

Sandia, UNM researchers mimic photosynthetic proteins to manipulate platinum at the nanoscale

Method has potential of changing the metal's properties; many new applications possible



NANOSCALE PLATINUM — Sandia researcher John Shelnutt and University of New Mexico PhD student Yujiang Song look at platinum at the nanoscale on a new scanning electron microscope at UNM's Center for Micro Engineered Materials. (Photo by Randy Montoya)

By Chris Burroughs

Sandia and University of New Mexico researchers have developed a new way of mimicking photosynthetic proteins to manipulate platinum at the nanoscale. The method has the potential of changing the metal's properties and benefiting emerging technologies.

"While we are in the early stages of research, we see the possibility of manipulating the nanoscale structure of platinum so that we can have control over the size, porosity, composition, surface species, solubility, stability, and other functional properties of these metal nanostructures," says John Shelnutt (1141), the Sandia scientist leading the research effort. "Such control means that the redesigned platinum could be used in many new applications, including catalysis, sensors, and optoelectronic and magnetic devices."

He adds that while research groups have reported a few platinum nanostructures — including nanoparticles, nanowires, nanosheets, and others — the addition of new types of nanostructures is "highly desirable and potentially technologically important."

Working with John in the research are Frank van Swol (1834), UNM graduate student Yujiang Song, and Eulalia Pereira from the University of

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Sandia addressing possible leveling off of revenue, rising medical costs, pension fund issues

Contingency planning to minimize change in day-to-day operations

By Michael Padilla

Sandia management is looking at various options in planning for three trends that will eventually have an impact on Sandia's revenues and costs. The trends include slowing federal revenue growth, increasing health care costs, and decline in pension fund values.

The medical and pension issue are national trends while revenue is specific to federally funded programs such as Sandia's business, says Frank Figueroa, VP of Business Management and CFO.

Sandia's management is studying approaches to address these issues, and to ensure minimal change in day-to-day operation of the Labs and acknowledging the value of all employees, he says.

"It is important for us to think and plan ahead so we can position Sandia to meet our national security obligations in the future," Frank says. "We must look at numerous scenarios, consider all possible mitigation options, and make timely decisions on our courses of action."

Frank says he is comfortable that Sandia is far enough ahead in the analyses and consideration of these issues that the Labs will be able to develop appropriate mitigation options.

Revenue

The first issue is a projected leveling off of the Laboratories' revenue for the outyears, starting in FY05. This is primarily due to the expected reduction in the growth of the NNSA budget, as stated publicly by Tom Hunter, Senior VP, Defense Programs, in his recently conducted Nuclear Weapons SMU All-Hands meetings.

"While we do not expect a precipitous decline, and while our Nuclear Weapons (NW) budget will in all likelihood remain reasonably stable, the NNSA budget will decline in real, constant-dollar terms," Frank says. It is important to note, he says, that there are some growth opportunities in Sandia's other business areas, predominantly in the Non-Proliferation and Assessments, Military Technologies and Applications, and Homeland Security Strategic Management Units (SMUs).

"It is our intent to grow sufficient revenue in these latter SMUs to maintain stable funding for the Laboratories," Frank says. "We are working hard to be fiscally prudent by carefully evaluating our business projections and ensuring our staffing is commensurate with those projections. We do not want any large perturbations in our employee base."

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Sandia helps JPL bring Mars rover Spirit to safe landing



A PORTION of the first color image captured by the panoramic camera on the rover Spirit. (NASA/JPL/Cornell)

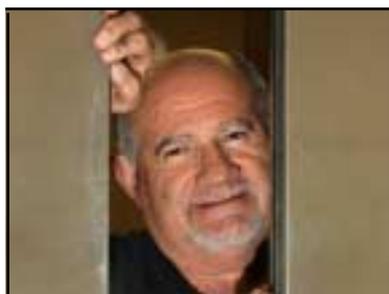
Sandian Carl Peterson (9100) lent his expertise in parachute design to NASA's Jet Propulsion Laboratory to help ensure the successful landing of the Mars Exploration Rover Spirit Jan. 3 on Mars.

Carl, who also participated on the Sandia team that helped conceive and design the airbags that brought the Mars Pathfinder to a safe landing in 1997, was asked by JPL about 2-1/2 years ago to consult on the current mission. He helped to review the work of JPL's Entry, Descent, and Landing Team, which was responsible for the design and development of the parachutes and airbags used on Spirit and its twin, Opportunity, scheduled to land on Mars Jan. 24.

Both spacecraft enter the Martian atmosphere at 12,000 mph and have only 6 minutes to slow down before landing. During that time, a series of events including firing retrorockets and deploying parachute and airbags must perform exactly as planned.

Carl worked with the JPL parachute development team on wind-tunnel experiments at NASA Langley and Ames to better understand the aerodynamics of the parachute. Last September, JPL asked Carl to be part of a 12-person "Red Team" to help review and analyze data from the landing sequence of the Spirit rover to determine if any changes were required for the safe landing of the second craft carrying the Opportunity rover.

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3 Sandia/California team develops ultraviolet fiber-based laser

5 Labs' elevator inspector Luis Apodaca cautious with job's ups and downs

What's what

Being a nonrunner, I do not hang around where people are running or talking about running. My occasional trips to stores that sell rubberoid-sole, cloth-upper shoes are defensive measures to counter the increasingly annoying effects of age and gravity, and always leave me agog at the variety on the shelves. In short, I don't understand the nuances of running shoes versus walking shoes versus running/walking shoes, and certainly don't know anything about running. Until I worked a couple of years in the Boston bureau of the Associated Press years ago, I thought marathons were something a few people ran in every four years at the Olympics.

Well, three decades on and getting out a little more these days, I'm aware that a lot of people run, and that there are more marathons than you can chuck a water bottle at. I even know a few people who actually enjoy running in them, a couple of whom added to my meager file of marathon information recently. I wandered up as they were chatting away about running and listened with mostly detachment until I heard the phrase "rock and roll marathon."

I asked what a "rock and roll marathon" is, and was informed that it's a marathon with rock and roll bands at stages along the route playing up-tempo music to rev up the runners as they go by. Yeah, they're great, the other runner said. They went on to describe other marathon amenities like beer breaks, people who spray runners with Ben-Gay, vats of Vasoline to plunge your hands into (I didn't understand that one), and even a Beverly Hills marathon with champagne breaks.

Even with woefully little understanding of runners and marathons, I visualized people spraying your sore muscles with Ben-Gay, handing you shooters of beer and champagne as you trot by, vats of Vasoline (I'm still puzzled - intrigued, but still puzzled - about that) and I could come up with only one thought: Who'd want to finish?

* * *

In case you didn't notice one of the recent "found" blurbs in the *Sandia Daily News*, Judy Loving (1997) found and wanted to locate the owner of what she could describe only as "a frog-like thing with a loop."

Well, the SDN editor e-mailed back, it might need a little more description: Is it maybe a key fob, or an earring, or a lapel pin? No idea, she answered, but it appears to be made of silver, if that helps.

Okey dokey, SDN responded, a silver frog-like thing with a loop it is.

"And it might be a woman's silver frog-like thing with a loop," she e-mailed.

* * *

One final visitation of the quest for the true meaning of y'all with three pretty cute tongue-in-cheek (I think) offerings.

- Sarah Rich (1763), who was "born and raised in Louisiana," wrote: "When you use 'y'all' to address one person, what you mean is, 'You and your fleas.'"

- David Peters (1743) chimed in with: "I hate to agree with the Texan on this (in Alabama Texas is Texas, not part of the South), but she was the only one to correctly identify 'y'all' as solely plural."

- And from retired director Paul Merillat: "The mizzenmast is aft of the steering station on a yawl."

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

Rajen Chanchani elected IEEE Fellow

Rajen Chanchani of BEOL Advanced Packaging Dept. 1745 has been elected a Fellow of the Institute of Electrical and Electronics Engineers (IEEE). The honor recognizes his contributions to advanced packaging technologies for high-density interconnections, chip-scale packages, micro-system integration, and multichip modules and substrates.

Each year, following a rigorous evaluation procedure, the IEEE Fellow Committee recommends a select group of recipients for one of the Institute's most prestigious honors.

Rajen, whose PhD and MS are in material science and engineering from the University of Florida, has been at Sandia since 1990. Before that he worked for five years at AT&T Bell Labs.



RAJEN CHANCHANI

He has developed several new concepts in advanced micro-system packaging for use in national security applications. He has co-developed a pioneering wafer-level chip-scale packaging concept, which, according to nomination materials, has revolutionized the worldwide electronics industry. He has also developed concepts for secured and tamper-resistant electronics.

Take Note ERA awards nominations open until Feb. 2

Here is your chance to acknowledge an individual or team whose work in support of Sandia's mission and values has been exceptional. Last year, the Employee Recognition Awards (ERA) program had a record participation, with coworkers nominating 772 individuals and teams for significant achievements and contributions. Once again you may nominate an individual or team who has gone that extra mile.

Nominations may be submitted via the web through Feb. 2.

The ERA program commends superior results in four general categories. One category is for teams. Three categories are for individuals: technical excellence, exceptional service, and leadership. If you would like to acknowledge an individual for exceptional people skills, the Leadership Category is where you can do this.

To nominate a person or team is an easy click away. Nomination forms with detailed instructions are available from the Web at Sandia's internal Web home page or at <http://www-irn.sandia.gov/era/04era.htm>. If you are unable to personally submit your nomination electronically, contact your Division ERA coordinator, who can direct you to someone that can help you.

The primary requirement of the nomination process is to describe the nominee's accomplishments in 250 words or less. An optional one-page supplement may be added for supporting evidence. Individual nominees must be current, regular, Sandia employees on roll since December 2002. Team members may include nonregular employees and contractors.

Any current, regular, Sandia employee may nominate individuals or teams.

Congratulations

To Sherry Ingwerson (ret.) and Ole Ingwerson, a daughter, Amelia Marie, born May 6, 2003, adoption finalized Dec. 8

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Recent Patents

Murat Okandan (1749) and Paul Galambos (1769): Apparatus and Method for Transforming Living Cells.

Arlee Smith (1118) and William Alford: Optical Parametric Oscillators with Improved Beam Quality.

William Sweatt (1743) and Steven Haney (8771): Mask-to-Wafer Alignment System.

Arlee Smith (1118), William Alford, and Mark Bowers: Method to Improve Optical Parametric Oscillator Beam Quality.

Douglas Chinn (8762): Ionizing Radiation Detector.

Douglas Adkins (1764), Charles Andraka (6218), James Moreno (ret.), Timothy Moss (6218), Kim S. Rawlinson (5714), and Steven Showalter (1764): Heat Pipe Wick with Structural Enhancement.

Paul Galambos (1769), Randy Shul (1763), and Christi Gober Willison: Process for Manufacture of Semipermeable Silicon Nitride Membranes.

Charles Andraka (6218), Douglas Adkins (1764), James Moreno (ret.), Kim Scott Rawlinson (5714), and Steven Showalter (1764): Exhaustive Search System and Method Using Space-Filling Curves.

Richard Kottenstette (1764), Carolyn Matzke (1141), and G.C. Frye-Mason: Microfabricated Packed Gas Chromatographic Column.

Sandia/NRL team develops ultraviolet fiber-based laser

By Nancy Garcia

Looking for a way to boost power in a compact ultraviolet laser, the Combustion Research Facility's Dahv Kliner (8368), colleagues at the Naval Research Laboratory, and Arlee Smith (1118) soon had the answer tied up.

They turned to fiber amplifiers, which were invented in 1963 and are now widely used in optical telecommunications. A fiber amplifier consists of a glass fiber (approximately the width of a human hair) whose core is doped with rare-earth ions; the ions can be pumped (typically with a highly efficient diode laser) to achieve optical gain. The advantages of these devices for optical communications — compactness, rugged-

Sandia California News

ness, efficiency, and high beam quality — were also attractive to Dahv and his collaborators. But they needed a much higher output power than can be attained by conventional fiber amplifiers.

Fiber amplifiers emit light in the infrared and need to be converted to the visible or ultraviolet by focusing through crystals. The efficiency of the conversion process is extremely sensitive to beam quality and optical power level. The small core size of a fiber ensures good beam quality but simultaneously limits the output power to prohibitively low levels.

To circumvent this limitation, the research

The researchers envision several future developments that will significantly expand the capabilities of fiber amplifiers.

team invented a method that allows the power to be scaled up by a factor of at least 100 while maintaining very high (diffraction-limited) beam quality. This method involves expanding the core diameter (e.g., from a typical value of 7 millimeters to 30 mm) to enable high-power operation, but coiling the fiber with a strategically chosen radius of curvature to suppress high-order modes that would normally degrade the beam quality.

"Coiling the fiber shuts off unwanted modes," Dahv says, "and the optical power is available to be extracted by the desired lowest-order mode, which gets through unscathed." Dahv explains, "It's well known that bending a fiber will change its light-guiding properties." The coiling technique, however, "went largely against conventional wisdom — it was thought that coiling the fiber would promote mode-scrambling, which is counterproductive."

The researchers first published this technique in 2000, and it has since been used by several groups worldwide to achieve record-setting power levels from fiber amplifiers.

More recently, the Sandia and NRL researchers frequency-converted the output of a pulsed fiber amplifier to generate wavelengths throughout the visible and ultraviolet spectral

regions. The coiled fiber amplifier provides high power and excellent beam quality that enable high conversion efficiencies in a very simple, compact setup.

The ability to efficiently generate high optical power with diffraction-limited beam quality has attracted much attention for a variety of applications. Military sponsors are interested in developing directed-energy sources for defense and optical counter-measures. Fiber lasers can also be fielded for chemical and biological detection and for aerodynamic data sensing outside aircraft. Automobile manufacturers are evaluating fiber amplifiers for welding on assembly lines. The ability to generate deep-ultraviolet light (wavelengths near 200 nanometers) has generated particular interest for the large materials-processing market (cutting, marking, drilling, circuit-board fabrication).

The researchers envision several future developments that will significantly expand the capabilities of fiber amplifiers. Further development of the coiling technique will enable even higher optical powers (many kW). In addition, they plan to incorporate additional functionality into the fiber (e.g., by adding integral gratings and other optical elements) and to develop fiber-based devices with novel capabilities that can address a number of long-standing problems with existing laser sources.

This work has been funded by Sandia's Laboratory-Directed Research and Development Program and by NASA. Work at the Naval Research Laboratory has been funded by the Air Force Research Laboratory and the Office of Naval Research.

Cluster computers coming online in California



SANDIA'S LATEST and greatest production cluster computers have been coming online recently in New Mexico and California. Using fast dual Pentium 4 Xeon processors and Myrinet message-passing hardware and software, they provide very fast capacity computing capabilities. Shown here is part of one rack of the 128-node Shasta cluster, which provides unclassified computing in California and has been outperforming the earlier but larger CPlant cluster in California since coming online Oct. 1. A 64-node classified cluster, Lassen, is in the process of coming online in California. New Mexico has two 256-node clusters that offer this dramatic hardware upgrade, the unclassified Liberty system and the classified Freedom system.

(Photo by Bud Pelletier)

Feedback

Q: Why did the federal and state withholdings change for the 11/3/2003 pay period?

A: There are many items that can change state and federal withholdings:

- Salary amount
- Tax status (Single, Married or Head of Household) and the number of exemptions claimed via a W4
 - Changes in imputed taxable income such as workers compensation and taxable insurance
 - Changes in pre-tax deductions for medical, dental, dependant care, and 401K
 - Employees can also add additional federal or state tax withholding via a W4 and a supplemental rate may be applied in some instances.

In addition, as we reach the end of the calendar year (October-December), employees may max out on their 401K pre-tax contributions in particular after receiving their non-base compensation award. If this is the case, employees will notice an increase in their taxes because they are no longer receiving the benefit of their pre-tax deduction. In addition, some employees will reach the limit on certain federal taxes and thus see a reduction in their withholdings.

This year, there have been no changes to the federal and state rates since July.

If you still have questions, please contact the payroll department and we will be more than happy to address your specific concerns.

— Jesus D. Ontiveros, Payroll Manager (10502)

Q: I was told recently that when an employee's vacation hours exceed 240 the amount that is lost goes into the vacation donation pool. I have not found confirmation on the Internal Web. Is this Sandia's policy?

A: A Vacation Donation Pool does exist. The pool is made up of vacation hours lost by employees who have exceeded the 240-hour vacation maximum. The Vacation Donation Pool is mentioned (not defined) in Corporate Process Requirement CPR300.6.17, "Vacation Donation Plan."

The Benefits Department is working to update CPR300.6.16, "Vacation" and CPR300.6.17 "Vacation Donation Plan" to include information regarding the Vacation Donation Pool.

— Larry Clevenger (3300)

Q: In listening to the Corporate Security briefing, I was struck again by the constant nomenclature difference between California and New Mexico for the same job or position. Aren't we one Laboratory? What a waste of time and resources just to keep track of the differences, etc., etc. Why can't these be standardized?

A: Boy, do we share that concern! There are a whole raft of historical reasons for the differences, some of them reaching back to the days when the large distance between sites made consistency more difficult and less important, some due to a difference in threat faced and some due to difference in size. The smaller California site does not need to dedicate an individual full-time to some functions that require that level of support in New Mexico, leading to shared jobs and then to different titles for points of contact or reporting. But there are many instances where there is no good reason for the different terminology to continue, and management at both sites is committed to fixing those as we go. You can help by pointing them out as you spot them, adding another pair of eyes to our effort.

— Ron Detry (4000)

Platinum

(Continued from page 1)

Porto in Portugal.

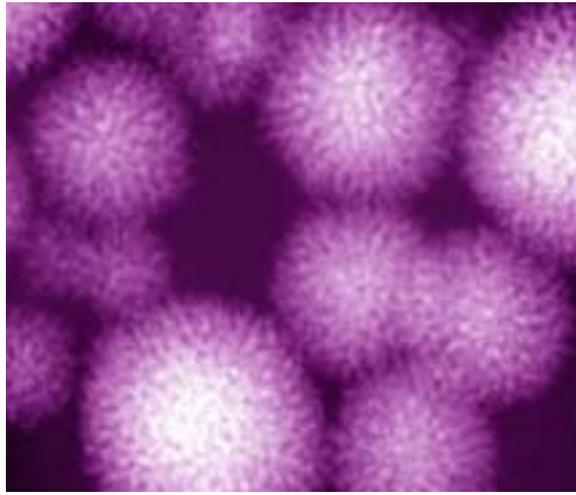
The new method of manipulating platinum was detailed in a paper in the *Journal of the American Chemical Society* published in late December.

The idea for the technique is similar to photosynthesis in plants where plants use the energy from sunlight to produce sugar. But instead of manufacturing sugar, the new method changes a platinum ion to the neutral metal atom. The photosynthetic proteins do this repeatedly, allowing metal to be deposited as desired at the nanoscale.

The method involves putting porphyrins — the active part of photosynthetic proteins — along with the platinum salt in an aqueous solution of ascorbic acid at room temperature. The porphyrins are placed in specific locations in the solution where it is intended that metal should be deposited. For example, the porphyrins may be confined to micelles or liposomes. Micelles are assemblies of detergent molecules in which the heads are exposed to the water and the tails stick together in the interior. Liposomes are similar structures but they are larger and have water on the inside and outside separated by a closed membrane — sort of like a cell. The membrane is composed of two layers of detergent molecules with the heads on the inner and outer surface facing the water and the tails form the interior

Method also used for cleaning up waste sites

The platinum nanostructure growth process is related to a technique John Shelnutt is developing with a local company, InfraSUR LLC, for cleaning up waste sites. The process works for a variety of heavy metal salts including uranium, mercury, lead, copper, gold, silver, and others. Their current emphasis is on cleaning up chromium(VI) contamination, which was featured in the movie *Erin Brockovich*.



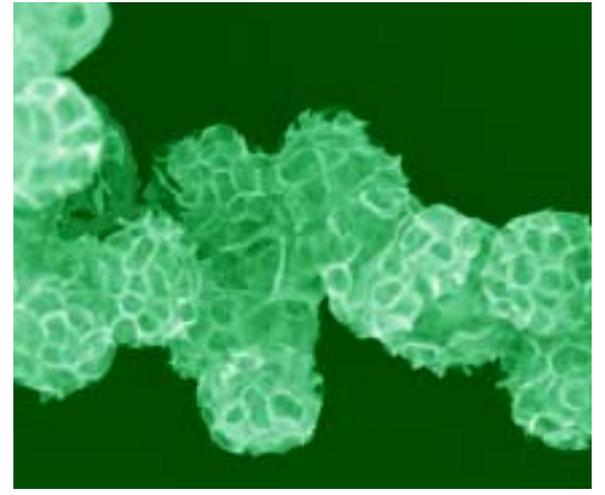
A TRANSMISSION electron microscope image of the platinum nano-Koosh balls. Sandia researchers use porphyrin molecules and light to grow seeds to allow the size of the nano-Koosh balls to be controlled.

of the membrane.

When light is shined on the porphyrins located in these detergent structures, the porphyrins excite, becoming catalysts for platinum reduction and deposition. As this occurs, the metal grows onto the surfaces of the surfactant structures as a thin sheet or in other ways. In the case of micelles, the platinum grows into balls that look like the common toy “Koosh™” ball. The ball size can be controlled by the amount of porphyrins and platinum in the solution, the amount of light illuminating the solution, and the amount of time the light is on.

For the metals platinum and palladium that form these nanostructures, it is enough for the porphyrin molecule to grow only a small metal “seed” particle composed of about 500 atoms. When it reaches this size, the seed starts to catalyze its own rapid growth (by oxidation of ascorbic acid), budding off arms in all directions and creating the Koosh-ball-like nanostructures. The porphyrin provides a convenient method of making these seeds at the location and time desired, leading to a uniform and selectable nanostructure size.

The platinum nanostructures take on a different form when they prepared under different conditions. When the porphyrin is in a micelle, the platinum nanostructures produced look like



A SCANNING microscope image of platinum-lace nanoballs. Liposomes aggregate, providing a foam-like template for a platinum sheet to grow.

Koosh balls. When the porphyrin is in the bilayer membrane of a liposome, the platinum grows in 2-nanometer thick sheet on the outer surface of the membrane, giving circular sheets — sort of like two-dimensional Koosh balls.

Under solution conditions for which the liposomes aggregate, growth can occur along the interfaces between different liposomes to give platinum foam-like materials and foam nanoballs. The type of nanostructure is mainly determined by the type of surfactant assembly upon which the platinum grows and the extent of growth from the individual seed nanoparticles.

Since the porphyrin remains attached to the platinum nanostructure and active in the presence of light, it can also perform other functions besides growing itself. For example when illuminated with light, the platinum nanostructure evolves hydrogen from water. This reaction is similar to one of interest to car manufacturers looking at new ways to build automobiles powered by hydrogen fuel cells.

John says that in addition to structuring the platinum, the process also happens very fast. A few minutes in light will create many seeds, which then grow into the mature nanostructures in tens of minutes. And the process is easy to do.

“It’s so simple it’s amazing,” John says.

Revenue/medical/pension concerns

(Continued from page 1)

Medical costs

The second issue is the growing medical costs sweeping the country and the world. Sandia’s health care costs are estimated to total \$78.5 million in 2003. This is an increase from \$72.5 million in 2002. Nationwide 2004 health care cost increases are estimated to be 12 percent to 13 percent, which marks the fifth straight year of double-digit increases.

Health care costs represent a portion of fringe — the cost of Sandia’s benefits. Therefore, increases in health care costs significantly affect Sandia’s fringe rate and overall “labor wrap rate” — the effective multiplier applied to a dollar’s worth of Sandia mission labor. If medical costs and the resultant fringe rate grow faster than the rate of inflation and faster than Sandia can grow the revenue stream, then the effective labor rates increase and customers experience an increase in the cost of Sandia mission labor, says Benefits Manager Becky Statler (3341).

“That could deter our customers from seeking our services and cause them to turn to other suppliers of technology solutions,” she says.

Sandia has already taken some actions recently to mitigate these increasing costs. These include more emphasis on preventative care approaches and increasing the employee share of costs. This has helped lower the cost growth at Sandia, but the Labs will need to continue to seek other ways to lower its costs in order to keep labor rates affordable, says Frank.

Becky says her organization has recently completed a thorough analysis of Sandia’s current and

projected health care costs and has begun investigating strategies to contain increasing costs.

“The traditional types of strategies we may consider include health care plan design changes and employee premium-sharing changes,” says Becky. “Because managed care is becoming a thing of the past and employers are trying to find other ways to contain health care costs rather than just shifting costs onto employees and retirees, various innovative advanced strategies are emerging.”

The primary objectives are to maintain a healthy workforce through health promotion programs (which Sandia has had for many years), to focus on high-cost populations using disease management programs (which Sandia has also recently implemented), to manage health care costs and delivery through collective purchasing, and to promote consumer accountability.

Becky says Sandia has not completed enough of the investigations to know which of the strategies or which combination of strategies we will pursue.

“The challenge will be to find ways of controlling costs while continuing to maintain a competitive benefits package,” she says.

Pension outlook

The third issue is the potential need for additional contributions to the Lab’s pension plan.

“For many years now, we have not had to contribute to our pension plan because our invested pension assets have grown at a faster rate than our liabilities,” Frank says. “This has happened because of our asset allocation and the favorable performance of the equity markets.”

Beginning in 2000, however, the equity market soured and the value of Sandia’s assets suffered. In addition, Sandian’s pension benefits were enhanced in 2002. Along with other factors, the market decline

(the analyses don’t include 2003 market performance results) has caused most companies in the country that still provide pension plans to begin having their employees contribute to their pension funds again. “Sandia is no different,” Franks says. “Although we are in better shape than most, we may need to begin contributing to our pension fund by 2006 or 2007.”

The effect of employer contributions to the pension plan is, like the medical cost growth issue, to hold the line on the fringe rate and over labor wrap rate.

“Estimating future pension costs is a complex problem,” says Pension Fund Manager Mark Biggs (10520).

Sandia uses a Monte Carlo simulation tool to supplement its annual actuarial valuation reports and to estimate future contribution requirements. The model produces a range of possible contributions for each future year based on the input assumptions. Sandia’s pension fund developed surpluses in the past when the plans’ assets grew faster than the benefit obligations, or liabilities. However, Sandia’s modeling expects liabilities to grow by about 10.5 percent annually in the future, while the plans’ assets are expected to return about 7.1 percent per year on average.

To keep this in perspective, Sandia will not have contributed to its pension funds for 20 years by the time of the first projected contribution, Mark says.

The timing and size of any possible future pension contributions will largely be determined by the actual asset returns earned by the pension fund in the next several years, Mark says.

Further communication on what is transpiring will continue and will be published in the Sandia *Daily News*. The *Lab News* will report on major developments.

Labs' elevator inspector cautious with dangers of job

By Michael Padilla

Looking up from the bottom of an elevator shaft, Luis Apodaca (10827) knows his job can be dangerous.

Much of the time Luis stands on top of an elevator car looking down into the empty, dark, and cold space. Good safety practices help him overcome his fear of heights, allowing him to inspect and service the numerous elevators throughout the Sandia complex.

"Being attentive and cautious of your surroundings is important to remember when you are working on elevators," says Luis, whose primary job is to ensure the reliability and safety of all elevators at Sandia. "You never know what could happen."

Luis has been inspecting Sandia's elevators since 1996. There are 62 elevators at Sandia, and more are on the way due to new construction at MESA and other areas throughout the Labs. He also inspects 10 elevators at Sandia/California and has helped at the Tonopah site. His expertise is often called upon from various entities to diagnose and offer advice on their elevator problems. Luis is on call 24/7, and he is used to getting paged throughout the day for elevator "emergencies."

"Most of the emergencies are operator error," he says. "People press multiple floor buttons or try to pry open the doors before an appropriate landing level is achieved. These operator errors can cause the elevator to malfunction."

Luis says Sandia has an excellent safety record regarding elevator operations. One of Luis' most memorable moments was when two Sandians were stuck in an elevator and the paramedics

were called after receiving a report that one of the riders was claustrophobic. Soon after the paramedics arrived the elevator was reset, and the riders disembarked at their designated floor. In the meantime paramedics waited and waited on the first floor for the riders in anticipation of assisting the claustrophobic individual. After what seemed to be an eternity, the elevator arrived at the first floor. Much to their consternation, the elevator opened and it was empty. The paramedics laughed, and went on about their business.

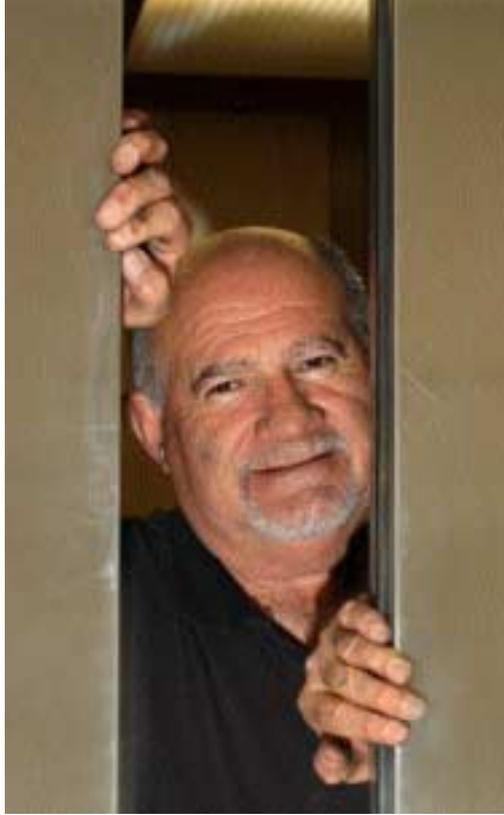
"I work hard in making sure that elevators are safe," Luis says. Sandia has only a few older elevators, with several of them being recently reconditioned with state-of-the-art electronics.

Luis strives to maintain the elevators in a high state of readiness and keeps up with the latest technology and resources available to inspectors. He is a member of the National Association of Elevator Safety Authorities International.

Luis says there are a few rules to keep in mind when entering an elevator. He says the first is to watch your step. Second is to leave closed or closing doors alone. Don't press multiple buttons simultaneously. If trapped inside, and doors don't open, ring the alarm button and wait. If no response is received

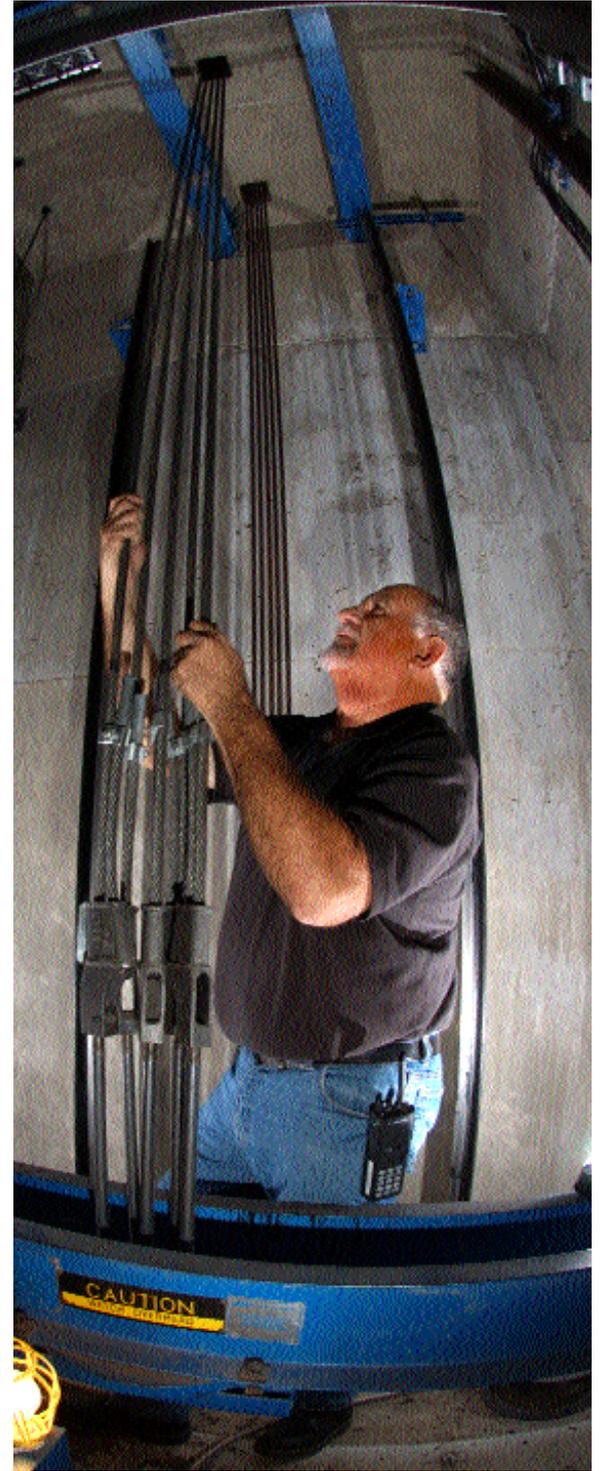
quickly, use the phone in the elevator to call for assistance. Most important, if there is a fire in the building, use the stairs.

"The most abused rule is that riders tend to force the doors open," Luis notes. When the normal operation of the doors is interfered with, the elevators are pushed off track or misaligned and tend to malfunction.



PEEPING OUT — Luis Apodaca ensures the reliability and safety of all elevators at Sandia.

Photos by Randy Montoya



HIGHER GROUNDS — Luis fine-tunes an elevator high above the third floor of Bldg. 890.



CABLE READY — Luis inspects the cables of an elevator.

Desktop computers to counsel users on decisions

What if your personal computer knew how you are feeling?

By Neal Singer

That computer on your desk is just your helper. But soon it may become a very close friend.

Now it sends your e-mails, links you to the Web, does your computations, and pays your bills. Soon it could warn you when you're talking too much at a meeting, if scientists at Sandia's Advanced Concepts Group have their way.

Or it could alert others in your group to be attentive when you feel you have something important to say.

Aided by tiny sensors and transmitters called a PAL (Personal Assistance Link) your machine (with your permission) will become an anthroposcope — an investigator of your up-to-the-moment vital signs, says Sandia project manager Peter Merkle (16000). It will monitor your perspiration and heartbeat, read your facial expressions and head motions, analyze your voice tones, and correlate these to keep you informed with a running account of how you are feeling — something you may be ignoring — instead of waiting passively for your factual questions. It also will transmit this information to others in your group so that everyone can work together more effectively.

"We're observing humans by using a lot of bandwidth across a broad spectrum of human activity," says Peter, who uses a Tom Clancy-based computer game played jointly by four to six participants to develop a baseline understanding of human response under stress.

"If someone's really excited during the game and that's correlated with poor performance, the machine might tell him to slow down via a pop-up message," says Peter. "On the other hand, it might tell the team leader, 'Take Bill out of loop, we don't want him monitoring the space shuttle today. He's had too much coffee and too little sleep. Sally, though, is giving off the right signals to do a great job.'"

Preliminary results on five people interacting in 12 sessions beginning Aug. 18 indicate that personal sensor readers caused lower arousal states and developed teamwork and leadership skills in longer collaborations. A lowered arousal state — the amount of energy put into being aware — is preferable in dealing competently with continuing threat.

The focus behind the \$200,000 effort, funded by Sandia's Laboratory-Directed Research and Development program, is to map the characteristics that correlate to "personal-best" performances.

"The question is, how do we correlate what we observe with optimum performance, so that we improve your ability and the ability of your team leader to make decisions? He can't tell, for example, that your pulse is racing. We're extending his ability," says Peter.

Those concerned about privacy — who see this as an incursion similar to Hal's, the super-computer that took over a spaceship in the movie *2001* — can always opt out, he says, just like people choose not to respond to e-mails or decline to attend meetings.

But in a sense, he says, the procedure is no different from that followed by the people who have heart problems: they routinely wear a monitor home to keep informed of their vital signs.

"In our game, what we learn from your vital signs can help you in the same way," he says. "It's almost absurd on its face to think you can't correlate physiological behavior with the day's competence."

After gaining generic maps of individual performance, the information would be linked in a working group through a program called Mentor.

No theory yet exists to explain why or how optimal group performances will be achieved through more extensive computer linkages. But Peter doesn't think he needs one.

"Some people think you have to start with a theory. Darwin didn't go with a theory. He went where his subjects were and started taking notes. Same here," he says. Peter presented a paper on his group's work at the NASA Human Performance conference Oct. 28-29 in Houston.

"Before we knew that deep-ocean hydrothermal vents existed, we had complex theories about what governed the chemistry of the oceans. They were wrong."

Now it's state-of-the-art to use EEG systems to link up brain events to social interactions, he says. "Let's get the data and find out what's real."

The tools for such a project — accelerometers to measure motion, face-recognition software, EMGs to measure muscle activity, EKGs to measure heart beat, blood volume pulse oximetry to mea-

sure oxygen saturation, a Pneumotrace™ respiration monitor to measure breathing depth and rapidity — are all off-the-shelf items.

"We give off so much information. But our only current way of interacting with a computer is very limited: through, essentially, a keyboard and mouse. So the limitation of my computer's ability to help me — this increasingly complex, wonderful machine with its ability to recognize intricate patterns — is its inability to recognize complex patterns in me."

Is all this really necessary? He answers with some humor, "Not at all. You can always ride a horse; you don't need an automatic transmission."

Asked whether this mechanistic view of human behavior can be accurate when many athletes, scientists, and artists have described themselves as feeling poorly yet made unusual gains in their work, and polygraphers have been unable to locate spymasters based on similar reading of vital signs, Peter replies: "I would not say that we have a mechanistic view, unless one considers studying precedent to be a mechanism. Based on a history of prior performance, we make a prediction on likelihood of suitability for current tasks. It's no different from making decisions based on baseball statistics: against left-handed batters in the last 200 night games, this person hits .207, so pinch hit the .298 person for him."

Further work is anticipated in joint projects between Sandia and the University of New Mexico, and also with Caltech.

"In 2004 we intend to integrate simultaneous four-person 128-channel EEG recording," says Peter, "correlating brain events, physiologic dynamics, and social phenomena to develop assistive methods to improve group and individual performance."

To complement this applied research, Sandia is supporting a \$50,000 graduate fellowship to study the neurology of learning processes under the Caltech Campus Executive program.

The Sandia project teamed with small business to produce the apparatus. Dave Warner, Steve Birch, and Tim Murphy of MindTel LLC, of Syracuse, N.Y., delivered the prototype with off-the-shelf components and custom software, based on an inexpensive networked PC platform, under budget in only 71 days, says Peter.

Feedback

Q: *I just finished reading the article on the Shoes for Kids program in the December 12 edition of the Lab News, and I must admit to being not only a bit mystified, but a bit miffed as well. Frankly, I can't afford to buy my own kids Nike shoes, even though they certainly would like to have a pair, and I certainly don't shop for shoes at Mervyn's for the same reason; too expensive. I understand the need these kids have, and I am hopeful that they have been "screened" to ensure that they are indeed needy. What I don't understand is why they can't have these shoes purchased at Wal-Mart, Payless, or some other retailer, which would provide less expensive shoes. It seems to me that the program would get more "bang for the buck" in that manner.*

Rest assured that the answer to this question would determine my decision as to whether I continue to donate to this program in years to come. I believe justification is warranted.

A: Shoes for Kids is a program that is in its 47th consecutive year here at Sandia and has evolved in many ways over the years. It is a program that continues because of the support of our generous employees and retirees. It is also a community partnership between the groups that work with us to fit approximately 450 children with shoes a year. We work with Sandia National Laboratories Federal Credit Union and their tellers and phone personnel to collect donations in our Shoes for Kids Account. The APS Office of Student Support Services helps us to coordinate with the schools we work with each year. They know which schools have a need. Within the schools, the counselors choose 25 students to

receive the shoes. The counselors know the children and their status. This program serves some very disadvantaged children and we trust the schools to choose those who will benefit most. We have bus companies that transport the children to the shoe store as a public service. Over the years, we have taken the children to many stores. In 1999, when Kinney Shoes went out of business, we had to find a new shoe partner.

Part of our philosophy has always been to provide disadvantaged children with an experience that was very meaningful to them. It is important that they get fitted properly and for that we rely on professionals that know how to fit children. We want them to have the benefit of getting a shoe that fits them and is of sufficient quality to last them a long time. We also had to look at logistics of how to get the kids to the store, fitted and back to school in a reasonable period of time. We checked with many shoe stores and decided to work with Mervyn's based on the following reasons: They have all sizes in one location as we work with children of all sizes, they have an inventory that is large enough to provide a good variety to choose from, they have a staff of at least three that dedicate themselves to working with the children, they provide us with shoes at the sales price plus a discount each time.

While some students get brand name shoes, last year our average shoe price was under \$28 and we were able to fit 450 students. As we introduce ourselves and explain the program at the store we give them a spending limit. They are good at being reasonable. Many Sandians volunteer their time to help fit the students and I would recommend it to any-

body to see how the program works. Please also check the website at <http://www-rn.sandia.gov/organization/div12000/ctr12600/shoes/donate.htm>.

Based on feedback from the schools, children, and Sandians involved we think we provide a big "bang for the buck" and are always open to new suggestions.

— Pam Catanach, Community Involvement (12650)

Q: *I would like to know what I can do about an individual on a bicycle who shows no regard for traffic and motorists. He enters the Eubank gate at about 6:50 a.m., weaves all through traffic, takes up a lane when there is a bike lane present and threatens people in their cars as he is breaking all the rules. The cars and motorists have been very courteous to him but his threatening actions and obscene gestures are going to prompt extreme indiscretion and possible aggressive actions. He disobeys all traffic rules and puts us at risk and we should not have to tolerate this. Please advise.*

A: Wow, what a frustrating way to start your day. I would like to personally thank you and the other drivers for extending your courtesies to this individual who so blatantly offends your sense of justice. There is little that can be done about weaving in and out of traffic and ignoring rules of the road unless a Security Police Officer or Air Force Policeman observes it; they would have an opportunity to issue a citation. However, Sandia Security is in the process of establishing a recorded line where Sandians can report activities that are of security concern. When this line is established the phone number will be announced in the *Sandia Daily News*.

— Ed Williams (10864) and Dennis Miyoshi (4200)



A 360-DEGREE PANORAMIC VIEW of the Martian surface, taken on Mars by the Mars Exploration Rover Spirit's panoramic camera. Part of the spacecraft can be seen in the lower corner regions. Sandian Carl Peterson worked with JPL on the parachutes that slowed the spacecraft. (NASA/JPL/Cornell)

Mars rover

(Continued from page 1)

"If the need arises, NASA can make changes in the software, landing site, entry trajectory angle, parachute deployment time, and several

other flight parameters," says Carl, who helped analyze the data at JPL as it came in.

The Red Team has continued to analyze the data for possible adjustments, and Carl will be back at JPL for the second landing.

Carl says the airbags used to cushion the

impact of current Mars Rovers have been improved by NASA and its contractor since their first deployment on Pathfinder. "The airbags now are a world apart from the prototype Pathfinder airbags that Sandia designed because of the work done by JPL and their contractor," he says.

CQuest photos to be available on Web FileShare

CQuest to continue to operate with high-resolution pictures

In the near future Sandians will have a new way to access the thousands of pictures of Sandia and Sandians taken over the years, including historical subjects and the latest research.

For the past ten years these photos and graphic images have been stored on CQuest, Sandia's primary on-line photo storage system managed by Russell Smith (12620). These photos have been put on Web FileShare, a four-year-old web-based information management system. Until recently Web FileShare was primarily used to store program and project business information. Now, in addition, it mirrors the 25,000-plus pictures that reside on CQuest.

CQuest will continue to be updated and available to users. As images are added to CQuest, Web FileShare will be updated at least biweekly.

"CQuest uses its own browser. It and Web FileShare exist parallel to each other," Russell says. "We saw Web FileShare as another way to access the massive CQuest collection."

Russell partnered with the Technical Library Operations Department (9616) that operates Web

FileShare and the Computer Support Special Projects Unit (9623) to move the collection to Web FileShare. This significant effort spanned a period of some 18 months.

Photos on Web FileShare will be low-to-medium-resolution. The low-resolution pictures will be one by two inches at 72 dpi. Medium resolution pictures will be 8 by 10 inches at 72 dpi.

"The low and medium resolution will be perfect for people needing pictures for web sites and Power Point presentations," Russell says. "However, people wanting high-resolution pictures for brochures and other publications can still get them from CQuest."

Anyone who has an account on the Sandia Restricted Network (SRN) can access both Web FileShare and CQuest. Information about how to get to Web FileShare and the CQuest photos can be found at <https://wfsqual.sandia.gov/wfshelp/cquest.htm>.

The official rollout of CQuest pictures on Web FileShare will come in February, complete with demonstrations of the system at the Bldg. 810 auditorium video-linked to California. Dates for the demonstrations will be announced later through

Pictures will be used

Beth Moser (9616), who operates Web FileShare, says she anticipates the CQuest pictures on Web FileShare will become very popular.

"It will bring images to a new audience," she says. "It's one more way for people to discover the pictures from this valuable collection."

Web FileShare is already well used. The number of people who log on every month is about 3,300 making about 160,000 hits. That compares to 3,500 hits a month when the system was about six months old.

Lab News and Daily News.

Sandians are encouraged to submit photo collections to Russell for entry into both CQuest and Web FileShare. This service is provided at no cost.

Loraine McCutcheon, Manager of Creative Arts Dept. 12620, says that sharing the CQuest pictures with Web FileShare is a perfect example of what the Integrated Enabling Services Strategic Management Unit is all about.

"Adding this valuable collection of images to Web FileShare provides our customers with an optional tool, maximizing productivity and the use of corporate resources." Loraine says.

— Chris Burroughs

Feedback

Q: I have a question pertaining to the amount of time a Sandia employee is allowed for a lunch break between the hours of 11:30 a.m. and 1 p.m. The SALUD program urges employees to exercise and as further encouragement, schedules activities at the parade grounds, which frequently (usually) continue longer than half an hour. I work across the street from the Kirtland parade grounds. A half hour is just enough time for me to walk across the street to the parade grounds, walk one lap (which I've been told is .6 miles), and return to the office. I'd prefer to make at least two or three laps and increase that to four, five, or six as I become accustomed to the exercise but half an hour is just not enough time. Please clarify. Also, is the policy the same for both exempt and non-exempt employees?

A: I'm glad to hear that you are participating in SALUD program activities. The lunch break for both exempt and non-exempt employees is half an hour as stated in CPR300.6.31:

"The 30-minute unpaid lunch period is observed sometime between 11 a.m. and 1 p.m. While employees may occasionally observe an extended lunch period, the lunch period may not be delayed, skipped, or shortened to vary the daily start and stop times, even as part of a flexible work schedule."

Employees who take more than their half-hour lunch period to participate in a SALUD activity should make up the time at the beginning or end of the day. Or consider participating in one of the SALUD activities that is scheduled before the workday begins or after the workday ends.

— Larry Clevenger (3300)

Plaque dedicated to Pat Eicker



ROBOTICS VISIONARY — Executive VP Joan Woodard and Pat Eicker (ret.), former Director of Intelligent Systems and Robotics Center, unveil a plaque in Pat's honor recently at the Robotics building. The bronze plaque, which features a picture of Pat, was dedicated to recognize his contribution to Sandia in the area of robotics. "For decades Pat has held a vision that robotics in many forms, materials, sizes, and complexity would shape 21st century manufacturing, hazardous operations, and repetitive job operations. To help others see the vision Pat has researched, lectured, listened, coordinated, preached, pushed, directed, managed, led, and even cajoled the diverse academic, industrial, military, and national labs to share that vision," Joan said.