several Indian sculptures, Hall, 298-9254.

MATCHING SOFA, LOVESEAT & CHAIR, \$400; coffee table, \$50; lift recliner, \$250; all excellent condition. Slack, 299-2314.

PIANO, Baldwin spinet, excellent condition, \$700. Ezell, 821-1768.

CALLAWAY BIG BERTHA DRIVER, 10 degree, stiff shaft, excellent condition, \$75; Callaway 7-wood, Great Big Bertha (titanium), stiff shaft. Petersen, 275-7467.

SOUTHWEST AIRLINES VOUCHER, expires 5/18/01, \$250, or trade for ticket expiring after 6/2/01. Shollenberger, 237-2677.

LAWN MOWER, excellent condition, Briggs & Stratton engine, self propelled, 21-in. cut, well cared for & very dependable, \$65 OBO. Ritchey, 299-7082.

ELECTRONIC ORGAN, Lowrey Mardi Gras, \$1,100; electric adjustable twin bed, \$500. Gilmer, 299-2533.

RIVERDANCE TICKETS, \$52 each, 2 great seats, Saturday, 4/14/01, 2 p.m. Lambert, 899-2060, after 6 p.m.

SOUTHWESTERN SOFA, \$150. Harris, 821-3001.

SCROLLSAW, Delta, 16-in., variable speed, \$90. Crow, 821-0956.

MATTRESS SET, oak queen headboard & footboard, dresser, mirror & nightstand \$1,000 OBO; 2-piece teak entertainment center, \$200; wicker chairs, \$10 each. Kettleborough, 293-4503.

TRUNDLE BED, brass frame w/2 mattresses, excellent condition, \$150. Hoyal, 823-1421.

TENT, large #3 room & dining canopy, \$100; 4 Goodyear tires, 225/75/16, used 2 mos., \$45 each; mower, heavy-duty, 5-hp w/bag, \$160; Health Rider exerciser, \$30; typewriter (WP features), used once, \$50; Nichols, 323-2493.

SCHWINN AIRDYNE EXERCYCLE, like new, barely used, \$350. Lee, 299-2349.

ALUMINUM EXTENSION LADDER, 40-ft., \$275. Shelmidine, 281-8413.

COMPANION CRYPT, at Sunset Gardens, \$5,500 OBO. Wheeler, 821-0049.

How to submit classified ads

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

- E-MAIL: Sandy Smallwood (sksmall@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 News, and then on the very top of Lab News homepage "Submit a Classified Ad." If you have questions, call Sandy at 284-3704. 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.

TRANSPORTATION

'77 FORD F100 PICKUP, manual transmission, good running condition, needs smog equipment, \$950 OBO. Bernard, 281-4462.

'89 DODGE RAMCHARGER LE 150, 318 V8, AT, 4WD, 97K miles, loaded, \$4,695. Klafke, 292-5349.

'97 VOYAGER, 3.3V6, all power, remote keyless, 4 captain's seats, hitch, excellent condition, \$10,500 OBO. Carroll, 292-5436.

'94 HONDA CIVIC DX, 4-dr., AC, PS, FWD, gray, 58K miles, clean, \$7,200 OBO. Boyle, 452-3617.

'99 DODGE DURANGO, 4WD, V8, options, 23K miles, warranty, dark green, \$21,500 OBO. Tilton, day 841-7254, evening 856-1467.

'87 CHEVY SUBURBAN, heavy-duty towing package, 3/4-ton, 454 engine, rear AC, \$3,900. Drayer, 294-8733.

'82 FORD F-150 PICKUP, long bed, 35K on new engine, many perf. mods., nice wheels, \$2,500. Halle, 831-4682.

'96 FORD BRONCO XL, manual, 302 V8, 4WD, AC, tow package, 60K miles, \$13,500. Vigil, 898-0509.

'67 MUSTANG 289, extensively restored interior/exterior mechanically, tires, \$7,500 OBO. Wahlberg, 873-2340, ask for John.

'99 JEEP WRANGLER SPORT, 6-cyl., 40K miles, hard/soft tops, AC, loaded, excellent condition, \$18,250 OBO. Barton, 286-3821.

'92 PONTIAC SUNBIRD, 97K miles, AC/heater, AM/FM, runs great, good student car, \$2,000. Williamson, 332-7399.

'95 FORD RANGER P/U, AM/FM/tape, excellent condition, 4-cyl., 63K miles, Truckmate, bedliner, AC, 5-spdl., \$5,440. Roseth, 856-6964.

'96 DODGE NEON, 4-dr., manual transmission, AC, cruise, good condition, tinted windows, AM/FM/cassette, \$4,500 OBO. Vigil, 293-5623.

'89 ISUZU PICKUP SLB, excellent condition, chrome row bar & grill, \$2,300 firm. Flores, 271-0004, after 4 p.m.

'90 GMC 1500 SLE, extended cab, excellent condition, 350, 4-spdl., AT, 163K miles, original owner, \$5,300. Holle, 281-7460.

'90 BUICK CENTURY, 4-dr., 6-cyl., AT, AC, power doors/windows, 105K miles, \$1,800. Fromm-Lewis, 332-1280.

'91 VOLKSWAGEN VANAGON GL, AT, AC, new tires, 97K miles, excellent condition, original owner. \$7,000 negotiable. Sorensen, 294-1625.

'62 MERCEDES UNIMOG, low miles, great condition, unsurpassed off-road military vehicle, all systems, fully functional, \$8,400. Johnson, 831-5679.

'99 MAZDA MIATA, bids through 04/01/01, right to refuse bids, sold as is. SLFCU 237-7386, 7354, or 7384.

'00 HONDA CIVIC LX, 4-dr., 5-spdl., silver, 13K miles, tinted, mats, sunscreen, 37 mpg, excellent, \$13,750. Van Den Avyle, 898-6474.

'92 GM GEO TRACKER, excellent condition, 77K miles, great fun car. Parrish, 299-2043.

'99 GMC YUKON SLT, 4WD, 4-dr., excellent condition, 25K miles, one owner, always garaged, leather interior, too many extras to list, must sell, \$3,000 below book. Cummings, 884-3602.

'93 SUBARU LOYALE, 4-cyl., AT, AC, power, 92K miles, good condition, blue book \$4,900, asking only \$2,500 OBO. Sharma, 298-2881.

'95 CHEVROLET TAHOE LT, 4x4, leather, CD, all power, runs great & looks great, \$15,500. Sanchez, 866-4225.

'95 HONDA CIVIC LX, 92K miles, CD, PS, PW, PL, AT, new brakes, excellent condition, \$6,300. Thacker, 867-2427.

'98 CHEVY 4X4, original owner, 1/2-ton, extended cab, 5.7-liter, AT, every option except leather, white/pewter, matching white camper shell, 17,400 miles, always garaged, all highway miles, looks like new, \$22,000. Dwyer, 271-1328.

'91 GMC 4X4, 60K miles, new tires, 3/4-ton, extended cab, 4-spdl., \$9,300 OBO. Sullivan, 298-4880.

'97 MUSTANG GT CONVERTIBLE, 31.3K miles, all options, new tires & top, fun car, below book, \$15,900. Rarrick, 792-5181.

RECREATIONAL

'99 YAMAHA XVS650 V-STAR CLASSIC, black, w/red pinstripes, leather saddlebags, 36-in. windshield, 5,902 miles, \$5,000. Wallner, 836-5752.

'92 MOUNTAIN BIKE, Specialized S-Works, 19-in., chromemoly hardtail, Manitou Pro fork, 21-spdl., older decent components, killer deal at \$300. Kovacic, 256-9867.

MOUNTAIN BIKE, woman's, includes helmet & chain, make offer. Taylor, 822-9819.

'99 GO-KART, 2-person, 5-hp motor, roll bar, seatbelts, adjustable seat, excellent condition, paid \$900+ new, asking \$500. Buteau, 856-7705.

'73 GLASSMASTER, split windshield, 14-ft., 70-hp motor, trailer, trolling motor, \$900 OBO. Estes, 856-1893.

'91 ROAD BIKE, Cannondale, 58cm, Ultegra components, \$300 OBO. Bradley, 281-7086.

COACHMAN CAMPER VAN, 17-ft., self-contained, new transmission, tires, great shape, motivated to sell, \$5,700 OBO. Sleeter, 299-3347.

'99 BAYLINER CAPRICE BOAT, 25-ft., 32 hrs., many improvements over new, now in Albuquerque, will be in slip at Elephant Butte this summer, \$21,900. Krein, 899-8312.

'95 ALJO TRAILER, 27-ft., w/hitch, 2 axles, self-contained, slide out, sleeps 6, mint condition, \$9,300. Bonsack, 898-6528.

'95 JET BOAT, Sugarsand SS, 15-ft., seats 5, 45 mph skying or fishing, excellent condition, cover, \$6,500. Davis, 292-0503.

'73 SPORTSTER, 1100 cc, custom, new battery, SS carb., reinforced frame, \$3,500. Valencia, 298-9254.

REAL ESTATE

2-BDR. TOWNHOUSE, 2-1/2 baths, approximately 1,400 sq. ft., brick floors, wood beam ceiling, kiva fireplace, garage, SW adobe style, North Valley secluded community, w/security gate, FSBO, \$128,000 OBO. Evans, 897-4782.

'97 4-BDR. MOBILE HOME, Skyline Cutlass, 16' x 80', 2 baths, 15' x 10' redwood deck, take over payments. Barraza, 856-9873 or 771-1217.

2-BDR. DUPLEX, 1 bath, carport, fenced yard, washer/dryer hook-ups, Texas SE, \$60,000. Barbera, 275-2562 or 530-0343.

3-BDR. MOSSMAN HOME, 1-3/4 baths, fireplace, large utility room, hardwood floors, circular driveway, near Candelaria & San Pedro, \$105,900. Duran, 881-6713.

3-BDR. HOME, 2 baths, 1,871 sq. ft., east of Tramway/Lomas, Sandia Hills, frame stucco, tile roof, 1192 Narcisco NE. Keeling, 275-8191.

3-BDR. HOME, 2,100 sq. ft., NE heights, newly remodeled kitchen & den, large corner lot. Dytzel, 296-1900.

4-BDR. HOME, 3-1/2 baths, 2-car garage, 1/3-acre lot, full basement, remodeled, new carpet, Ridgecrest area. Davis, 881-1899.

3-BDR. DOUBLEWIDE MOBILE HOME, 2 baths, Four Hills Mobile Home Park, excellent condition, appliances included, great yard, view at mhpurchaser.com, \$18,500. Romero, 275-1737.

2-BDR. MOBILE HOME, 14' x 70', 2 baths, carport, porch, w/10' x 12' storage shed, well maintained, Four Hills, 5 minutes from Sandia, \$16,000. Jenkins, 299-7368.

CUSTOM 4-BDR. HOME, 2 baths, 3.3 acres, 2,000 sq. ft., 2-story, 3-car garage, boathouse, barns, corrals, Tome area, \$247,500. Schaub, 865-8807.

WANTED

MOTHER/SON DIRT BIKES, & gear, 250 cc or less, prefer '97 or newer. Field, 332-0996.

"CASHFLOW 101" GAME, used, will purchase at reasonable price. Dubes, 550-5827.

AMATEUR JAZZ MUSICIANS (especially rhythm section), for fun, informal jams on standards, w/intermediate-level saxophonist. Davis, 296-4879.

BLYTHE DOLL, from early '70s ('72?), has eyes that change color, will purchase. Langwell, 293-2728.

HOUSEMATE, for apartment in private home, nice residential area, private entrance, convenient to Sandia, \$350/mo. Smith, 298-7365 or 292-1976.

CAR DOLLY, reasonable condition, reasonable price. Dickenman, 994-3451.

BASS GUITAR, good condition, at reasonable price. Aguilar, 873-1261.

HOUSEMATE, huge bedroom, w/bath, fully furnished, near Montgomery/Tramway, non-smokers only. Trinkle, 237-1051 or fosbury_flop@yahoo.com.

WASHER & DRYER, in good or new condition. Salas, 823-2679.

SAFE DEPOSIT BOX, have 3" x 10" safe deposit box at SLFCU Kirtland Branch, would like to trade for one at Juan Tabo site. Reuter, 884-8347.

DRAFTING/DRAWING TABLE, used for student. Jennings, 268-8789.

DRILL PRESS, used, but functional, prefer bench instead of floor model & well-known manufacturer. Lagasse, 298-0977.

SW AIRLINES RAPID REWARDS TICKET, will trade \$250 American Airlines voucher. Owens, 839-4286.

ATX CASE for computer. Sarkis, 266-2790.

USED TATTING BOOKS. Lauben, 299-4086.

SOUTHWEST AIRLINES ONE-WAY TICKET (coupon), good through May. Bundy, 821-1846.

RESPONSIBLE ROOMMATE to share large 3-bdr. house in NE Heights w/young adults, \$300/mo. + utilities & \$150 DD. Whittet, 281-2216.

LOST & FOUND

LOST, earring, screw back, silver design, w/three dangling chains. Everett, 268-7818.

LOST, seashell necklace. Armijo, 284-4198 or 552-9762.

Trinity Site tour April 7

Visit the Trinity Site with the National Atomic Museum's Scientific Tour Series on April 7. The bus leaves the museum for White Sands Missile Range at 6 a.m. \$45 pays for transportation and a guided tour that includes stops at Ground Zero, "Jumbo" and the historic McDonald Ranch House. The trip also makes a stop at New Mexico Tech for lunch and an explosives demonstration or a visit to the acclaimed Gem and Mineral Museum. Call the museum store at 284-3242 for tickets and more information.



NATIONAL
ATOMIC
MUSEUM
Albuquerque, NM

TVC's equity capital symposium to feature five Sandia-based start-ups

Technology Ventures Corporation's Equity Capital Symposium, the state's premier showcase for high-tech business startups, is gearing up for its eighth annual session May 9-10 at Albuquerque's Hyatt Regency Hotel. With 17 presenting companies, including five based on Sandia-developed technologies, this year's symposium is the largest ever, says Randy Wilson, TVC's Director of Business Operations.

Every year since 1994, TVC has offered investors from New Mexico and around the country the opportunity to hear, first-hand, about investment opportunities in some of the area's most promising technology-based companies.

The start-ups will give presentations with the goal of gaining funding for their ventures. Selected by TVC in a competitive process, the companies have been coached by TVC professionals on how to make the most effective sales pitch to busy investors, many of whom spend most of the working days of the year hearing similar presentations.

The 17 companies represent, in TVC's view, the new technology start-ups (and expansions) with the best chance of capturing investors' interest, Wilson says. They were chosen from among more than three dozen business plans submitted to TVC for consideration. Beginning in January, advisory teams were set up for each presenter. The teams are helping each company refine its business case, finish its business plan, package its funding proposal, and learn the language that turns investors on — all aimed at getting presenters ready for the big show at the Hyatt in May.

The start-up companies at this year's

symposium represent a variety of technologies, ranging from wireless telecommunications to microelectronics manufacturing systems, from robotic applications to multispectral and polarization imaging systems.

Here are brief summaries of ventures with connections to Sandians and/or Sandia technologies:

- **SenSolve, Inc.** develops and markets proprietary sensors that increase the productivity of automated manufacturing equipment while eliminating expensive scrap. SenSolve seeks investment capital to expand sales and marketing activities and distribution channels via alliances with robot manufacturers.

- **SilverWeb Production Technologies** produces enterprise-level software for the intelligent assessment of product data in manufacturing. The software allows a manufacturer to identify key drivers of end-product performance. SilverWeb seeks investment capital for software commercialization and entry into the \$1.5 billion semiconductor manufacturing software market.

- **VisWave** produces database visualization solutions that enable researchers, analysts, and decision-makers to accelerate their understanding of large databases. VisWave's patented software, based on work done at Sandia, automatically collects related data and transforms it into an intuitive visual format. VisWave seeks \$3 million in capital to complete final software development.

- **Engineered Collectives Corp.** aims to develop and sell intelligent, programmable toy robots that can communicate and act in concert with one another. The technology is a form of col-

lective intelligence that enables toy robots to act and think together. The technology, sold first as a toy, can also be readily applied to a wide variety of industrial applications such as security and environmental restoration. ECC seeks a partner with toy industry experience and \$5 million in equity.

- **MicroChemLab Technologies** develops highly distributed chip-based chemical microsystems that will enable revolutionary advances in point-of-care diagnostics and early disease detection through rapid, sensitive, low-cost, portable, and reliable chemical analysis. The company seeks first-round funding to capture market share in a \$4 billion market.

The annual symposium is an important part of TVC's efforts to advance economic development within New Mexico's technology sector. A nonprofit organization established in 1993 by Lockheed Martin, TVC serves as a bridge between the public and private sectors for commercializing technologies developed at the national laboratories, regional research universities, and defense-dependent businesses. TVC identifies technologies with commercial potential, coordinates the development of business capabilities, and seeks sources of risk capital. In the seven years since its inception, TVC has helped form 40 new businesses, secure more than \$295 million in funding commitments to its client companies, create more than 3,125 jobs, and bring nine venture capital firms to New Mexico.

To learn more about the symposium, call TVC at 505-246-2882 or check out the symposium Web site at <http://www.techventures.org/symposium.html>. — Bill Murphy

Recent Patents

Douglas Bickel, William Hensley (both 2344), and David Yocky (5912): Process for Combining Multiple Passes of Interferometric SAR.

Scott Habermehl (1746) and Jeffrey Sniegowski (1749): Use of Silicon Oxynitride as a Sacrificial Material for Microelectromechanical Devices.

Kurt Wessendorf (1732): Active-Bridge Oscillator.

James Hickerson, Jr. (15414), Frank Zanner, Michael Baldwin (1846), and Michael Maguire: Monolithic Balasted Penetrator.

Paul Gourley (1140): Method for Determining

Properties of Red Blood Cells.

Daniel Segalman and James Redmond (both 9124): Method and Apparatus for Suppressing Regenerative Instability and Related Chatter in Machine Tools.

Robert A. Anderson (1846), Robert Hughes (1744), and James Martin (1122): Sensor Devices Based on Field-Structured Composites.

John Torczynski (9113): Module Bay with Directed Flow.

Ernest Garcia (2614): Micromechanisms with Floating Pivot.

Coronado Club

March 22, 29 — Bingo, buffet, and Lounge Hockey Night — watch hockey on the big-screen TV in the lounge area.

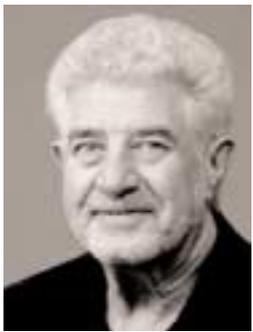
March 23 — Kids bingo. Food line, 5 p.m.; bingo, 6 p.m.

March 31 — Last day to purchase discounted pool passes for the 2001 summer season.

April 6 — Country-Western night featuring a western buffet. Dining, 6-9 p.m.; dancing 6:30-10:30 p.m.

Coming in April — Annual kids' Easter Egg hunt; Easter Sunday brunch.

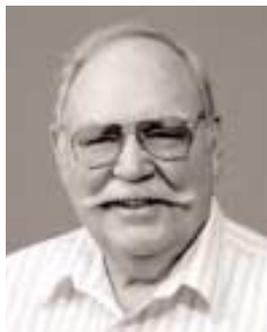
Recent Retirees



Larry Wilhelm
43 9325



Robert Fisher
36 1800



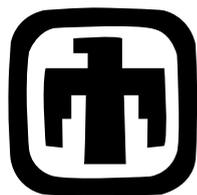
Earl Rush
34 6215



William McCulloch
33 12301



Marjorie Hedges
10 9103



Hey Kids! You're Invited to ZOOMzone at the National Atomic Museum. Grand Opening!

Saturday, March 24
from 11 am to 4 pm

Get ready to unscramble the puzzle and tease your brain. KNME-TV and the National Atomic Museum are bringing you the ZOOMzone. Recreating the look and feel of the hit PBS show ZOOM, the ZOOMzone will let you test your ideas and share your scientific knowledge.

