State of the Labs 2001: With strong budgets, more work, aggressive hiring, 'awesome' R&D, Sandia forging future

After turbulent times, Sandia's top two officials welcome stability, new programs, outstanding research

This year's annual Lab News State of the Labs interview had a whole different flavor from last year's, when Sandia and the other national labs were going through some very difficult times. The outlook has markedly brightened, and Sandia President and Labs Director C. Paul Robinson and Executive VP and Deputy Director Joan Woodard spoke enthusiastically about that and a host of subjects important to the Labs and its employees. Among the topics are the Labs' best-ever budget, new sources of support, new programs, the stabilizing effect of NNSA, the first meeting with the new secretary of energy, a planned examination of energy needs in a long-term global context, the Labs' aggressive new recruiting and hiring program, efforts to ease managers' burdens, programs to maintain a balance of life and to keep Sandia a family-friendly workplace, the latest attempts to improve Sandia's lagging pension plan, the problem of good scientists leaving for private industry, the Labs' nevertheless outstanding R&D, and several phenomenal advances in technology that should prove important to the entire nation. Paul also offers his first public comments about his controversial testimony in the Wen Ho Lee case. They were interviewed by Ken Frazier, Bill Murphy, and Chris Burroughs of the Lab News *staff.*

LABS PRESIDENT C. Paul Robinson and Executive VP Joan Woodard in Paul's office during the annual *Lab News* State of the Labs interview. (Photos by Randy Montoya)

***LN**: What a difference a year makes! Last year when we talked to you, just about everything that had happened in the previous year was bad. There had been a very difficult time. This year a lot has changed, much of it, maybe even most of it, for the better. Could you characterize our situation now and the degree to which it has improved?*

Paul: Let me start with budget. When we sat down last year we had just received a marked-up budget from the Congress, but DOE had still not decided how to allocate it. They indeed held back some of it during the year. This is their usual practice. We were really worried. I think it is fair enough to say that it was going to be very, very tight, but we had examined enough budget cases that we made the decision we were not going to have a force reduction, we were going to tighten the belts a lot, try to develop some other programs, and get through the year. Well, during the course of that year, DOE continued to release more money than we expected that they would, and people doing Work for Others programs saw their budgets increase, both for other federal sponsors and the work we do for private companies. We closed the year with $200 million more in income than what our target was when we started. That was not all spent during the year, so for the first time in I believe four or five years we added to the carryover account for the laboratory — which was a surprising change.

***LN**: We had been drawing down on the carryover, correct?*

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Z's magnetic field shocklessly shoots pellets 20 times faster than a rifle bullet

'Fastest gun in world' accelerates small flyer plates to 20 km/sec

By Neal Singer

A magnetic field that accelerates pellets faster than anything except a nuclear explosion has been developed experimentally at Sandia.

The machine that generates the field has been jokingly dubbed "the fastest gun in the West," but the description is an understatement.

"It's the fastest gun in the world," says Sandia physicist Marcus Knudson (1610), lead scientist on the project. The propulsion speed of 20 km/sec — almost three times that necessary to escape the gravitational pull of the Earth (about 7 km/sec) — would send material from New York to Boston in half a minute, and from Albuquerque to Santa Fe in a few seconds. A typical rifle bullet is propelled at 1 km/sec.

The machine, Sandia's Z accelerator, currently propels dime-sized pellets called flyer plates only a few hundred millimeters to gain information on the effect of high-velocity impacts. The data gained can be used to simulate the effect of flying space junk impacting the metal skin of an orbiting observatory traveling in the opposite direction. The data are expected to aid materials scientists trying to balance lightness against strength for satellite and observatory shells. The technique also has potential as a hypervelocity "kinetic kill" weapon that, emanating from a lighter, more mobile source than the huge Z machine, still could strike disabling blows

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Sandia LabNews

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Sandia National Laboratories

Sandia system makes robot history at Pantex

Automated arm hefts hot pits so people don't have to

By John German

The noblest promise of robots has been to keep people out of harm's way — to perform tasks that are too dangerous, too difficult, or too monotonous for humans to do safely every time.

On Jan. 23 at the Mason & Hanger Pantex plant near Amarillo, a Sandia-developed robotic system performed such a task — it grabbed and moved a W80 pit across a room.

It was the first time a nuclear weapons pit had ever been lifted by a robot.

The historic operation was the first in a final series of qualification trials for a new automated Weigh and Leak-Check System (WALS) developed jointly by engineers at Pantex and Sandia's Intelligent Systems and Robotics Center 15200.

Safety, reliability, flexibility

Periodically war reserve pits from a variety of dismantled US nuclear weapons are pulled from storage inside Pantex bunkers, unpacked from their containers, removed from their shipping fixtures, weighed, leak-checked, repacked, and returned to storage.

This month, following a final DOE review, Pantex plans to begin weigh and leak-check operations using the automated system — all but eliminating the human exposures to radiation that are routine under the current manual procedures.

"WALS was developed to automate some of the highest-dose operations at Pantex, such as human handling of pits during maintenance and inspection procedures," says project leader Bill Drotning of Applied Systems Dept. 15271.

Sandia designed, developed, integrated, and tested the WALS robotic system (a commercial robotic arm on a 25-ft. track), its control software, user interface, custom tooling (grippers and special tools the robot uses to handle the pits and fixtures), automated work cell stations, and a suite of sensors and safety features necessary to operate the robot safely and reliably.

Pantex designed, developed, and tested the automated weigh and leak-check measurement stations in the WALS work cell, to and from which the Sandia robot will shuttle the pits.

To accommodate a range of different pit, container, and fixture types and sizes from a variety of US nuclear weapons, the robot incorporates

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This & That

Joan and Paul tell a different story — no, not different from one another, but certainly different from last year in this issue's annual State-of-the-Labs interview. Things looked pretty tough for Sandia about this time last year when the bleak budget situation was threatening to cause people and program cuts. Here, in fact, is the exact headline that ran with our 2000 State-of-the-Labs interview: "A tough year for Sandia: Amid great science, Labs and its employees face problems, pressures, stresses, and strains." (We've got to quit paying that headline writer by the word ... but I digress!) Anyhow, contrast that one with the upbeat headline on this year's article (page one, please).

* * *

All the pretty pictures ... — in our Jan. 26 Labs Accomplishments issue didn't turn out so pretty. Some did, but others came out "fuzzy." This is one of the few times we've printed lots of color in the same issue, and our old coal-fired press just wasn't quite up to the job.

But, if you have a speedy computer and good color monitor, you can see those pages and pretty pictures fully registered by downloading the PDF files from Sandia's external website. Go to our regular *Lab News* web page (http://www.sandia.gov/LabNews/LabNews.html) and click on the link near the top, Labs Accomplishments 2001. After that, you can choose to download the PDF files or view the html files. Note that ONLY the PDF files have all the color photos carried in the print edition.

* * *

From toilets to nuclear power plants — While we're talking Internet, I want to mention a great educational site, www.howstuffworks.com. *Albuquerque Tribune* reporter Sue Vorenberg, who sometimes reports Sandia news, told me about this site that explains in easy-to-understand language how hundreds of things work — mechanical and biological.

Here's a short sampling from recent home pages (they do change every so often): How oil refining works, how stereo speakers work, how blood works, how your kidneys work, how car engines work, and how e-mail works. It also has special categories, including science and technology, where you can even get a lay explanation of how nuclear power plants work. (Why didn't they have this when I was doing homework?) Now while you're goofing off at work on your computer, at least you can learn something.

* * *

Bigger discounts? — Sandians who travel a lot appreciated getting those "billfold-sized" cards several weeks ago that secure federal government rates at hotels, etc., but several employees called me saying they would have been even more appreciative if these cards were small enough to actually *FIT* inside a normal billfold. Why were they so big, they asked? Well, this took nearly all of my investigative reporting skills and tricks, but after an exhaustive inquiry into this important matter, I discovered the real reason: the bigger the card, the bigger the discount! I'm having mine blown up to 8-1/2 by 11 inches in hopes that it'll get me a super deluxe room at Motel 6 for less than 10 bucks.

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

Sandia LabNews

Sandia National Laboratories

http://www.sandia.gov/LabNews

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LOCKHEED MARTIN

Employee deaths

Patricia Spader of Business Operations Dept. 11001 died Feb. 4 after an illness. She was 58 years old. Patricia was a paralegal and had been at Sandia since 1992. She is survived by her husband Gerald, sons Kenny King and Rusty King, daughter Donna Hart, mother Irene Cervantes, and nine grandchildren.

* * *

Martin Dylski of Corporate Storage Services Team 10268-1 died Feb. 6 after an illness.

He was 61 years old. Martin was an administrative staff associate providing material management support. He is survived by his wife Sachiko and daughter Christina.

Lockheed Martin/ Sandia donates $100,000 to Hispano Chamber of Commerce

Lockheed Martin/Sandia National Laboratories has donated $100,000 to the Albuquerque Hispano Chamber of Commerce's Barelas Job Opportunity Center.

The Barelas Job Opportunity Center, now under construction at 1309 Fourth Street SW, is expected to be completed this month. The building will also house the Albuquerque Hispano Chamber of Commerce.

Lockheed Martin/Sandia's Corporate Contributions Program awards community investment grants to local nonprofit organizations that

SANDIA DIV. 14000 VP Lenny Martinez, left, presents a $100,000 check on behalf of Lockheed Martin and Sandia in support of the Albuquerque Hispano Chamber of Commerce's Barelas Job Opportunity Center. Receiving the check are AHCC officials Loretta Armenta and Phil Castillo. Looking on is Sandia Corporate Outreach Dept. 12650 Manager Mike DeWitte, right.

encourage the development of youth in the community.

"This gift is part of Lockheed Martin/Sandia and Technology Ventures Corporation's long-term partnership with the Albuquerque Hispano Chamber of Commerce and continuing commitment to the job center," says Don Carson, Director of Public Relations and Communications Center 12600. "We are pleased to help make the Barelas Job Opportunity Center a reality. This Center will be a major asset for the Barelas neighborhood and the entire City of Albuquerque. I applaud the Chamber for having the vision to build it."

Although the job training center will be open to any Albuquerque resident, the Hispano Chamber of Commerce will devote a significant amount of the space to providing jobs and career development opportunities for Barelas-area residents. Barelas, one of Albuquerque's older Hispanic neighborhoods, has been economically challenged since rail travel declined in the 1950s followed by the building of Interstate 40 in the 1960s, which diverted traffic away from downtown.

Gary Beeler and Don McCoy receive DOE's Distinguished Associate Award

Sandia retirees Gary Beeler and Don McCoy have received the DOE Distinguished Associate Award for their many years of stewardship of the nation's nuclear stockpile. The award is the highest nonmonetary award for employees of DOE-owned, contractor-operated facilities. Winners must be nominated by DOE program managers and cannot apply for the honor. Both men were nominated by Labs Director and President C. Paul Robinson.

Gary's citation: "For a distinguished career providing exceptional service in the national interest in varied responsibilities associated with ensuring the safety and security of our nation's nuclear weapons stockpile. Mr. Beeler's career exemplifies the breadth and depth of his numerous contributions to the nation's nuclear weapons complex. He has played a critical role in developing partnerships across the complex that include other national laboratories, the Department of Energy and contractors."

Don's citation: "For numerous, sustained, and exceptional contributions to the development of our nation's nuclear weapons stockpile through more than 30 years of service. Mr. McCoy has made numerous contributions to a diverse number of weapons systems culminating in the B61-11. He has engendered considerable respect among his colleagues through his leadership capabilities — capabilities that have impacted the design of several critical nuclear weapons systems."

Researchers create a camcorder-size gas imager

Device detects invisible leaks of natural and refinery gas

By Nancy Garcia

In a real sense, a group led by Tom Kulp (8356) took an assignment to develop a portable natural gas leak detector a step further than required — creating a prototype that can be carried, rather than rolled on a cart.

During a recent review, the development was hailed as a "major milestone" by Jeff Siegell, chairman of the Smart Leak Detection and Repair Project of the American Petroleum Institute (API), who had originally advocated shrinking a van-size version to cart-size. The API has been leading a broad committee to evaluate alternative technologies that can quickly and efficiently detect or repair the largest refinery leaks. In addition to API personnel, the Smart Leak Detection and Repair committee includes representatives from the oil industry, major refineries, the Environmental Protection Agency, ICF-Kaiser, and DOE.

About seven years ago, Tom's group began developing a predecessor instrument that relied on older laser technology and had to be carried in a customized van. While this version was used to demonstrate feasibility of the approach, it was not practical for everyday use, he said. "You can't just drive into the piping networks of a refinery."

Currently, a "sniffer" is hand-carried to each refinery valve to check for leaks. The new remote laser-imaging approach permits scanning several valves at a time, creating a real-time video display of whole plumes.

During a demonstration of the new device, the committee watched a plume of propane, emitted from an outdoor valve, on a television monitor as committee members took turns aiming the imager (which resembles a camcorder) at the source. For field use, this prototype is equipped with a battery pack that fits in a knapsack.

The imager works by lighting up the area with a wavelength absorbed by the hydrocarbon bonds common in refinery gases or methane. The light is scattered back to a detector, creating an image of the background scene on a monitor. In areas where some light is absorbed by a plume, the image is darkened, appearing as a smoky cloud. The technique is called "Backscatter Absorption Gas Imaging."

THIS OPERATOR-PORTABLE imager was tested by Tom McRae of Laser Imaging Systems during a recent demonstration. In the background, from left, are Marie-France Benassy (Elf Antar France), Tom Logan (EPA), Elizabeth Adam (TotalFina Elf), and Dan Vanderzanden (Chevron).

For a meter-thick gas plume, the device's sensitivity is generally a few hundred parts per million. Over the course of an hour, it is able to detect as little as two grams of leaking gas, which is well within the requirements for refinery application, committee members say.

Alternative means of leak detection are being pursued because the current methods are very labor-intensive and inefficient and refinery leaks are an issue concern to regulators. Refinery emissions of volatile organic compounds contribute to ozone formation (smog). The committee is seeking methods that allow the largest leaks to be quickly detected and fixed — an approach that would be aided by a detector that can scan many valves from a distance.

Two developments enabled shrinking the imager to a portable version. First, the device uses a compact nonlinear laser, an optical parametric oscillator. It, in turn, uses a new crystal called periodically poled lithium niobate. This crystal is very efficient and is used to generate light that is broadly tunable. Second, the laser uses a high-efficiency, air-cooled pump source, a fiber amplifier partially developed by Dahv Kliner (8356) in collaboration with the Naval Research Laboratory.

"To actually take this thing from a van and into a fully portable unit is absolutely fabulous."

The prototype mechanical components were designed by Sal Birtola (8365). Ricky Sommers (8356) designed the electronics. Karla Armstrong and former postdoctoral fellow Uta-Barbara Goers (both 8356) handled the optical design and assembly.

The unit will be field-tested at a refinery in Beaumont, Texas, and may eventually be copied for longer-term evaluation. The committee is expected to use the field test to develop guidelines to permit use of this type of device as an alternate work practice. There has already been an interest expressed to Sandia in commercializing this technology, which might yet be made smaller and lighter than the portable prototype.

"To actually take this thing from a van and into a fully portable unit is absolutely fabulous," Siegell says.

PACKAGE DEAL — Ricky Sommers, left, and Karla Armstrong (both 8356) show the inner workings of the portable imager. (Photo by Lynda Hadley)

Sandia CaliforniaNews

Senator Bingaman visits Sandia/New Mexico

WATER WALK-THROUGH — Sen. Jeff Bingaman, D-N.M., left, talks with Labs Director Paul Robinson during a quick visit to Sandia's Cooperative Monitoring Center Monday. Bingaman's visit included a series of presentations by Labs researchers about ways Sandia's technical capabilities could address three key water issues — vulnerability of and threats to water-distribution infrastructures, sociogeopolitical stresses relating to water scarcity, and economic concerns associated with supplying drinkable water. (Photo by Bill Doty)




State of the Labs

(Continued from page 1)

Paul: We had been drawing down on it, somewhat by DOE trying to get everyone to draw down their carryover, but in addition the launch of a major satellite program, MTI, the Multispectral Thermal Imager, had spent what was the biggest part of each year's carryover. We knew that was going to be a big carryover, which would eventually be exhausted, and we launched the satellite. This year we began the fiscal year looking at a budget of nearly $200 million from where we had finished last year.

Joan: The revenue projection for just operating, not capital equipment, is $1.46 billion. That's on the order of $400 million up from our worst-case start of last year.

***LN**: A very substantial increase over just a couple years.*

Paul: And our construction is $48 million also, slightly up from where it was.

***LN**: When Sen. Domenici was here recently he was quite upbeat about all this too, and you were as well. It's obviously a refreshing change from how things have been.*

Paul: Yes.

New levels of support

***LN**: To what would you attribute a pretty dramatic turnaround in support? What's behind that?*

Paul: As usual with Sandia it occurred in more than one program. Clearly the largest in Work for Others was National Missile Defense, where we design, launch, and fly representative target vehicles, and when there is a hit or miss we score that on behalf of the government. So I like that job for a lot of reasons. We got the job because of some of the other portfolios we were responsible for. Such as, we support the assessment of foreign military programs, so we were able to base our threat targets on realistic expectations. And we have always been good at designing and flying reentry vehicles. And so Kauai has been busy, but we also have begun to launch quite a few more out at Vandenberg Air Force Base in California. That's been the biggest single increase. The second reason I can think of is the work we have been doing in cybersecurity, which has several facets and several customers. That work has been growing. You of course read of our Red Team results, the 35 out of 35 successful penetrations of other systems. Cybersecurity is a huge challenge, as is national missile defense. I think it's good for us to be involved in both of those programs and have customers other than the Department of Energy looking toward us with support.

Joan: It has been a good mixture of both increase in the nuclear weapons program and work for other agencies. All the issues that have occurred over the past 18 months have brought attention and new learning on the part of a number of key decision-makers in Washington, generating a better understanding of the reason for the existence of these labs and the whole complex. Further, there is a fair amount of work coming along in the Stockpile Life Extension Program. Overall, there has been some welcome increase in funding in the nuclear weapons program. The other piece of our increase has been a diversification of our customer base. The nonproliferation work and assessments work for the intelligence community are a big piece. In energy and critical infrastructure, even though the total has stayed the same — some of the energy programs have come down a bit —we also have had some increases in the critical infrastructure area. That's starting to coalesce into some specific projects.

Paul: It would be very important for us to note that for the first time in 10 years we have a nuclear weapons development activity going on in the Laboratory. It is a phase 3, in this case instead of an initial design it's a redesign. We call it 6.3 instead of just phase 3. (Phase 6 is when something's out in the stockpile, phase 3 is design, so 6.3 is, you are redesigning something that is currently in the stockpile.) We start with the Trident I program. In addition to the redesign of Sandia components, the Navy is paying us also to redesign an integrated arming, fuzing, and firing device. I already see in people within the weapons program a very great difference in how they do their work. We're not just thinking about the future and preparing for the future and not just looking at surveillance of the stockpile that's out there, but here we are encountering a major new challenge. One of the most important roles we have as a Laboratory is to be system integrators, bringing everything together and integrating it with the military carrier. For something with 6,000 parts, which is typical of a nuclear warhead, that is a big challenge. If you haven't integrated a system with that complexity in 10 years, how do you know you still can? So beginning these programs is timely, and I think it's very good for the Laboratory to be in this phase of work again.

> *"I have believed all my career that nuclear weapon issues are even more important than foreign policy issues in the sense that you must not have partisan divides over them."* — ***Paul Robinson***

***LN**: So we have a whole different psychological feeling in the Labs?*

Paul: Exactly.

Joan: And with a new dimension of requirements from our customers. Cost of our designed systems is receiving a lot of attention this time around. There are some very stringent and challenging cost-reduction requirements, particularly in the reimbursable for the Navy.

The advent of NNSA

***LN**: In the political area we have now the NNSA [National Nuclear Security Administration] in place. That must be a welcome change. I know you advocated it, and others did too. What has been the result of that?*

Paul: I know for me the interactions are a lot better than where they have been in the past. It's single-point contact as opposed to the great number of offices you had to consult with in the past. They are still in the process of organizing NNSA in how to pull the parts together. But, for example, the nonproliferation and national security work was getting stove-piped from the nuclear weapon design work, and now they report to a common person, retired Gen. John Gordon. To start to see those decisions, one reflected off the other's needs, and synergism breaking out, it's a pleasure.

Joan: Another piece I see is access. It is just so much more prevalent. Not only Paul with John Gordon directly but also even among the other folks in the staff in the organization. We just learned of one recently where Don Carson in public relations is establishing a very wonderful, very teamlike relationship with the public relations folks within NNSA. That sort of healthy, respectful interaction has not been quite as common as we would have liked in previous years. This has been a nice change.

***LN**: Has there been a benefit in Gen. Gordon's tenure overlapping a change in the Administration?*

Paul: I think it would have been impossible without that. He's had a chance to do a learning curve of just what the problems were. I think he now understands them quite well, of the need to streamline, which was a key driver for the legislation creating NNSA. I spoke this morning with an individual who will head an office for John in systems studies and policy support studies, looking out a little further into the future and trying to develop a sound basis for future directions. He invited stronger Sandia participation, since that's something we have prided ourselves in. It was great news.

Joan: And that's really significant. The existence of that office is significant because it provides the foundation to have a multiyear budget plan, and you know how we have struggled with fairly wild budget fluctuations over previous years. This should give us a longer term perspective for program and planning.

Paul: Gen. Gordon is writing a five-year plan, which will parallel the way the Pentagon does its budgeting. It's called FYDP, the five-year defense plan. Besides giving us more visibility to adjust to changes instead of being surprised as we were this time last year, it should allow us to get in close step with things going on in the Department of Defense, where they will make changes in delivery vehicles; so that we can stretch out or speed up our programs to more closely match that. Particularly now in the production work that we're now doing, you're on a shorter string to respond to changes than in engineering design. No question this is going to smooth out the peaks and valleys.

> *"It would be very important for us to note that for the first time in 10 years we have a nuclear weapons development activity going on in the Laboratory."*

The new secretary of energy

***LN**: Paul, you very recently met with new Secretary of Energy Spencer Abraham. How did that go and what did you talk about?*

Paul: First, I was asked to come in and give some background discussions prior to his confir-

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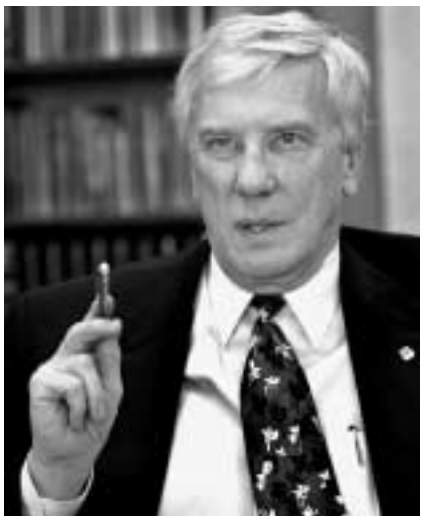

State of the Labs

(Continued from preceding page)

mation hearings, about the very wide spectrum of work that goes on in the department — and certainly Sandia, I believe, has as broad a portfolio as any laboratory. I found him very sharp, a quick learner, and I believe we set the basis for what will be a very teamlike relationship going forward. He believed that the strongest reason he was chosen to be secretary of energy was to try and get much better relations going with the Congress. That's a worthy goal! I have believed all my career that nuclear weapon issues are even more important than foreign policy issues in the sense that you must not have partisan divides over them. You know, in foreign policy we say that "debate stops at the water's edge." With nuclear weapons, the debate should never extend beyond the classified community that is considering what to do, and you need to have those initial debates and come out of them without partisan shapings. I think in the same way that the new President has stated a goal to be the president of all people regardless of party, Spencer Abraham believes very strongly that is how he will approach Department of Energy duties.

"I found him [Energy Secretary Spencer Abraham] very sharp, a quick learner, and I believe we set the basis for what will be a very teamlike relationship going forward."

***LN:** And he understands the new situation with NNSA within DOE well?*

Paul: I felt during his confirmation he articulated that very well, including saying that's his number one responsibility in the job, but that in fact he can rely very heavily on Gen. Gordon to carry most of that load for him. In fact I should tell you, Gen. Gordon and Spencer Abraham have already developed just terrific working relationships. It's great.

Joan: All that is good, because in fact the secretary will be consumed for some time with the energy issues that have newly come up. Perhaps we are biased, but I think that research and development in technology plays a role in working those energy challenges. In fact, one idea that came from the discussions Paul had with Secretary Abraham was to conduct an icebreaker retreat with the directors of the multiprogram national labs. The focus will be energy, and the format will be that of a Prosperity Game. So this is bringing a Sandia development, Pace VanDevender's game concept, to bear on what I think is an important problem, and also developing relationships that will be fabulous for the new administration.

Paul: It could have greater benefits than just getting to know each other, which was its first benefit, and that is, we are trying to look 10 to 20 years out in addressing the energy problem. I believe everybody recognizes already there is no instant answer that's going to ease the crisis in California and the growing crisis around the country.

Joan: And the focus is on the global context, which is also wonderful, thinking back on the specific wording of our core purpose, ". . . peaceful and secure world through technology." It's got just the right focus.

Paul: The other key part of our discussions, and like a lot of successes it has many fathers and mothers, in some of our thinking to prepare for transition we had said the energy problems are not just the Department of Energy's. As a nation the United States has only 2 percent of the proven reserves of oil and about 3 percent of proven reserves of natural gas; on the other hand, the lion's share of the known reserves of oil is in the Persian Gulf countries, 55 percent, and with natural gas 40 percent of the reserves are in Russia. Now, that says it's not just the Department of Energy's purview. You must have the Department of State; the Department of Defense, because these are very unstable security areas of the world; clearly Department of Commerce — we're going to have to trade to get these resources; and similarly Department of Interior and the Environmental Protection Agency at home. And so suddenly it's a large multiplicity of agencies that have got to come together. And we said as secretary of energy you can't do that by yourself, maybe it would be a good idea to get the vice president, who has recent intensive energy experience, to chair a task force on behalf of all of the government to try to build a strong national energy policy. You probably heard that they announced that. So we felt like we were able to be of some small help in making that happen.

***LN**: Do you have any sense from the new secretary when he might come visit the Labs in a formal visit where employees could meet him?*

Paul: I suspect his plans have been changing as the crisis in electricity in California has grown worse. He wanted to put a priority of doing that very early. In fact, the time scale was so short before California would run out of any of their interim solutions that he has devoted 90 percent of his energy to working on that, which he is still doing today.

***LN**: How long was your meeting, and did you find him personable?*

Paul: More than four hours, and I found him likable. His staff had told me he has a photographic memory, and it sure looked that way to me. He is very quick on the uptake and has been demonstrating that in a lot of the lessons he's taken to heart. I hope we are able to be of some help to him in dealing with the problems on his plate.

Testimony in the Wen Ho Lee case

***LN**: Paul, let's go back to something a bit in the past, and forgive us if it seems a bit personal. We haven't had a chance to talk to you about this. You testified very strongly in the case of Wen Ho Lee for the prosecution, and you received a lot of criticism for it. Can you tell us anything about why you did that and what the repercussions have been and the effect on you?*

Paul: Yes. It certainly has been not been the easiest assignment I've drawn in awhile. Most people in the Laboratory, I think, don't know how I happened to have gotten involved.

***LN**: No.*

Paul: The initial question was what is the potential damage from having downloaded all of these secrets and placing them in an uncontrolled way — such that they could have migrated to another country. The government prosecutors asked what would be the significance of that. So they asked the Pentagon if they would provide a witness to come during the Christmas holidays of 1999 to testify at the trial. Well, not a lot of people wanted to come. And they said, you should probably check it with the Strategic Command in Omaha, which has overall command authority for nuclear weapons, and get someone from there. So that was their next call. When they called Omaha, they said, well, my goodness, the chairman of our STRATCOM Advisory Group for policy is already in Albuquerque. He is the director of Sandia National Labs. The next call was to me. And I said fine, as I didn't think this is something I could easily walk away from. And so that was the basis for why I was testifying, as opposed to my being lab director here.

Now, I do not know with certainty what the motivations were by Wen Ho Lee in taking the actions that he has admitted he took. That's probably the most troublesome part to anyone who has been associated with the case. But in fact, I still believe it was a very, very dangerous thing he did. To take all of the designs of US nuclear weapons, the Nevada test data associated with those weapons, and a further library of all the threat designs we've looked at for terrorism threats and take them out of protective custody into first an unclassified computer and then later make portable tapes — multiple copies of those tapes, so we learned during the course of it — is still frightening to me. Now the government, which was going to have a very difficult time prosecuting the case, I believe did a good job in keeping focused on what happened to the information that was taken out of classified storage. They put that as their first priority to understand. All of the deals that were made and plea bargains were to find out the answers to "What happened to the information?" which I think is the right focus. I testified that the value of such information is more than a trillion dollars. It is the integrated work of the nation in nuclear weapons for a very, very long time. And so to do everything you can to find out what happened to the information and to assure the country that it has not migrated off our shores seemed to me the right place to put your focus.

"I do not know with certainty what the motivations were by Wen Ho Lee in taking the actions that he has admitted he took . . . . But . . . I still believe it was a very, very dangerous thing he did."

***LN**: When the case collapsed, and then he was released, how did you feel about that?*

Paul: One of the things the media have

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talked about a lot has been the dropping of 59 charges to one charge. I think what people had not understood is where the 59 charges came from. The way the system at Los Alamos was designed, a common file system stored unclassified and classified data, with a robot that would actually grab computer cores and connect them to the computer so you could move rapidly to carry out solutions to problems. If you were downloading something from the common file system, in going to an unclassified computer, you had to swear that what you were downloading was unclassified. That was done 59 times. And so when they finally decided to bargain for one count, it was the same offense multiplied many times. So I was not particularly disturbed that they chose that. Again, the trade was to find out what happened to the tapes, which is a process still underway in debriefs with the government now.

Work, staffing, recruiting

***LN**: We want now to talk about things specifically related to Sandia. With the new budget, are we in a situation where we may have more work than we have people to do it? What can we do about that, and what is the situation for keeping and getting new staff?*

Joan: Overall Lab size is up a little over what we currently had on roll at the start of the year. We project retirements and separations, and the projection of retirements is a little larger than what we've seen in previous years. The combination of those two puts us in a position to have a hiring program this year of on the order of 500, and, for probably on the order of the next five years, the same level.

***LN**: 500 per year?*

Joan: 500 per year. . . and that's split about half and half between technical professionals and other folks within the laboratory. We're starting, but it's a slow start. We knew from 10-15-20 years ago how to successfully recruit top people. It's been confirmed from consultants we've talked to that the same methods work today. But we have to rebuild the machine. We haven't recruited for so long. So just things like the recruiting teams and getting our new hires that came out of school onto those teams from their alma maters — we need to get that built and in place. At this point — actually by the end of December — we hoped to have over half our hiring [for the fiscal year] completed, and we're at the 20 percent mark. Half was a really aggressive goal. In fact, if you looked at our best years in the '70s and '80s, I'm not sure we had completed half by December. We're still very confident, and things are really picking up in terms of activity: interviews, candidates coming in, offers going out. Our acceptance rate is going pretty well. Across the Lab, it's still in the mid-80s. Even in Division 1000, which is largely a science and technology organization, we're running at about a 75 percent acceptance rate. We're getting in grads from some great schools, so we're hitting the kinds of schools we need to be hitting.

I just had an opportunity on Monday to have lunch with a group of about 20 relatively new hires to the labs, and it was awesome. Just talking to them about why they came to Sandia and how they find it! They were excited, they came here for the same reason we talk about, which is why Sandia exists — technology, national security, a purpose that's important to the country. They talk about the equipment, the access, and the working with high-class people. So, it reinforced to me what the character of Sandia is at a time when we really need to make sure we all understand that. That was fabulous.

Paul: I would like to jump in to compliment the work people have done to get the recruits we have, because I know the job is a lot harder than it ever was before. There are fewer graduates in engineering and science degrees—and at the same time there are fewer US citizens with those degrees. And the competitive offers, even with the somewhat cooling in the dot-com economies, there are still very generous amounts of money being thrown at the new graduates. And so for us to do as well as we are is quite amazing. I think it says we have a huge challenge in each of the next years if we're going to get the folks we want.

At the same time we were trying to do this hiring, our California site, which is certainly the leading edge of the intense competition, has been losing more people than at any time in the past. I guess I can use the slang word when we first heard about it: we have a "geek leak." That sprang up at our California site. It was nearly 10 percent attrition in one calendar year.

Joan: It turns out the big increase was in retirements, a lot of people retiring and then moving to a second career.

Paul: The area of our site — Livermore, Pleasanton, Dublin, California — has taken on a new name. It's being called "Silicon Alley." A lot of the Silicon Valley/San Jose companies are relocating and setting up branches there: Cisco Systems, Oracle, PeopleSoft. And they have been making huge offers to a lot of our people, including a whole lot who have chosen not to leave. But I think that's going to be a challenge also, just to keep who you have on board, much less bring in a lot of new talent.

"We project retirements and separations, and the projection of retirements is a little larger than what we've seen in previous years. The combination of those two puts us in a position to have a hiring program this year of on the order of 500, and, for probably on the order of the next five years, the same level."

— Joan Woodard

New hires and re-hires

***LN**: How about the lunch you had with new hires. Is that something you plan to do periodically?*

Joan: It was part of a visit I make to each of the divisions. I try to spend a day with each of the divisions at least once or twice a year. As part of that I have lunch with a cross section of folks within the organization. In this meeting with relatively new hires I also asked them, "What about your friends or your peers at school? Where are they? How are they finding it?" And they had a lot of stories about folks who went out and some are making huge amounts of money, but they, in fact ,voluntarily brought up the differences — the ability to manage a balance of life at Sandia is a lot easier than at some of the dot-coms. . . and also the ability to have the overall support of equipment, infrastructure, and excellent people found in a major national lab.

***LN**: Are you finding a sense [among new hires] of specifically wanting to do work because it's in the nation's interest?*

Joan: When I asked them, "Have you heard anything about core purpose and the values of the Lab?," I got nothing much back. Paul will be very disappointed. So we have our work cut out for us, Paul, in trying to continue to work that communication, but we'll get there. But, when I asked, "What do you think our core purpose is?" they said, "Well, we're here for national security, national defense." So they knew, it was in their heart. They understand there is this national purpose that we're here for.

Paul: Folks at California organized an afternoon session at Fall Leadership this year to have recent hires and re-hires from both New Mexico and California give a view from the outside coming in to the directors and vice presidents. And I found it very strong that the chance to do something bigger with their life rather than just making a narrow product is still a very, very important attractor. This included some of the folks who came back, even though they earned very good money while they were out — it wasn't as fulfilling. And I can say from personal experience, having worked in the lab in my early career and then out in industry for a while, I didn't feel nearly as fulfilled or feel that my work was as important as in the labs.

Joan: This panel also brought up the point I made earlier about balance of life. Many re-hires cited as part of the reason they came back was that they were having to compromise the rest of their life, which wasn't acceptable to them. And when you read literature about what students are looking for in their career, balance of life and lifestyle are very important.

More than just family-friendly

***LN**: Especially for a woman; I've found Sandia a very family-friendly place.*

Paul: We're trying to be even more so. We have gone through several cycles of trying to be helpful in the child care arena. They have been, at best, interim solutions. DOE opened its child care facility and then the Air Force opened up some slots in theirs, but now there's an initiative working with the credit union to build a child care facility in Research Park. Once we're successful with that, we'll have to take up the question that's arising for everybody in our society, and that's elder care, which is becoming a very serious problem. So we think part of making this a good place to work is being much more proactive in those two areas.

***LN**: Joan, you've been in your job now for two years. Is it what you expected?*

Joan: [Laughs]. The first couple of years were nothing like I expected. You've heard us talk about it before. My question to Paul was: "Is it always like this?" In fact, those years were like nothing that had ever occurred before. Recent time — the last year or so — has been a real delight. We have wonderful people to work with, both in the Labs and many of our customers. There are really two reasons we have had the kind of revenue increase over the last year. One is that there were some folks in DOE who realized we were in a starvation situation and helped us; but the other thing is that the leadership of the Lab and all the different business units and their employees all really worked hard. That was wonderful to see.

Technology — every time I get to go out and make one of those visits to the divisions, it's just awesome, it's amazing. Yesterday afternoon I took Col. [Jan] Eakle, the [Kirtland] base commander, on just a brief visit to the decontamination foam development work; it's just amazing to see what's going on.

I also see some very encouraging things in the formation of the NNSA and in all the things that Paul talked about. The other thing that's been wonderful is that John Gordon and his folks have put the spotlight back on the science and technology and the business for which we exist. Science Day — it was so welcome at a time when it's crucial for people to be reminded of why they're here and that the work they're doing is really important.

The work environment that we talk about as so important — it's more than just child care, it's more than just family-friendly. It's also, do people feel like they're trusted, trusted by their customer in a reasonable, respectful relationship? We have

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some work to do there, I think, to rebuild and regain that trust, to have a very healthy relationship and healthy interactions.

And I must say, Paul's been a delight to work with. I've learned a lot. A tremendous teacher and a tremendous model.

Paul: I think we have a terrific relationship. The concept that we pioneered with [previous Executive VP] John Crawford of two of us in a box has worked very, very well as a support network. To each be able to function and actually "have a life." Even though I'm not sure we really have other lives, at least we can travel on work business as well as function at home by interchange of work.

Easing managers' burdens?

***LN**: Last year, I [C.B.] went to the Women in Management conference. I wonder what's come of that. This is a whole other story, but just briefly, what's going on in terms of women in management and women at Sandia in general?*

Joan: The Women in Management conference, as you may recall, highlighted a number of issues, but in fact a significant fraction of them were issues that face all management, men *and* women — continuing to highlight that we have put a tremendous burden on first-line managers. In many cases that burden has made an unmanageable situation.

A number of things have been kindled as a result. One is that we are taking a look again at the work done earlier by Directors Pat Eicker and David Williams on the burden, the responsibility, and the overall scope of the manager's job. I've asked each of the vice presidents, through whatever mechanisms they have in place or want to put in place, to get some sense about how their management is doing, and in particular ask the very special question of how has the implementation of the Level 2 manager helped that situation. That's happening right now, and I'm about to start getting some of those reports from the different divisions.

Another piece that came up is that we have managers who really work hard to do a good job with the management of their people — and yet, there're a lot of times when we just don't give the reinforcement and the encouragement and the recognition we should. So we took a little bit of a step this year with the Employee Recognition Award to put a little more emphasis on that in the criteria for the award. For next year we're hoping to take a look — and I don't know exactly what'll come out of this — but perhaps a separate award category to highlight the importance of good management of people and give some noteworthy, important, and sorely needed praise and recognition to folks who do a very good job of that.

The other thing that's happened involves the Women's Program Committee, which we have had for years under the Diversity/EEO/Affirmative Action Program. In that group, there have been a few souls who have kept engaged and been involved, so we're bringing them together with the folks who have been involved in this Women in Management activity and trying to revitalize the Women's Program Committee. It will help us also with pipeline issues — trying to get young people interested in science and technology careers.

Paul: Let me suggest: One metric of whether NNSA is succeeding or not will be whether the first-level managers' jobs get easier and lives get better. Because I think what heaped a lot of things on them was the micromanagement that we talk about. The key word is "streamline." If John Gordon is successful in streamlining, cutting out a lot of that extra oversight, which unfortunately landed in the managers' laps — it rolled downhill as far as it could go — that should help. We need to work hard at streamlining in order to make their lives more livable.

Pension improvements?

***LN**: Here's a subject that obviously all employees are very much interested in but also relates to the issue of attracting new employees: pension benefits and what further improvements might be possible. I know you've all worked very hard on this issue. You've announced one change that affected past retirees. What is the latest word on anything that will affect retirement benefits for current employees?*

Paul: Well certainly, Pete Domenici answering that question during his colloquium set the expectations, which have been very much something we've been looking at. The University of California, since Pete's talk, did increase their formula. Now, there are some comparisons you have to do between their plan and ours because they do not have a company match of contributions. But even when we tried to harmonize those — and we've found you have to do this in auditable ways, and we used an outside firm to help us do that — we are coming in second best. At the Sandia Board of Directors meeting on Jan. 29 we presented a roadmap that we intend to pursue to try and achieve parity with the UC labs. That's the goal we've looked at. It is not going to be easy. I told the board members frankly that at this first meeting of the year and under the new administration, we were exposing them to our roadmap because we wanted them to be in the chair at take-off in order that when we make our landing we can be sure they're going to still be with us.

"At the Sandia Board of Directors meeting on Jan. 29 we presented a roadmap that we intend to pursue to try and achieve [pension-plan] parity with the UC labs. That's the goal we've looked at."

— Paul Robinson

Their remarks were to bless the approach we're taking. Ralph Bonner is once again leading the effort. It would involve looking at retirement health benefits, possibly some adjustments in the life insurance. Every time I tell people how lucky they are that, by far, we are number one of any company we've ever seen in terms of life insurance benefit — this is a legacy of the AT&T days that AT&T has since abandoned — it's equivalent to the notoriety of having a government building named after you: you have to wait 'til you die to have that honor. So most people haven't regarded the large life insurance policy, post-retirement, as such a big benefit. So we've put together this roadmap and have begun an accelerated schedule to put it forward and have already begun the discussions with Lockheed Martin, which will then take us to discussions with the Department of Energy.

Joan: Given that a lot of people are probably wondering and waiting and hanging on, it has been Sandia's policy that any changes in benefits be retroactive to the date when the discussions started, and for this particular cycle, that started approximately mid-December. So for anybody looking forward — if we're successful, whatever we're successful with — it is our policy and our intention that the changes be retroactive.

***LN**: In other words, folks don't have to hang on waiting for the change; they can go ahead and retire?*

Paul: We've always felt that any system that causes one to be a winner or loser by whether or not they plan their future would not be a good system, so we've got to harmonize those as we move forward.

What about vacation time?

***LN**: Are any of the benefit changes involving the possibility of increasing the vacation time for the newer employees?*

Joan: That's being cued up. It's part of the look that Don [Blanton] and the folks in HR are giving to all aspects of rewards and recognition.

Paul: Our total rewards.

Joan: And what they're doing is they're looking at all rewards, piece by piece, and determining what kind of shortfall issue there is and what our strategy might be to work that. Child care is a piece of that. Vacation is a piece of that. Currently, our vacation program is the same as the UC labs. That's important. I think some folks are still under the impression that we have less, that they have better vacation than we do.

Paul: In our focus group, a number of people came forward and said if we could get that equivalency, it'd be great. We said, "Wait, we are equivalent [in vacation days], and you won't like it."

Joan: We are trying many strategies, such as ways to introduce some mechanisms by which people can expand the amount of time they have off, but probably at some sort of a cost. Our vacation as a piece when compared to national benchmarks is not at the very top, but it's pretty close to the top across the board until you get to much higher years of service, 35 years or so, where some companies have more than 24 days. It's interesting to me that in this lunch I had with new employees, one of the things they said was, "Sandia's really a good place to work. They have a lot of vacation. And there's a lot of flexibility that 9/80 and flextime gives them."

Sandia's great technical work

***LN**: What technical accomplishments in the last year in particular are you most proud of, most want to take note of?*

Joan: Well, we're on the verge of a revolutionary new technology for lighting. We've developed and gone through competitive testing of the decontamination foam that has just wiped out the competition in both chem and bio. There're a ton of accomplishments. The lighting is an exciting one.

Paul: It's not often that research that was not directed at that application gives you the possibility to replace the Edison light bulb. That doesn't happen every day. So that is very exciting.

***LN**: Is that the VCSEL [vertical-cavity surface-emitting laser] technology?*

Paul: The blue VCSEL. Ultraviolet light is down-converted in phosphors that are built in. It shows the possibility to give a greater fidelity of sunlight, which is what we'd all like to have in our room light. Sunlight is how our eyesight is centered. So, if we could get that in our lighting, I think we'd all enjoy it a lot more. At the same time, being able to save hundreds of gigawatts — that's the projection — could be a nice contribution from a Department of Energy laboratory. The VCSELs have been an exciting theme around here. A lot of the new starts have been VCSELs for new communications purposes, where you're working at a trillion hertz. A companion group working in the Compound Semiconductor Lab developed a VCSEL at 1.3 microns. That's in the infrared, farther than you can see with your eye, but the ideal for transmission through optical fibers.To say there's been an outpouring of interest from commercial firms would be a real understatement. Optimizing lasers for fiber optics has been one of those holy grails we've been trying to do for five years.

***LN**: Does that have implications for Sandia's*

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royalties?

Paul: Our royalty incomes continue to grow at exponential rates. We gave employees $400,000 [in royalty incomes this year] and that was just part of the more than $2 million we received as income to the Laboratories. The rest has gone to research programs. I believe that is going to keep on a steep rise from here on. The intellectual property goals we've been setting continue to do that — both in increased number of patent disclosures and patents granted. That affects not only the royalty incomes but CRADAs [cooperative research and development agreements] Sandia has with other companies. Companies want to partner with us because we have something to offer in unique intellectual properties. As a result, that work is continuing to grow.

Joan: In fact in that area we brought the notion of a higher level strategy for intellectual property. This will allow us to ensure that patent disclosures and patent filing applications efforts for those technologies are just right so that their impact would contribute to more potential licenses. Recent data show that in the areas of license and initial disclosure, we are doing a lot better. We can already see that.

EUVL a 'very sweet technology'

Paul: There are two areas I really want to mention in technical highlights. The first one — as reporters you will not appreciate; I'll apologize in advance, but I wanted to be on the record — is in our highly classified programs, where we made some enormous breakthroughs that you have not heard about nor will you hear about. In the highest levels of government Sandia has been praised as never before. Some of the more important work we've done in a decade happened this past year.

Second, this is the culmination period of what has been a very exceptional and important relationship. The CRADA with the major chip builders — Intel, Motorola, AMD, Micron, and now ASML. These companies formed an Extreme UV lithography [EUVL] CRADA under a limited liability corporation. They put up $250 million. That's real money, private money. It followed Sandia's first success in creating a 100 nanometer (which is 1/10 micron feature size) microcircuit. They put up the money to see if we could accelerate the time scale for bringing that into an industrially feasible manufacturing device.

We just completed the assembly of the engineering test stand, which we delivered. We built the first circuit on Jan. 26. And we are preparing to hand it over to the industrial consortium on April 11. What is even more — and I could brag about the great work — is that it was not just making an industrial version. But there were multiple trade studies, engineering design studies — is this the right design? This has been a very sweet technology. As we've made adjustments, the performance has improved. It will be a much higher performance device. It will produce chips faster.

In addition we found ways to extend this technology for at least another order of magnitude and maybe a factor of 20 shorter [smaller] spacing. We'll be approaching 5 to 7 nanometers before this technology sees fundamental limits. More important than the limit, it keeps Moore's law, which is the engine driving the microelectronics industry, going for another 15 years. That's a very major accomplishment.

In April when we roll this out for industry, it will be recognized as some of the best work we've ever done in an industrial partnership.

More important than the device are some of the technologies that had to be developed to make this all possible. Folks both in California and New Mexico worked together to develop a design tool that allows 500 engineers to work on the same design within a computer-based design system. The people at Intel — we had a statement made for a video Intel was producing — claimed that was the most remarkable development in the program. I believe the application of that technology is going to find a home in all of the major programs starting with the weapons program here. So it has been a very exciting project.

I sent the folks a message of congratulations on the wonderful accomplishment they made. Many late hours and a lot of creative ideas brought it into being. So it's a very important occasion for the Laboratories.

This is important not just for those companies. This is very important for the nation in semiconductors. I think it will be the kind of success that the creation of SEMATECH added to the electronics industry.

Paul makes a point as Joan looks on during the State of the Labs interview.

***LN**: Can this technology be adapted to nanotechnology?*

Paul: You will start to recognize a lot of what we put forward as the reason to build MESA. We will be drawing all the advanced technologies and related technologies in one facility that will be here on the site. It will bring our state of the art up to the latest of industry.

Genomics, bioinformatics, and Sandia

***LN**: You were in Washington for the signing of the agreement with Celera and Compaq on the next major advances toward superdupercomputers, as we called them in the* Lab News *(Jan. 26 issue).*

Paul: This job has some wonderful perks. Being able to take a red-eye flight from California to that event was a real perk. It was the last day in office for Bill Richardson and the president's science advisor, who were both part of the event. As its role in the CRADA, Sandia will supply its expertise and massively parallel computers and software and algorithms to the biological applications of Celera, a genomics company. We will get a return of learning about technology that a lot of people have been licking their chops to understand. That's biological science, a new field called bioinformatics. But what gave me so much pride was participating in a distributed press conference with press from around the country, including a number of financial advisors. One reporter asked a critical question of Celera — why Sandia? Why not one of the other labs that has a lot more biology? Craig Venter, Celera CEO, gave a dynamite answer. He said this was easy for them. If you want to look at who is the very best in advanced supercomputing, you come to Sandia.

> *"We're on the verge of a revolutionary new technology for lighting. We've developed and gone through competitive testing of the decontamination foam that has just wiped out the competition in both chem and bio. There're a ton of accomplishments."* — ***Joan Woodard***

***LN**: Where's the world's fastest supercomputer?*

Paul: It's at Lawrence, once it goes into operation. It's not into yet into production operation.

***LN**: Does it have any Sandia algorithms?*

Paul: They are moving closer to our techniques. It is still unique. IBM had been developing it. Celera likes our technique, which makes use of commercial off-the-shelf processors, not special processors or architectures. The regime we'll be working in with Celera follows closely on the line of our C-Plant [computational plant, a cluster of several thousand small computers]. It will initially use the Compaq Alpha chip as the building block. These are very inexpensive chips. You get a lot of supercomputer for a very small amount of money. I also am proud to say Sandia doesn't mind saving money in the process of building supercomputers.

Labs' R&D hitting the marketplace

***LN**: It's a pleasure to talk to you after half a year, at least, of so many good things happening, in contrast to the year or so before that.*

Paul: Good things in research and development continued to happen throughout that period. I am convinced that insights in science and engineering and advances in technology occur completely uncorrelated with the times we live in. Your recent issue of the *Lab News* with the achievements of the last year, the accomplishments issue [Jan. 26], should be living proof. That's as solid a set of accomplishments as you've ever published. And it was during what was one of our hardest years, where people all over the Laboratories were scratching to get through the year.

***LN**: Sandia is losing leading people, like Paul McWhorter, to start new companies. How do you feel about that?*

Paul: One of the national reporters came through here to talk about the Laboratory helping new companies start up based on its technologies. He talked to a number of people. When he wrote the story he began with the following opening, "Imagine that one of the largest, best companies made an announcement of a new program where they would encourage their very best employees to leave." Well, it was a shock. We hadn't quite looked at it in such a stark detail. Technology transfer is a contact sport. I think if people only stayed in the Laboratory it would take longer to get the technology in use. And in that sense, Tom Brennan [who took entrepreneurial leave to found his own company, now a part of Emcore] was one of the first, the trailblazer with technology. I think it's a necessity to get some people moving outside the Laboratory. Tom has now founded a new venture to work more closely with the Laboratory to help create other ventures in the future. I think we should all look at this as a success. I believe over time successful entrepreneurs will still say, "Gee, this has been great. I'm going to turn over the running of the company to someone else and come back to the Laboratory because that's who I am and that's what I want to do."

***LN**: That has happened, hasn't it?*

Joan: Yes, it has. The other thing I wanted to point out is that Emcore is one of our largest CRADA partners. MEMX [the new company founded recently by Paul McWhorter and other former Sandians to commercialize Sandia's microelectromechanical systems technology] will be there some day. We are looking at different models for business for the Laboratory where employees don't have to move totally out of the Labs, taking a full leave of absence. There will be mechanisms where they can still retain relationships with the Laboratories, working with companies, and maintaining the right distance in terms conflict of interest. So, stay tuned. We will have more on that.

Paul: I think we are still experimenting with what are the best ways to blend technology developed by taxpayer money within the government for government missions out into the commercial world. I think we'll try a bunch of models. Maybe we'll never finish experimenting to find the best way.

Pantex

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computer vision to determine the positions of objects, force control to precisely and gently place pits in the work stations, and ample safety features.

"We designed in several layers of safety to make sure the system could never drop or damage a pit," he says.

Mechanical locks and sensors ensure that a sequence of events has taken place before a pit can be let go, for instance, even after a software error or intentional act.

To meet the stringent safety requirements for pit handling, the system passed more than a dozen formal reviews, says Bill. Because the operation had never been done before, new requirements were developed, as well.

Handling pits without doses

When fully operational the WALS is expected to handle 200-300 pits per year. Moving that many pits around manually would result in total doses to human workers of 2,000 to 15,000 millirems per year, depending on the operations performed.

Except for a few container-unpacking procedures early in the weigh and leak-check process, all direct worker contact with the pits will be eliminated by WALS.

Testing and certifying the automated weigh and leak-check process for a variety of pit and shipping-container configurations ensures that safety procedures are followed to the letter every time, says Bill.

Automation also minimizes manual lifting of heavy containers, fixtures, and pits.

"This system is safer and more reliable than a manual process," says Bill. "The designs used in WALS have paved the way for future nuclear weapons-handling operations that will someday be automated."

Sandia now is working on modifying the robot's pit-handling tools so the system can accommodate new sealed insert containers that will replace the old-style containers.

Several Labs' automated systems are already in use around the weapons complex, including a system for inventory and retrieval of pits in storage racks inside Pantex bunkers, a system for automated disassembly of gas generators at Pantex, and an automated canning system for retired plutonium, now part of a prototype plutonium-packaging line at Los Alamos National Laboratory (*Lab News*, May 5, 2000).

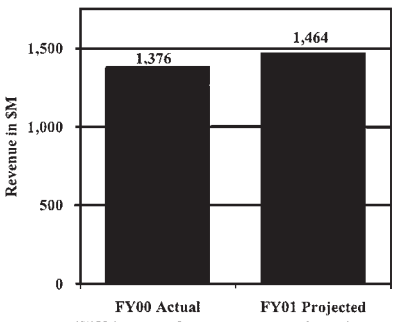
PIT BOT — Bill Drotning, left, and Howard Kimberly with a developmental pit-handling system at Sandia similar to the automated Weigh and Leak-Check System (WALS) now at Pantex. The robot is seen grasping a bowling ball. (Photo by Randy Montoya)

The Sandia WALS team has included Bill, Al Jones (ret.), Howard Kimberly (software lead, 15272), Walt Wapman (hardware lead, 15271), Brian Kast (15271), Charleene Lennox (15272), Paul Johnson (15271), Jim Majors (15271), Dave Darras (former contractor), Dan Homan (former contractor), Bob Watson (9811), Joel Kuhlmann (former employee), Carla Montoya (former employee), Kevin Jones (15272), John Webb (ret.), Ellis Dawson (1639), and Jim Spalding (ret.).

Spotlight on Sandia

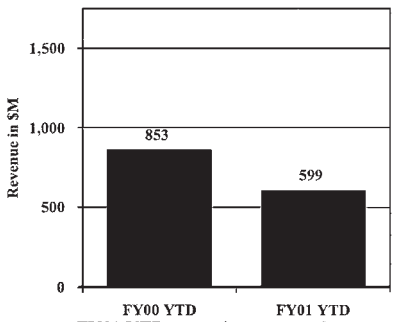
Welcome to the first quarterly report of Sandia's financial health. Frank Figueroa, VP 10000 & CFO, and his folks in the Controller's Organization 10500 developed these charts specifically for publication in the *Lab News* to show Sandia's financial status in various areas. The charts will be updated and published each quarter. The subject matter of three of the charts — those dealing with total operating revenue, year-to-date operating revenue, and affordable vs. actual full-time-equivalent employee counts — will be the same each quarter. The fourth chart, the one at the lower right, will highlight a different aspect of Sandia's financial health each quarter. For this first report, the chart shows the change in Sandia's Laboratory Directed Research and Development (LDRD) program from FY00 to FY01. The significant increase is primarily due to the increase in the sizing constraint from 4 percent for FY00 to 5 percent in FY01 of total operating costs.

Total Operating Revenue Comparison - FY00 to FY01 1st Quarter



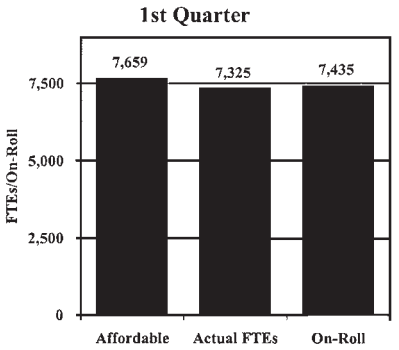
FY01 operating revenue projected to exceed FY00 by $88M, primarily due to growth in NNSA.

YTD Operating Revenue Comparison - FY00 to FY01 1st Quarter



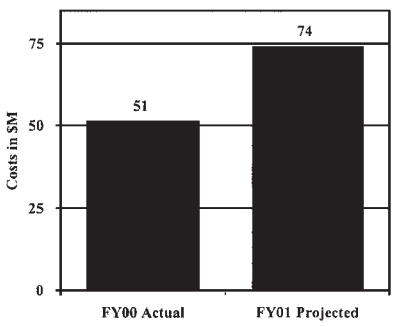
FY01 YTD operating revenue lags behind FY00 by $254M, primarily due to continuing resolutions at start of FY.

FY01 Affordable & Actual FTEs and On-Roll Comparison 1st Quarter



FY01 affordable FTEs significantly above actual and on-roll, primarily due to new hiring ramp-up.

LDRD Program Comparison FY00 to FY01



LDRD Program shows significant increase due to sizing constraint increase from 4% to 5% of lab operating costs.

Magnetic field

(Continued from page 1)

through an adversary's heavy armor. These more mobile sources are already in development. Perhaps most important, though least dramatic, the technique is the fastest, most accurate, and cheapest method to determine how materials will react under high pressures and temperatures. These characteristics can then be expressed in formulas called "equations of state" — equations that tell researchers precisely how materials will react if basic conditions like pressure and temperature are changed by specific amounts.

Accurate knowledge of equations of state is essential for the US to maintain its nuclear weapons without physically testing them. This Science Based Stockpile Stewardship Program uses the most powerful computers in the world to predict the result of unimaginably high temperatures and pressures upon materials. Accurate predictions depend on accurate input about the characteristics of those materials — that is, by a full knowledge of their equations of state.

Researchers currently are unable to determine these material characteristics except by the less accurate, more expensive methods of impacting test materials with laser beams, or at lower energies with projectiles from gas-powered guns.

The propulsion technique works by applying the Z machine's 20 million amps to produce an evolving magnetic field that expands in approximately 200 nanoseconds to reach several million atmospheres pressure. The relatively gentle acceleration produced by the field is similar to that which might be experienced in a very smoothly rising, high-speed elevator, rather than from the shock imparted by a firearm. Accelerated to 13 km/sec, the plates are neither distorted, melted, nor vaporized, as they would be if shot from a gun.

When the plate is accelerated to a speed about 20 times faster than a bullet, or 20 km/sec, the more forceful acceleration needed to reach higher velocity causes temperatures of 2,500 K in the flyer plate; this liquefies aluminum flyer plates. Better understanding of launch configurations is expected to eliminate this problem, though liquidation still is superior to the worst alternative of vaporization — the result if conventional acceleration could be used to reach these speeds. (No power can be delivered from a vaporized pellet.) Characteristics of copper and titanium plates are also being investigated. The plates are accelerated in the vacuum chamber at the core of Sandia's Z machine, the most powerful producer of electrical discharge on Earth. Sandia scientists last year used Z's enormous magnetic field to test materials by compressing them — a method called isentropic compression.

In this even newer technique, staggering the firing of Z's 36 lines eliminates the shock that melts the flyers at the higher velocities. The resultant expansion of the powerful magnetic field propels small objects somewhat the way a surf boarder is propelled who catches one of a succession of enormous waves.

A paper accepted by the *Journal of Impact Engineering* describes techniques that accelerated the plates to 13 km/sec.

A paper to be submitted this spring to the *Journal of Applied Physics* shows how improving the configuration of the loads increased the speed of the "flyer plates" to 20 km/sec. The work is funded primarily by DOE.

Bldg. 807 investigation: Bioassay results come back negative, independent building assessment begins

Investigators still have no answers to the central question, but they do have new ways of asking

By John German

Sandia has reported the results of urinalyses to the 72 people who voluntarily participated in bioassays conducted in January as part of the ongoing Bldg. 807 health concerns investigation.

Of the 72 urine samples tested for the presence of five metals by a private toxicology lab in Salt Lake City, none contained unusual concentrations of thallium, manganese, lead, or mercury.

Two of the samples contained elevated levels of arsenic, but followup analyses of those samples determined that the arsenic was of the organic variety, suggesting dietary origins. Arsenic levels in the other 70 samples were within normal ranges.

Aerospace Systems Development Center 15400 management and staff occupying Bldg. 807's first floor asked for broader medical testing following reports from some employees that bioassays conducted by their private physicians indicated the presence of thallium in blood samples (*Lab News*, Dec. 15, 2000).

Sandia's Medical staff offered the urinalyses after toxicological experts recommended this procedure as a preferred method (rather than blood analyses) in cases of possible long-term, low-level exposure.

"These results, together with the industrial hygiene sampling and analysis from last spring, provide some reassurance that employees in the building are not experiencing current, low-level exposures to these metals," says Sandia Medical Director Dr. Larry Clevenger (3300). "But we still have a lot more questions than answers in this investigation."

No new answers

The negative bioassay results, while they represent another step in unraveling the Bldg. 807 mystery, says Larry, still leave employees without an answer to the question that has been driving the investigation for more than a year: "What is causing some people who have worked in Bldg. 807 to feel ill?"

"The bioassay results are reassuring to the people living in Bldg. 807," says Jerry McDowell, 15400 Director. "However, the most profound symptoms were experienced by people with offices in a hallway that was evacuated several months ago. Unfortunately, we did not collect bioassay data from people while they were residing in the most suspect area of the building. As a result, many employees are still looking for answers."

"We are looking for advice from people that have many years of experience investigating these types of problems."

So far no current or past hazard has been identified that explains the health problems of the more than 50 people who are concerned that something in the building might have caused a variety of health issues. (For a summary of the investigation, see http://www.sandia.gov/health/advisory/index.html.)

Independent sampling

The Bldg. 807 Management Action Team, headed by VP-7000 Lynn Jones, now is exploring new ways of asking the question in hopes they will lead to answers.

Sandia this month opened a services contract with IHI Environmental, a private environmental consulting company based in Salt Lake City, to perform an independent indoor environmental quality assessment of Bldg. 807.

Early last year, Sandia's industrial hygiene experts collected and analyzed nearly 200 air, dust, breathing zone, and drinking water samples from the building's offices, common work areas, and HVAC systems to try to pinpoint a chemical that might be causing the health concerns.

That effort turned up nothing indicating the presence of a current health hazard.

"Our employee advisory team recommended that a comprehensive, independent evaluation of the facility was a necessary component of the investigation process," says Larry. "Results from such an evaluation would provide additional information about specific areas of Building 807 and would be a helpful complement to the studies completed earlier in the year by Sandia's industrial hygiene staff."

Six-phase building assessment

Jeff Downs (7124) and Judy Davenport (15405), working with a group of concerned employees, helped define the contract's requirements and guided the contractor-selection process, beginning with a pool of 14 candidate companies specializing in building health evaluations.

IHI will follow a six-phase approach to its assessment of the building. The first phase, to begin within a month, will include literature research to correlate the employees' reported neurological and respiratory symptoms with possible toxins and then develop three alternative plans to detect the presence of agents likely to cause these symptoms.

In phases 2 through 6, IHI will conduct new sampling and analysis in the building, develop and carry out plans to characterize or quantify exposures to any identified toxins, and coordinate remediation of identified exposure sources, if necessary.

IHI will have access to historical, design, and industrial hygiene information regarding the building throughout the investigation and will collaborate with the University of New Mexico team conducting an epidemiological study of the building.

That work is expected to be completed by late spring, says Larry.

"An independent team will bring in expertise in areas that Sandia has not investigated yet, such as looking at microbial activity," says Judy. "We are looking for advice from people that have many years of experience investigating these types of problems, whether they are building-, environmental-, or program-related."

A planned project to renovate a filter bank serving the building's induction ventilation air-intake system has been put on hold until IHI can assess the filters, says Johnny Vaughan (7000). See the Bldg. 807 investigation Web site for details about the work.

The next level of understanding

Meanwhile the epidemiological study of the reported illnesses by doctors at UNM's Health Sciences Center continues. In late December UNM mailed questionnaires to some 700 people, including former and current Bldg. 807 occupants and some non-occupants who will serve as a control group.

UNM will use data from the survey to try to understand, from an epidemiological perspective, how the prevalence rates and distributions of symptoms experienced by individual 807 occupants differ from other populations.

"It is important that every individual who receives a questionnaire complete and return it to UNM," says Larry. "These survey results will be very helpful in better understanding the health issues that have surfaced in the investigation."

He says the initial phase of the study, which might result in new hypotheses and a recommendation for more specific studies, should be completed in the next few months.

"The epidemiological study will allow us to do some stratification and analysis so we can try to isolate some of the health issues," he says. "We hope they will get us to the next level of understanding."

Sandia science fair judges encourage next generation of Labs' technical talent

IT'S LIKE THIS — Sandia geophysicist Marianne Walck, Manager of Geophysical Technology Dept. 6116, explains the internal dynamics of a volcano to a fourth-grade student at Collette Park Elementary School in Albuquerque during the school's Feb. 13 science fair. During science fair season, scores of Sandians volunteer their time and expertise as judges. (Photo by Randy Montoya)

Sandia Classified Ads Sandia Classified Ads Sandia Classified Ads Sandia Classified Ads

MISCELLANEOUS

YOUR VACATION, our timeshare, anywhere you want to go for a week. Walters, 857-9767.

FOUR 6-PLY M/S TIRES, N78-15, on Ford 15-in. white spoke wheels, less than 200 miles, $275; Warner/Swasey engine lathe, 12-in., new Miller 250 wire-feed mig welder, drill-press, welder's work station, & much more. Schaub, 865-8807.

OAK ENTERTAINMENT CENTER, 5'3" wide, video slide-out, smoked glass stereo area, lights, adjustable shelves. Savage, 837-2692.

YAKIMA ROOF RACK, extra wide, $60; Thule roof rack/bike attachment, $70; ski attachment, $35. Dell, 291-0274.

WAVELESS WATER BED, king-size, soft side, 6-drawer under bed storage, standard king sheets, $250 OBO. Martinez, 298-7382.

CHEVROLET/PONTIAC CONVERTIBLE TOP BOOT, fits '88 through'91, spotless, $37.87 OBO. Underhill, 294-5774.

STERLING FLATWARE SERVICE, for 12, 6-piece place settings w/serving pieces, excellent condition, $2,000. Bentz, 857-0728.

SCHACHT HAND LOOM w/8 harnesses, shuttle, & various accessories. Larsen, 292-7896.

BMX BIKE, Giant Mosch, aircraft-aluminum frame, 22-in. wheels, helmet, new seat, paid $430, asking $199 OBO. Dubicka, 296-6557.

TABLE SAW, 8-in., table saw & 4-in. jointer on castered stand, 3/4-hp motor, Sears Craftsman, $125. Coleman, 884-5009.

GIFT CERTIFICATES, Octopus Car Wash, full-service, books of 5, $25 ea., 2 available. Wilson, 244-1949.

MACINTOSH QUADRA 700, keyboard & monitor, includes external drive, excellent condition, $200 OBO. Pryor, 275-7780.

PICKUP CAMPER COVERS, one aluminum, insulated, white, & one fiberglass, red, $100 & $150. Muirhead, 281-2925.

MOVING SALE: entertainment center, computer desk, bedroom, dining, living room furniture & more, call for details. Manginell, 294-2896.

EXERCISE BIKE, old; scales, diet 1-16 oz. measurements; twin box spring, mattress, headboard, new sheets. Beck, 294-4591.

FIVE MOTOROLA MOBIL RADIOS, price negotiable. Zamora, 864-4647, ask for Richard.

DODGE CAMPER SHELL, black/silver, $125; console color TV, 24-in. screen, $75; gray/beige flower design couch, $50. Crosby, 260-1070.

HARPSICHORD, French double manual w/stand, '76 from Hubbard kit, transposing keyboard, ebony case, goldleaf banding, $7,900 OBO. Allendorf, (925) 294-2895.

CRIB/MATTRESS, $100; stroller, $25; car seat, $20; infant seat/stroller, $15; portable crib, $25. Tharp, 792-0790.

WOOD PANELING, out of large family room, free. Akers, 797-1096.

BRUTUS WEIGHT BENCH, excellent condition, squat, adjustable bench, curl, leg-extension/curl, etc., includes 750 lbs., bars, dumbbells, $275. Snelling, 293-3949.

FAXMODEM, US Robotics Sportster External, 33.6 56K, $40; computer tower stand, $15; homemade coffee table, $20. Wilsey, 237-8614.

OAK SLEIGH BED, queen-sized headboard & frame, a beautiful steal-of-a-deal, $600. Hess, 899-8139.

TRAILER HITCH, Reese brand, class-3 (5,000 lbs.), 2-in. receiver hitch for current body style F-150 Ford ('98-'01), cost new $181, asking $90. Dobbs, 281-1958.

DINING TABLE, 36" x 60," smoked glass, w/oak trim, 6 chairs, $75. Schiller, 856-0744.

WATER BED, queen-size, oak frame, w/storage drawers & book shelf headboard, $150. Low, 299-7395.

BUTCHER-BLOCK FURNITURE: couch, chair, ottoman, coffee table, 2 end tables, $250 photos http://members.aol.com/lawishard/; woman's skis & boots, size 7, $25. Wishard, 292-4802.

DAYBED, w/popup trundle & mattresses, $200; new queen-size pillowtop mattress set w/frame & headboard, $350. Maddox, 298-3815.

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

COFFEE TABLES, Autumn Wood, laminated oak slab, Danish walnut finish, 22" x 46" x 16" H & 20" x 28" x 16" H, $75. Gubbels, 884-3711.

MATTRESS SET, Sealy, full-size, pillowtop mattress, box spring & frame, new, recently purchased, never slept on, $350. Rogers, 798-0311.

NEW LINOLEUM, approximately 80 sq. ft., simulated tile, earth tones, $50; two 5' x 7' mirrored closet doors, free; computer SVGA, 15-in., color monitor, sleep mode, very nice, $40. Mouncho, 299-0883.

NORDICTRACK PRO, never used, $200; Summit St65 stair stepper, $50. Edmonds, 275-7768, ask for Joe.

DINING ROOM TABLE, w/2 extension leaves (44-80"L), pecan/dark oak, 4 matching upholstered oak chairs, very nice, $300. Molecke, 296-5850.

HOTPOINT WASHER/DRYER, heavy duty, $300/pair; TEMA entertainment center, $100; wicker twin headboard, $50; rocking chair, $25. Holt, 332-0582.

FOUR MICHELIN TIRES, mounted on Mercedes rims, 205-70-R14, Roadhandler Sport, very good condition, $250. Cordova, 292-4477.

SUNSETTER RETRACTABLE AWNING, w/cover, 13'W, coffee stripe, installation instructions, used only 3 mos., $600 OBO. Palya, 881-2720.

TWO ADJACENT LOTS, w/cement liners, in Sandia Memory Gardens, both for $1,150. Hodgden, (936) 636-2351.

FISHER-PRICE BABY MONITOR, w/AC adapter, $20; electric baseboard heater, 8-ft., $10. Cocain, 281-2282.

JUKEBOX, 50's, Seeburg KD200, great sound, play either side of 100 45-rpm records, $1,300 OBO. Moss, 275-7299.

VERTICAL MILLING MACHINE, 2-hp, stand, tooling, like new, $800; 58-ft. tapered aluminum pole, $300. Harrington, 296-8208.

SNAPON TOOLS, never used, torque wrench, $180; hex driver set, $140; impact driver, $140; more. Clevenger, 821-0046.

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

HONDA EB11000 GENERATOR, 11-KW, used 6 weeks to power trailer, less than140 hrs., new with no scratches or dents, $4,000. Boissiere, 922-6095.

MUSIC EQUIPMENT: mixer, $150; equalizer, $80; monitor speakers, $100; TX81Z synthesizer module, $100; metal rack(s), $10 ea. Sleefe, 281-4103.

KING-SIZE WATERBED, 6-drawer, mirrored headboard, complete w/padded rails, heater, liner, mattress pad, sheets, $175 OBO. Shoulta, 293-2697.

EXERCISE MACHINE, stair stepper, Precor model 719E w/digital readouts, almost new, $200 OBO. Santana, 294-0536.

MATERNITY CLOTHES, long/short sleeve shirts, pants, pantsuits, jackets, dresses, etc., sizes SM-XLG, excellent condition. Lopez, 831-0777.

VACUUM CLEANER, Hoover upright, self-propelled, $35; shop vac, 4-hp, $40; Raleigh 12-spd. bike, $35; steel shelf, $5; man's golf clubs, $35. Gluvna, 884-5251.

OUTBOARD MOTOR,'98 Merc., 3.3-hp, like new condition, $400 firm. Stinebaugh, 275-3170.

TELESCOPE, Dobsonian, 6-in., F/8, w/8 x 50 finder scope, Plossl10 & 25 eyepieces, $300. Garrett, 856-6191.

PIANO, Currier spinet, maple finish, 48" H, 56" W, 42" D, 88 keys, $350. Humphreys, 292-5819.

WASHBURN GUITAR, D12-N, acoustic 6-string, excellent condition w/hardshell, fuzzy-lined case, $350; 2 mandolins made by Doce, a retired Martin guitar maker, $225 & $425. Newman, 266-6928.

GEORGE STRAIT CONCERT TICKETS, in Vegas 4/1, 3 floor seats at face value, $178.50 for all. Chavez, 265-7331.

TRANSPORTATION

'93 TOYOTA SR5, extra-cab, 4WD, 57K miles, fully loaded, w/shell, excellent condition, one owner, $11,000. Jinzo, 345-6388.

'97 SATURN, SL1, AC, 5-spd., radio/tape, 81K miles (freeway), new tires, good condition, $7,600. Bauerle, 792-3157.

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 frame, 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.**

'96 CHRYSLER T&C MINIVAN, power everything, CD/tape, power-train warranty, excellent condition, book $17,500, make offer. Strascina, 797-3639.

'89 MAZDA, 323, 5-spd., 114K miles, 33-mpg, AC, stereo, runs great, some dents, $950 OBO. Sayre, 296-9341.

'77 DODGE 4X4 POWER WAGON, winch, solid ambulance box for possible hunting RV, runs well, $1,750 OBO. Schaub, 856-8807.

'90 HONDA ACCORD, 5-spd., AC, 175K miles, roof needs paint, new tires, new battery, $2,500. Reber, 898-0076.

'95 CHEVROLET TAHOE 4X4 LT, 4 dr., every option, runs perfect, 150K highway miles, $18,500 OBO. Sanchez, 866-4225.

'89 CADILLAC SEVILLE, 4-dr., white/red leather, 99K miles, beautiful, $5,800 OBO. Thuman, 881-3885, leave message.

'85 MAZDA RX-7, AC, AM/FM/cassette, bra, good condition, 85K miles, $2,000 or trade for older Jeep Cherokee. Keltner, 298-7577.

'84 FORD F-150 TRUCK, PS, PW, AT, 80K miles, runs great, $2,000 OBO; small camper shell, $100 OBO. Chavez, 323-9343.

'97 CHEVROLET S10, 4x4, 3-dr., extended cab, white, 4.3 V6, AT, 56K miles, alarm, custom wheels & tires, $14,300. McDuffie, 296-8510, ask for Keith.

'71 FORD F150 PICKUP, new engine, 9K miles, $1,800 OBO. Zamora, 296-8251.

'98 CHEVY 4X4, 1/2-ton, extended cab, 5.7-liter, AT, every option except leather, white/pewter, matching white camper shell, 17,200 miles, always garaged, all highway miles, looks like new, $23,000. Dwyer, 271-1328.

'77 V-8 VEGA GT, rebuilt alum. 215, 4-spd., new duals, tires, needs minor work, very quick, $2,000. Gritzo, 292-3244.

'99 BMW F650, 6,800 miles, black, GIVI bags, $6,200. Foster, 271-2008.

'99 GMC JIMMY, 4x4, 4-dr., SLT, 12K miles, loaded, security system, tow package, under warranty, like new. Hackard, 299-4333.

'75 FORD TORINO, fully reconditioned, excellent shape, $2,500 firm. Armstrong, 832-4496, ask for Barbara.

'87 GMC JIMMY, full-size, 350, 4WD, PS, PB, PW, AT, $3,900. Garner, 899-0370.

'00 CADILLAC, Escolode silver, under 3K miles, book $38,825, make reasonable offer. Hayden, 831-3226.

'95 CHEVROLET LS PICKUP, extended cab, 4-cyl., 5-spd., AC, PS, AM/FM, bedliner, cruise, alloy wheels, 54K miles, great condition, $9,000 OBO. Vigil, 877-5922 or 620-4440.

'93 GMC STEPSIDE PICKUP, Z-71, 4WD, matching snug-top, beautiful green, all records, $11,300. Collins, 286-8035.

'93 MAZDA PROTEGE LX, 4-dr., AT, AC, PW, PS, cruise, alloy wheels, AM/FM/cassette, 57K miles, $4,100. Wright, 298-4567.

'92 JEEP CHEROKEE LAREDO, 4-liter high-output six, 4WD, AT, AC, full power, excellent condition, below retail, $6,990. Hollister, 323-1659.

'93 TOYOTA PREVIA VAN LE, 4WD, 86K miles, loaded, new tires, transferable warranty, logbook, $10,600. Mundt, 293-2444.

'95 HONDA ODYSSEY VAN, white, AC, AT, power, low miles, mint condition, $13,700. DuBay, 268-0307.

'99 FORD RANGER XL, regular pickup, 2.5L-EFI, 5-spd., manual OD, AC, AM/FM, harvest gold, 14K miles, $8,950 OBO. Lin, 821-6183.

'96 CHEVY BLAZER, 4WD, 4-dr.,V6, AT, AC, cassette, white, 57K miles, excellent condition, $14,400 OBO. Wilson, 821-6703.

RECREATIONAL

'88 MOBILE TRAVELER MH, 21-ft., less than 38K miles, new GM 350 w/warranty (less than 3,000 miles), $10,500 OBO. Stephens, 292-9867.

BICYCLE, Trek Mountain Track 800, woman's, 26-in. wheels, red frame, like new, $140; Rhode Shuttle adjustable 3-bike carrier, $35. Smallwood, 839-7298.

'93 DUTCHMEN, 28-ft. CLC, 15K miles, fully equipped, levelers, stove never used, like new condition, twin beds, Ford 460. Hayes, 299-1200.

'99 MOBILE SCOUT TRAVEL TRAILER, 26-ft., lightweight aluminum frame, front kitchen, queen bed in rear, oak interior, all available options, like new, $16,500. Carson, 797-1730 or 480-6025.

'87 RINKER SKI/FISH BOAT, 17-ft., 140-hp, Merc, I/O, SS prop, new full Bimini top, plus accessories, $5,000. Kelly, 271-9589.

LAKE POWELL TIME SHARE, 60-ft. house boat, mid May, $850/yr. maintenance fees, $3,500/offer buy in. Hudson, 821-8988.

'94 BASS TRACKER PONTOON BOAT, 18-ft., 40-hp, Merc. boat, motor, trailer, trolling motor, like new, extras, $7,000. Whatley, 898-7742.

GO CART, street slicks, live-axle, 5-hp B&S, alcohol-ready, disc breaks, fast, $200 OBO. Adcock, 873-1821.

'98 CAMPING TRAILER,Starcraft Spacestar, fully self-contained, sleeps 6, excellent condition, NADA $7,945, asking $7,500. Drake, 866-6494.

'88 CIMARRON TRAVEL TRAILER, 34-ft., new fridge, AC, M/W, queen bed, spotless, loaded, hitch, $6,995. LeRoy, 296-4575.

NEW SNOWBOARD, Rossignol Nomad w/DNR interface bindings, ladies' boot also available. Veres, 797-4714.

BICYCLE, street/road, 23-in., Bertin frame, 27-in. wheels, seat pack, luggage rack, tools, lock, spares, etc., $200. Lambert, 293-8825.

SLIDE-IN CAMPER, Mitchell Fish Hut, good condition, LWB, $600. Eisenberger, 877-7041.

KAYAK, red, Perception KeoWee, 2-seater, large cockpit, tracks well w/1 or 2 paddlers, excellent condition, $300. Murphy, 294-1778.

MOUNTAIN BIKE, boy's, 24-in., Trek, 18-spd., metallic blue, very good condition, $175. Baldwin, 856-5309.

REAL ESTATE

3-BDR. HOME, completely remodeled, huge yards, corner lot, great rental property, must see, NE Heights, $6,000 down, plus closing costs & take over payments at $88,000. Lewis, 294-0766.

2-BDR. HOME, 1 bath, 1,100 sq. ft., beautifully remodeled, hardwood floors, cove ceilings, Italian tile, near Bataan Park, $130,000. Brandiger, 284-5208.

4-BDR. HOME, 2-1/2 baths, 2,435 sq. ft., wonderful family home nestled in quiet NE cul-de-sac, huge yard, FSBO, $172,000. Bailey, 271-9715.

2 BDR. CONDO, 1 bath, Nob Hill/UNM, great for college kids, $50,000. Tanner, 265-4429.

TWO-ACRE VALLEY LOT, in Tome, covenants, owner will finance. Aronson, 898-8893.

3-BDR. HOME, newly remodeled w/ marble & glass-block accents, professionally landscaped, 1,515 sq. ft., excellent location, Menaul & Juan Tabo, $131,500. Garcia, 294-7872.

4-BDR. HOME, 2-1/2 baths, 2,800 sq. ft., all brick, brand new roof, new heater & AC, Glenwood Hills neighborhood, market appraisal $239,000, asking $219,000 without realtors. Dwyer, 271-0741.

3-BDR. CUSTOM HOME, 1,844 sq. ft., will consider trade, your Albq. home for home in Edgewood, 2.2 acres, beautiful area, paved roads, awesome views, $168,900. Bronkema, 286-0423.

4-BDR. HOME, 2 new baths, 3,000 sq. ft., in-ground pool, great northeast neighborhood, w/views, $279,000. McDonald, 299-0314.

WANTED

CHILDREN'S TOY BOXES, good size, good condition, & right price, need 2. Hernandez, 857-9233.

GENTLY USED CAR, for Nana to transport grandkids, PB, PW, 6-cyl., reasonably priced. McIntyre-Pacheco, 873-0999.

SMALL SAIL, or storm sail for Bic sailboard. Stromberg, 299-8591.

CHESAPEAKE BAY RETRIEVER PUPPY, purebred or cross OK, must be well socialized, parents available for view. Rockwell, 884-4206.

ELECTRONIC MOTORIZED TREADMILL, (not self-powered), for relaxing walk in the evenings. Jenkin, 299-9309.

QUEEN BED. Lauben, 275-7466.

C64 GAME, M.U.L.E, PC copy. Haynes, 268-9370, after 5 p.m.

JAZZ MUSICIANS (especially rhythm section), for informal jams w/intermediate-level saxophonist, also interested in sax quartet. Davis, 296-4879.

PORTACRIB & stroller. Stixrud, 298-0478.

ICE SKATES, cross-country ski equipment, for 6 & 9 yr. olds. Ling, 281-5328.

LOST & FOUND

TURQUOISE LOOP EARRING, found, in parking lot, south of cafeteria. Sleeter, 844-2432.

SHARE-A-RIDE

EAST MOUNTAIN VANPOOL, has openings, no need to drive, Frost Rd., N-14, Tijeras. Burns, 281-3922 or Brocato, 286-8031.

'Your Thoughts, Please' poses second question

There's a new opportunity to express your opinion through questions posed by the *Sandia Daily News*-based "Your Thoughts, Please" program.

This month's question: "The Sandia Board of Directors is interested in learning more about what Sandians think about Lockheed Martin Corporation. Please address any of several things within your response — What do you believe Lockheed Martin should provide to Sandia as an entity? Do you believe Lockheed Martin should provide anything specifically to employees? What value has Lockheed Martin added to the Labs since it began operating Sandia for DOE? What are you most familiar with concerning Lockheed Martin's involvement with the communities in which Sandia operates? Other comments you believe are important?"

For a reminder about the program's ground rules see the Jan. 12, 2001, *Lab News* (page 9), the Feb. 21 or Jan. 24 issues of *Sandia Daily News* on the web at http://www-irn.sandia.gov/newscenter/news-frames.html, or contact Bruce Hawkinson (844-4042) or Rod Geer (844-6601).

Brave students to spin wafer coatings in zero gravity

No matter what you do, don't take your first 'vomit comet' ride on a full stomach

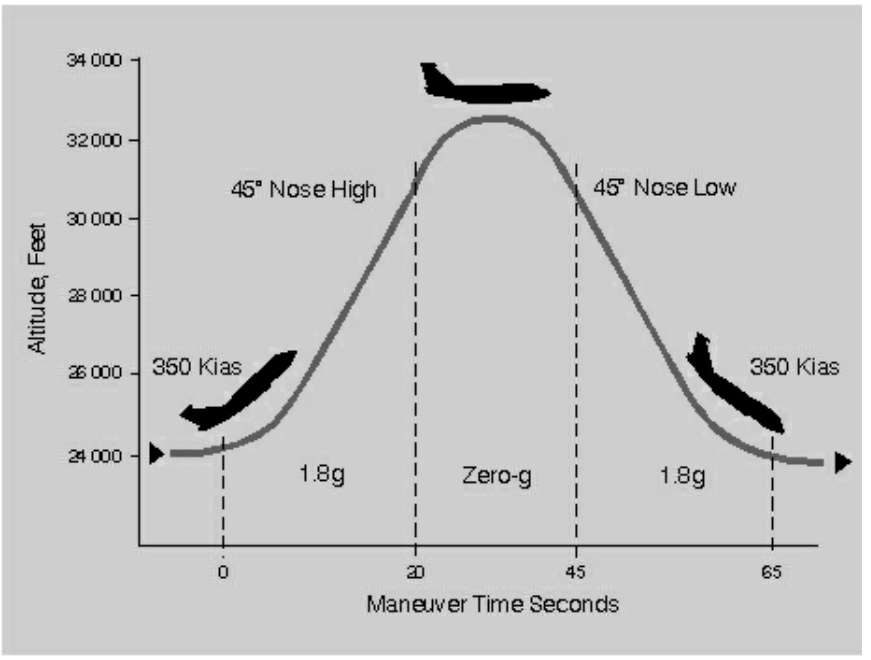
By Neal Singer

If — 32 times over a two-hour period — food or liquid in a human stomach is accelerated upward and then downward, experiencing two G's each cycle and freefall at each upper changeover, a gastronomically unpleasant situation may occur, interpreted by stomach and brain as a mandate to retch.

That is the situation facing Sandia student intern Jason Brown (1812) and three other chemical engineering students from the University of New Mexico when they ride NASA's KC-135A airplane on March 29-30 to learn whether a viscous polymer coating applied to a spinning silicon wafer can be deposited more smoothly in zero gravity than it can be on Earth.

"This," Jason says, "is the ultimate roller coaster. And I love roller coasters."

The gutted, former stratospheric-tanker refueling plane they will ride over the Gulf of Mexico climbs on a 45-degree angle that resembles (photographed just above the clouds) a passenger plane making an eerie break for freedom. The plane goes weightless near the pinnacle of its parabolic arc for about 30 seconds, when experiments must take place, and then accelerates downward before rising again. The four college students, riding in pairs, will get 30 passes of weightlessness on each flight, along with one arc approximating the gravity of the Moon and another of Mars.



NASA'S LEGENDARY "Vomit Comet," a modified KC-135, flies a series of these up-and-down arcs, or parabolas, to give its passengers a light-headed feeling. At the top of each parabola the contents of the plane are weightless. Essentially, the plane and everything in it are in freefall as they go over the top of the parabolic arc. At the bottom of the parabola, as the plane pulls up to climb again, things feel almost twice as heavy as they do on Earth. The roller-coaster nature of the flight path induces nausea in about 60 percent of passengers. (NASA graphic)

ZERO G AND I FEEL FINE — University of Michigan engineering students in the KC-135 "vomit comet" during last year's round of NASA's student microgravity experiments. (University of Michigan photo)

Jason and coinvestigating UNM student Kelly Kuhn readily agree that "Being All You Can Be" is not usually part of the reason people study chemical engineering, but say their class is dedicated to changing the image of chemical engineers from "little guys with calculators and pocket protectors."

"Of course, we expect to write a paper on this," says Kelly, who also admits she is debating whether to swallow a NASA-offered anti-nausea pill that will settle her stomach but might slow her thinking.

The KC-135A ride is popularly referred to as the "vomit comet" because about 60 percent of riders on these flights experience nausea. Similar intermittently weightless flights have been used by NASA in support of most of its major space initiatives.

What will happen to the coating at zero gravity is unknown and of scientific interest, agree Jason's mentor Steve Thornberg (l812) and spin-coating guru Tony Farino (1746). Steve provides technical guidance and helped obtain corporate support for the proposal that NASA accepted; Tony provided the students the necessary test equipment. The students — who also include Doug Peters and Bill Jackson, with Tom Gamble as backup — will vary the wafer's spin speed, coating thickness, and rate of deposition. The results will be compared with identical tests run earlier in Earth's gravity. The researchers may find that gravity makes no difference to the evenness of deposit. Or they may find that the absence of gravity means the coating won't adhere at all but instead just floats off. Or they may . . . just may . . . help define parameters from which a better quality coating can be made.

There are other reasons for going. The UNM-based, Sandia-backed group won one of NASA's 16 slots for student experiments — heavily competed for among hundreds of college student teams — partly because they intend to build on their already-demonstrated activism. "We plan to take videos and pictures of us floating, and after we come down, visit grade schools to show kids that science can be exciting," says Jason.

But the golden fleece of Jason and the other Argonauts is to form better coatings on their spinning silicon wafers. To achieve this, the self-named Spin Doctors have "ruggedized" their equipment by installing a metal frame around their plastic work bench. They secured the analytic equipment to the bench, installed bolt brackets to attach the table to the floor of the plane, completely covered the top of the spin-coater's hood to prevent unwanted expulsions of material during weightlessness, and are considering changing plastic hood hinges to metal. They will have eight days of training in Houston before going up with their project, and will bring their prized results — which in size, shape, and luster resemble music CDs — back to Sandia for analysis.

Steve, who'll be at NASA's Ellington Field during the flight, hopes he doesn't hear any radio message announcing, "Houston, we have a problem." But he's happy with the project. He says that the science of the trip is right in line with Sandia's basic mission in semiconductors and the Laboratories' long-standing support and encouragement of students, which is why Sandia corporately sponsored the UNM proposal to NASA.

Also helping are Sandia High School students Cindy Stallard and Jessica Saunders. The title of the student experiment is "Study of Polymer Spin Coating for Photolithographic Semiconductor Development in Space."

Retirees and near-retirees: Interested in teaching?

Sandia will be partnering with the City of Albuquerque and local educational institutions to enable professionals retiring from the workplace to transition into the classroom (K-12).

The proposed program will focus on recent retirees as well as employees contemplating retirement within the next five years.

If you are interested in exploring this opportunity, send an e-mail to Patrick Milligan (12650) at pbmilli@sandia.gov or call him at 844-5150.

Recent Patents

Robert Rowe and Edward Thomas (12323): Methods and Apparatus for Tailoring Spectroscopic Calibration Models.

M. Steven Rodgers (1749): Compliant Displacement-Multiplying Apparatus for Microelectromechanical Systems.

Sympathy

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

To Joan Woodard (2) and Jim Woodard (5922) on the death of her mother and his mother-in-law, Mildred Anna Brune, in St. Louis, Mo., Feb. 2.

To Sophia Garcia (12660) on the death of her brother, Steve Olona, in Austin, Texas, on Nov. 21.

Coronado Club

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

Feb. 23 — Western Night; buffet, $11/person; dancing to the music of Isleta Poorboys.

March 1, 8, 15, 22, 29 — Bingo

March 16 — St. Patrick's Day celebration, 7-11 p.m. Music by Roger Burns Trio; Irish Step Dancers of Colorado, 8-8:30 p.m. Reservations required: 265-6791.

March 18 — Sunday brunch buffet; buffet 10 a.m.-1 p.m.; music by Swing Shift 1-4 p.m.

Video Services productions earn international recognition in two recent competitions

Video Services Dept. 12610 productions have achieved finalist status in the 43rd New York Festivals International Film and Video (non-broadcast) competition: "They Once Were Where You Are Now" (Multicultural Education category), produced by Myra Edaburn for Marie Brown (3511) and the American Indian Outreach Committee; and "Improving Robotic Dexterity" (PR: Customer Relations category), produced by Regina Valenzuela and Bob Gardner for Leslie Rettinger (15201) and Ray Harrigan (15221).

"In a record-breaking year of entries, these productions have surpassed thousands and been recognized as the world's best work," says a New York Festivals news release.

The same two video productions received second-place Awards of Distinction from The Communicator Awards competition. "The Weapon Intern Program Presents the Graduating Class of 2000" received Honorable Mention (third place) in the Tribute category; produced by Myra Edaburn for John Hogan (2907) and Andy Rogulich (2911).

The Communicator Awards is a national program that recognizes outstanding work in the communications field. There were 3,312 entries in the 2000 competition.