Sandia, UNM research shows brain injury may occur within one millisecond after head hits car windshield

Damage begins prior to any overall motion of head and is a new concept for doctors to consider

MODELING BRAIN INJURY — Sandia engineer Paul Taylor (1435), left, and Corey Ford, neurologist at the University of New Mexico's Department of Neurology, study models of early traumatic brain injury. (Photo by Randy Montoya)

By Chris Burroughs

Research by a Sandia engineer and a University of New Mexico Health Sciences Center neurologist shows that brain injury may occur within one millisecond after a human head is thrust into a windshield as a result of a car accident.

This happens prior to any overall motion of the head following impact with the windshield and is a new concept to consider for doctors interested in traumatic brain injury (TBI).

Paul Taylor of Sandia's Multiscale Computational Materials Methods Dept. 1435 and Corey Ford, neurologist at UNM's Department of Neurology and MIND Imaging Center, made the discovery after modeling early-time wave interactions in the human head following impact with a windshield, one scenario leading to the onset of TBI.

TBI is associated with loss of functional capability of the brain to perform cognitive and memory tasks, process information, and perform a variety of motor and coordination functions. More than five million people in the US live with disabilities associated with TBI.

"In the past not a lot of attention was paid to modeling early-time events during TBI," Paul says. "People would — for example — be in a car accident where they hit their head on a windshield, feel rattled, go to an emergency room, and then be released. We were interested in why people with head injuries of similar severity often have very different outcomes in memory function or returning to work."

More notice has been given to TBI in recent years because of the large num-

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Honoring one of our own

Sandia pioneer Glenn Fowler honored for his contributions in helping the Labs live up to President Truman's charge: "Exceptional service in the national interest." See photo and story on **page 7.**

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Sandia National Laboratories

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Labs partner with state to help NM small businesses

Sandia, Los Alamos National Laboratory, and the State of New Mexico recently announced the signing of a joint memorandum of understanding to formalize and strengthen a collaborative effort to bring technology and expertise of the national laboratories to small businesses across New Mexico.

Exercising provisions within the "Laboratory Partnership with Small Business Tax Credit" passed by the state legislature in 2000, the New Mexico Laboratory Partnership increases the level of expertise and resources both labs can devote to communities and small businesses facing technical challenges and other obstacles to economic growth.

"This is an important step toward creating the partnerships and business climate needed to ensure strong and vibrant regional and state economies," said Lillian Montoya-Rael, director of Los Alamos National Laboratory's Community Programs Office.

"This is also a very clear demonstration of the governor's and state legislature's commitment to leveraging the presence of national labs in New Mexico and to building a brighter future for the entire state," added Montoya-Rael. "This program mirrors the New Mexico Small Business Assistance program [NMSBA] first established by Sandia in 2000."

The purpose of the MOU is to document the relationship between the parties and recognize the collaborative effort to bring technology and expertise of the national laboratories to small businesses in New Mexico by developing a joint NMSBA program.

"This MOU creates one program using the resources of two national labs," says Vic Chavez, manager of Supply Chain Resources and Development Dept. 10222. "Sandia's NMSBA program has made a significant impact around the state. I envision even greater successes as we join together with our colleagues at Los Alamos."

'Fingerprinting' technique demonstrates wireless device driver vulnerabilities

Mike Janes

The next time you're sipping a latte´ and surfing the Net at your favorite neighborhood wireless café, someone just a few seats away could be breaking into your laptop and causing irreparable damage to your computer's operating system by secretly tapping into your network card's unique device driver, a team of researchers at Sandia/California has concluded.

There is, however, more cheerful news. By role-playing the position of an adversary (also known as "red teaming"), Sandia researchers have demonstrated the unique "fingerprinting" technique that allows hackers with ill intent to identify a wireless driver without modification to or cooperation from a wireless device.

Fingerprinting is a process by which a device or the software it is running is identified by its externally observable characteristics.

Revealing this technique publicly, Sandia researchers hope, can aid in improving the security of wireless communications for devices that employ 802.11 networking.

Wireless device drivers fraught with vulnerabilities

Device drivers, according to security researcher Jamie Van Randwyk (8965), are becoming a primary source of security holes in modern operating systems. Through funding from the Laboratory Directed Research and Development program, Jamie and a team of college interns set out last year to design, implement, and evaluate a technique that has proved capable of passively identifying a wireless driver

> *"Wireless network drivers, in particular, are easy to interact with and potentially exploit if the attacker is within transmission range of the wireless device."*

used by 802.11 wireless devices without specialized equipment and in realistic network conditions. Jamie presented his team's findings last month at the USENIX Security Symposium in Vancouver, British Columbia.

Video and keyboard drivers are generally not exploited because of the difficulty in attaining physical access to those systems, leading some to believe that device drivers are immune to vulnerabilities. However, Jamie says, physical access is not necessary with some classes of drivers, including wireless cards, Ethernet cards, and modems.

"Wireless network drivers, in particular, are easy to interact with and potentially exploit if

(Continued on page 4)

Winging it at the sled track. Story on **page 7.**

Also inside . . .

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What's what

This year's retiree picnic at the Rio Grande Botanic Garden near Albuquerque's Old Town was, by any account, a success. More than a thousand people showed up at a lovely setting and enjoyed reminiscing with old friends and colleagues.

But Joseph Muench, who retired in 1987 after a Sandia career of 40+ years, has a suggestion for the planners of what he and others hope will be next year's picnic — that it be a little earlier in the day. Having a picnic as a get-together for retirees "is appreciated and a good idea," he wrote recently from his Placitas home. He signed up and was looking forward to it, "but when the time came to go, I could not face the thought of downtown traffic during Friday rush hour and then driving home at night. Even the bus at Coronado Center involved driving at night."

He still drives at night, he added, but many of his retired friends do not, and so had to miss the picnic.

It was a nice note. Not grumpy or carping. Just a suggestion from an original Sandian.

* * *

With a steady stream of stories about executive unseemliness, greed, and outright criminality as background, Bruno Morosin (retired, but contracting with Energy Sciences Dept. 1130) emailed a few days ago, inspired by a story in *The Wall Street Journal* (www.careerjournal.com/recruiters/whosnews/2006/10/20061018-whosnews-12.html). He ticked off the "generosity of UnitedHealth Group [one of the providers of Sandia health care coverage] towards their soon-to-be-former CEO William McGuire" — a package that, with outright cash payments and stock options accumulated over the years, is worth an estimated $1.1 billion, on top of the $530 million McGuire has been paid to run the company since 1992.

"Some of Sandia's (and my much smaller) health care contribution must be going towards that neat retirement for Mr. McGuire," Bruno wrote. "Sandia should send a strong disapproval letter to the UHC board. After all, this is part of the ever-increasing health care cost increases we Sandians are seeing."

His note cc'd George Samara (1130), who emailed that he, too, is "sad and furious that this type of treatment is happening with increasing frequency in American industry," and questioned Sandia's "dealing with companies like this."

* * *

In answer to a query, a cheery email from Hovey Corbin (5419) arrived last week, noting that he has a file of *Lab News* that includes nearly every issue since Vol. 20, No. 13, dated June 28, 1968. That was 11 days after he started work at Sandia. The query about his collection was a response to a recent note from him saying that he would like to have copies of the two issues he missed while he was away.

He started saving them intentionally, he says, and "could spend weeks going through them reading all the neat articles that have been published down through the years." He didn't spend weeks checking on the date of his earliest issue — only until about 1 a.m. one night last week. There's always that peril when starting to look through a valued collection.

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

Sandia LabNews

Sandia National Laboratories

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Retiree deaths

Ruth M. Barrett (age 92) . . . . . Aug. 21
Donald A. McFadden (91) . . . . . Aug. 25
Dora J. Bowers (90) . . . . . Aug. 28
Larry S. Lopez (74) . . . . . Sept. 2
Charles K. Lee (86) . . . . . Sept. 5
Eustaquio Eddie Rael (79) . . . . . Sept. 8
Emilio M. Chavez (87) . . . . . Sept. 10
James C. Gibson (66) . . . . . Sept. 10
Stephen A. Butkus (86) . . . . . Sept. 12
E. Irene Mesecher (89) . . . . . Sept. 15
Dennis C. Cordova (75) . . . . . Sept. 22
Joe B. Sanchez (81) . . . . . Sept. 22
Ray Larribas (85) . . . . . Sept. 23
Bernice P. Sanders (88) . . . . . Sept. 24
Glenn W. Holmes (90) . . . . . Sept. 26
C. Gutierrez (88) . . . . . Sept. 27

Lab News Reader Service

The *Sandia Lab News* is distributed in-house to all Sandia employees and on-site contractors and mailed to all Sandia retirees. It is also mailed to individuals in industry, government, academia, nonprofit organizations, media, and private life who request it.

Retirees (only): To notify of changes in address, contact Carol Wade, Benefits Dept. 3332, at 505-845-9705, e-mail cawade@sandia.gov, or Mail Stop 1021, Sandia National Laboratories, Albuquerque, NM, 87185-1021.

Employees: To change the number of copies of the *Lab News* your mail stop is receiving please call Honario Anaya, Mail Services Team 10268-4, at 844-3796. At Sandia/California contact the Mail Room at 294-2427.

It's time again to weigh in as readers

...survey coming soon about Lab News, Daily News

We've all noticed it. Sandians have opinions. About this. About that.

Now the folks who put out the Lab News and the Daily News are ready again to ask what you think about their products. They last asked in late 2003. You can read results of that survey in the Feb. 6, 2004, issue of Lab News (www.sandia.gov/LabNews/LN02-06-04/plabnews02-06-04.pdf).

As has been the case for the past two surveys, this one will be administered via email to a stratified random sample of Labs employees. The difference this time, however, is that all data will be collected by SurveyMonkey (www.surveymonkey.com), a popular Internet-based intelligent survey site. In addition to simplifying and speeding data collection and analysis, using this tool will enhance confidentiality.

To choose a **stratified random sample**, divide a population into strata, groups of individuals that are similar in some way that is important to the response. Then choose a separate SRS from each stratum and combine these SRSs to form the full sample.

The survey should take about 10 minutes to complete. Although it contains many of the same questions asked dating back to at least the early-90s it is shorter than the late 2003 version.

Past surveys — dating back about a quarter of a century — have led to a variety of changes — typically evolutionary rather than revolutionary.

So, if within the next several weeks you turn out to be one of the randomly selected to receive an email urging you to complete the survey, please respond quickly and thoughtfully. All those at *Lab News* and *Daily News* will appreciate it.

Security salutes honors standout team

Andrew Sanchez (12410), Denise Soto, and Leroy Jinzo (1534) are members of the team that has been recognized as the "standout team" in the Security Salutes program.

The three worked to ensure that new contractors receive a "New Employee Initial Security Briefing," which supplements the DOE-required briefing. The briefing helps all new employees, contractors, and consultants start work with a comprehensive understanding of their security responsibilities.

The Security Salutes program was developed to recognize individuals who exhibit positive security behavior and practices. It encompasses all members of the workforce, including California, remote sites, and cross-cutting programs.

Over the course of the year some 36 individuals and teams have been recognized for their support of security practices, including:

• Reminding individuals who were wearing their badges off Sandia premises of badge restrictions and consequences.

• Observing, approaching, and reporting an individual taking pictures near a limited-area gate.

• Taking action to protect white-bagged UCI information and to inform the owner of protection requirements, which raised awareness of this issue among other residents of the building.

To nominate someone for a notable security practice or to find out more about the Security Salutes program, type "Security Salutes" into the search bar on the Sandia's home page.

Recent Retirees

Retiring and not seen in *Lab News* pictures: Vincent J. Dandini (6454), 32 years; James T. George (6345), 35 years; Grant J. Lockwood (1344), 43 years; Rebecca D. Villane (8332), 26 years.

People, not technology, most important factor in protecting information systems, speaker says

By Nancy Garcia

Our new knowledge economy has its upsides and downsides. For one thing, its backbone, information technology, is gaining in complexity but declining in security, says information security expert Bruce Schneier.

The reason, he believes, all boils down to financial incentive.

Schneier delivered a Truman Distinguished Lecture at Sandia/California on Oct. 5 on "The Economics of Information Security — 10 Trends." His talk underscored the notion that people have more influence than technology in minimizing risk.

With roots as a cryptographer, Schneier, an author and chief technical officer of Counterpane Internet Security, Inc. — a company that provides outsourcing for security monitoring — has adopted a broader view of security concerns over time. His perspective takes into account relative risks of particular vulnerabilities and motives or capabilities of would-be attackers, who as a group have also grown in sophistication and stealth.

Schneier described 10 trends in information security, beginning with the concept of the economic value of information.

In the case of online bookseller Amazon, for instance, both personal recommendations and even the convenient one-click purchase feature arise from back-end databases. For failed dot-coms, databases were sometimes their only valuable asset. "With Pets.com," he jokes, "it was their sock puppet and their database." Data, such as old emails at Microsoft, also have forensic value for law enforcement.

"Nobody sniffs your credit card number as it goes over the Internet. They hack your computer."

Networks are critical infrastructure

Second, Schneier holds that the network has gained stature as a critical infrastructure. "We don't bother opening our mail anymore," he says. "If it were important, you'd get it on email." The concern is that there are not a lot of backups were this infrastructure to fail. For instance, the 2004 blackout on the East Coast clearly generated a cascade effect on information.

ONE FOR THE MONEY — Bruce Schneier examines the incentives of those who could protect information systems, saying they do not often bear costs of a failure. (Photo by Randy Wong)

Next, third parties are controlling information. "Your information isn't under your control anymore. As the country learned about a week ago [in the Mark Foley congressional page scandal], even instant messages are fair game." Schneier says that although individuals may take the precaution of shredding old credit cards, "Nobody steals credit cards one-by-one from the trash. They steal them by the thousands from servers. . . . The normal protections don't work in the hands of third parties."

Fourth, criminals are thriving on the Internet. Hackers appear less ominous by contrast, he adds. "It's moving up the criminal food chain. This is a sea change that really defines security." Major concerns include identity theft, spam, phishing (tricking someone into providing confidential information about themselves), and to a lesser extent, denial-of-service extortion.

The most complex machine ever built

Fifth, there is an ever-increasing complexity that he sees as the biggest threat to security. New operating systems are issued with twice the code, which may require repeated application of patches through several iterations before bugs or vulnerabilities are fixed. "It's an enormous security challenge," Schneier says. "I think the Internet is the most complex machine mankind has ever built."

"The old worms put a funny message on your computer and erased your hard drive. The new worms sit quietly and steal your passwords."

Bruce Schneier

Sixth, slower patching and faster exploits create a window of vulnerability. Worms may have up to 40 variants that use differing mechanisms. Unprotected machines create a window of vulnerability. "Your security is improved if my mother patches her computer," Schneier points out. But an individual like your mother may be unmotivated to take precautions; one remedy is for patching to be easy and automatic.

Seventh, automatic worms have grown in sophistication. "Think criminal versus hacker," Schneier says. "The old worms put a funny message on your computer and erased your hard drive. The new worms sit quietly and steal your passwords."

'They hack your computer'

Eighth is the notion of trustworthiness. It is a conceit to believe the risk resides in a pipe between two computers. "Nobody sniffs your credit card number as it goes over the Internet," Schneier explains. "They hack your computer." There has been a shift from passively sniffing passwords to actively putting Trojan spyware on someone's computer, he continues. "We can't build a secure network on top of an insecure computer."

Ninth is the end-user as the attacker. End-points have become untrustworthy. Media companies, for instance, might subvert our security by trying to protect content, as happened when Sony exposed personal computers to exploit by loading music disks with automatically installed copy-protection software. "You can't make bits not copyable; it's like trying to make water not wet."

Tenth is regulatory pressure. Schneier calls himself a fan of regulation. "There seems to be an increasing growth in regulation," he says. (He also likes the concept of product liability for software.) He says banks improved security when they, rather than the customer, were liable for fraudulent withdrawals.

Overall, his view is that the trends indicate that "things are getting worse, not better. Nontechnical aspects have become more important than the technical aspects. We need to look at economics, not computer science."

In information technology, he sees four economic factors. A network's value is considered to grow by the square of its users. That leads to the tendency of markets to have one dominant firm. Information technology has high fixed costs but low marginal costs. There are also high costs to the users to switch providers, so customers tend to feel locked in. Finally, the first to market has an advantage, tempting software companies to release new versions right away and then perfect the product in ensuing versions. This uncertainty about quality on the part of unsuspecting consumers reflects an asymmetry of information between buyers and sellers.

Failure of an economic trade-off

Trade-offs are an issue if you think about economics as a security driver and weigh costs and benefits. When you see a failure of security, he says, it's almost invariably a failure of an economic trade-off, and a poor understanding of risks, which vary technologically and change all the time.

Looking at who benefits or bears security costs helps as well. The effect of a decision might be external to the person making that decision, for example — such as his mother contributing to your security by installing patches. People can still be enlisted to the cause. For instance, guaranteeing a free transaction to a customer who does not receive a receipt is a way to enlist the customer in ensuring the purchase is rung up rather than the payment being surreptitiously pocketed by an unscrupulous employee.

"This is how you use economics to solve security problems," Schneier says. "Technology helps, but you don't need technology."

His solution to ramp up security covers five steps. They are: understand the security problem and stakeholders; understand the security and nonsecurity trade-offs; align the economic incentives; implement countermeasures to reduce risk; and iterate.

"Security," Schneier advises, "is a process, not a product."

Sandia CaliforniaNews

Feedback

California travelers to Sandia/New Mexico

Q: *I understand that sometime in the future California employees will be issued a generic badge for access to Kirtland but, in the interim, is there a mechanism that I can check to find out whether or not I am actually on the entry list before I leave? As an occasional visitor to Sandia/New Mexico and on several occasions even after submitting Electronic Access List forms in advance of my travel, I have not been listed on the base access list when I have arrived.*

A: The "Non-Resident Vehicle Pass" (NRVP) is now in place and can be requested by using SF 2730-VPA, "KAFB Non-Resident Vehicle Pass Application." This new credential will allow a Sandia/New Mexico non-resident badged employee or contractor to drive onto KAFB in any rental vehicle. In the event you do not possess an NRVP, it is the Badge Office's recommendation that before you submit the EAL you simply request a read receipt (two working days in advance of your visit) as that will provide you with the indicator that your name or the names that you have included on the form have in fact been added to the master list at the Eubank gate.

— Bob Schwartzman (4233-1)

Fingerprinting

(Continued from page 1)

the attacker is within transmission range of the wireless device," says Jamie. Because the IEEE 802.11 standard is the most common among today's wireless devices, he and his team chose to evaluate the ability of an attacker to launch a driver-specific exploit by first fingerprinting the device driver.

"Passive" approach and "probe request frames" are key

The passive approach used by Jamie and his colleagues demonstrates that a fingerprinter (attacker) need only be in relatively close physical proximity of a target (victim) in order to monitor his or her wireless traffic. Anyone within transmission range of a wireless device, therefore, can conceivably "fingerprint" the device's wireless driver. Reconnaissance of this type is difficult to prevent since the attacker is not transmitting data, making the attack invisible and hard to detect.

Sandia's fingerprinting technique relies on the fact that computers with wireless configurations actively scan for access points to connect to by periodically sending out "probe request frames," of which there are no standard 802.11 specifications. Consequently, developers have created a multitude of wireless device drivers that each performs the "probe request" function differently than other wireless device drivers. Sandia's fingerprinting technique demonstrates the inherent vulnerabilities in this situation through statistical analysis of the inter-frame timing of transmitted probe requests.

"Fingerprinting" not a new concept

Fingerprinting an 802.11 network interface card (NIC) is not a new concept, says Jamie, and many tools exist that can help identify card manufacturers and model numbers via a wireless device's Media Access Control (MAC) address. Sandia's approach, however, is more advantageous in that it fingerprints the device driver, where most exploits rest due to the driver's placement within the operating system. Additionally, the features used by the Sandia passive technique are not a configurable option in any of the drivers tested, unlike the MAC address in most operating systems.

Sandia's fingerprinting technique has proven to be highly reliable, achieving an accuracy rate ranging from 77 percent to 96 percent, depending on the network setting. Furthermore, the technique requires that only a few minutes worth of network data be collected, and tests confirm that it can withstand realistic network conditions.

The complete research paper prepared by Jamie and his colleagues, "Passive Data Link Layer 802.11 Wireless Device Driver Fingerprinting," discusses the technique in detail.

WIRELESS NETWORK DRIVERS, say Sandia researchers, are easy to interact with and potentially exploit if the attacker is within transmission range of the wireless device. By role-playing the position of an adversary, Sandia has demonstrated a unique fingerprinting technique that allows hackers with ill intent to identify a wireless driver without modification to or cooperation from a wireless device. (Photo by Randy Wong)

Get your stuff ready: Your building may be mini-blitzed

By Chris Burroughs

Waiting time to get unwanted and excess property removed from Sandia buildings has dropped significantly due to a new program put in place by Reapplication Services.

The new three-month-old process, "mini-blitzes," targets 16 Labs buildings that generate the most pick-up requests to be visited on a recurring day of the month to relieve them of excess property. People who work in the buildings receive e-mails one week prior to the scheduled mini-blitz.

"We started this process three months ago and have reduced the number of tickets in the queue waiting for pickup from 350 in July to 33 today," says Phil Rivera, Reapplication Services 10267-1 team lead. "Our team really worked hard to bring the number of pickup requests down using the mini-blitz process. Working with the customers helped us build a successful process."

"We started this process three months ago and have reduced the number of tickets in the queue waiting for pickup from 350 in July to 33 today."

History of the mini-blitz process dates back several years when Reapplication used to have "Lab Clean Up Days." People would put all their excess property outside their buildings and Reapplication would pick it up.

Customer feedback to bring back the Lab Clean Up Days prompted Division 10000 to revisit and pilot a similar process for feasibility.

Nancy Davis, process coordinator for the proposed pilot, pulled together people from Reapplication, Transportation, and Custodial Services, commencing a pilot program last year called "Spring Clean Up Days," where buildings housing people in Division 10000 were targeted for property removal; thus the concept of "blitzes" came to be.

"It worked so well that we decided to start the mini-blitz process," Phil says.

"But we aren't finished yet. The goal is to reduce the cycle time from the point of customer generation until we receive the property into the Reapplication yard to within a sustainable two-day time period, with our ultimate long-term goal being to complete the reapplication request in real time, meaning completing the pick-up request the same day." Phil says.

More information about the monthly mini-blitzes can be found at http://cfo.sandia.gov/logistics/Property/Reapplication%20(Reapp)%20Mini-Blitzes%20Schedule.htm. People with questions about the mini-blitzes or anything in general dealing with Reapplication Services should call 844-1729.

Mini-blitz schedule

Reapplication will follow the schedule below for mini-blitzes. You will receive a reminder approximately one week before your building blitz. If a mini-blitz day falls on a holiday, the mini-blitz will be performed on the next working day.

Building	Mini-Blitz Day
800 – 802	4th Monday
810	1st Wednesday
821	3rd Wednesday
823	3rd Thursday
836	4th Thursday
870	1st Thursday
880	1st Monday
886/887	2nd Wednesday
890	2nd Monday
891	2nd Thursday
892	2nd Monday
960 - 962	4th Wednesday
6585	3rd Monday

Feedback

As election day approaches

No politickin' on the bulletin boards; and, reporting those new traffic cam tickets

Q: *Company policy is clear that partisan political statements are not appropriate material for posting on lab bulletin boards. Does this also apply to union bulletin boards? A "Workers Memorial Day" poster has been on that board since April stating that "the Bush administration and conservative Republicans have moved to roll back and weaken [OSHA] protections" and urging political action, seemingly in clear violation of this policy. Please clarify the boundaries in this matter.*

A: The Laboratories has agreed to provide bulletin boards for the Security Police Association (SPA), Office & Professional Employees International Union (OPEIU), and Metal Trades Council (MTC) for the sole purpose of posting union notices. The Laboratories has given blanket approval for the posting of routine notices. If the posting is not a routine notice, the Laboratories Bargaining Agent must give approval prior to it being posted. The Collective Bargaining Agreement also states that nothing inflammatory or derogatory shall be contained in material posted on bulletin boards. Since the poster you described is inflammatory and not a routine notice, it should have been submitted to the Laboratories Bargaining Agent for approval. Also, I want to assure you that the leaders of the three bargaining units at the Laboratories do not support the improper use of union bulletin boards. Labor Relations did contact the union that maintains this bulletin board and the poster has been removed.

— BJ Jones (3500)

* * *

Q: *What are the reporting requirements if I receive a traffic ticket from the City of Albuquerque's intersection cameras or speed vans? Since the ticket is only considered a safety violation with no impact on our driving record, is it reportable if the fine exceeds $250?*

A: Since this is a charge, which indicates a violation of law, it is still reportable. As you note in your question, since this is a traffic violation it is only reportable if the fine exceeds $250.

— Corey Cruz (12420), Corporate Investigations

Z-machine shockwaves melt diamond

As nuclear-fuel capsule envelope, even diamonds aren't forever

By Neal Singer

Instead of transmuting lead to gold using chemicals and spells — the dream of alchemists of old — Z-machine shockwaves have melted diamond to a liquid and turned it ultimately into graphite powder.

Romantically a waste, perhaps, but the unusual experiments had a high purpose: To quantify the response of the very rigid material to extreme pressure. This knowledge will enable researchers to set conditions under which diamond could best serve as a shell for fuel capsules of deuterium and tritium. Enhanced performance of these capsules could achieve better weapons simulation data and, ultimately, energy production through controlled nuclear fusion.

The experiments were also done in a rush — just before Z closed for a year-long renovation — at the behest of researchers at Lawrence Livermore National Laboratory's National Ignition Facility.

LLNL researchers wanted information on the best material to encapsulate tiny targets to be struck by NIF's powerful laser beams. These, when fully up and running, are expected to evenly compress a pellet so that its content of deuterium and tritium, would fuse to create neutrons — a key indication of fusion.

Researchers at Z are similarly interested in a better pellet envelope, since the refurbished, more powerful Z machine will use X-rays to also compress deuterium pellets in an attempt to raise the bar on its own nuclear fusion efforts, which two years ago produced fusion neutrons.

But diamond — one of the most rigid of materials — might seem an unlikely material for compression. Why not, say, a casing of easily malleable plastic?

Compression, it turns out, is not an issue. "At the pressures we're interested in, [millions of times that of the atmosphere at sea level] everything is compressible," says Mark Herrmann (1674), who designed the capsule. "We want a capsule ablator [shell] with a low atomic number [like carbon, the element of which diamond is made] because they are good absorbers of radiation and are very dense."

The ability to absorb a lot of radiation and not re-emit it means that most of the X-rays (produced by NIF or Z) that hit the fusion capsule will be absorbed and cause the dense interior of the diamond shell to rocket inward, compressing the deuterium-tritium mix.

Also, "Synthetic diamond is structurally strong and very uniform," says theoretician Mike Desjarlais (1674). The casing thus is less likely to

Illustration by Michael Vittitow

cause unequal pressures, producing perturbations that would fatally weaken the desired reaction.

"We want to create an equation-of-state model from what we learn about the diamond melt and then provide it to designers of ICF capsules," says principal investigator Marcus Knudson (1646), who ran the experiments at the Z facility. (ICF is an acronym for Inertial Confinement Fusion, a method that forcefully compresses pellets to achieve nuclear fusion.)

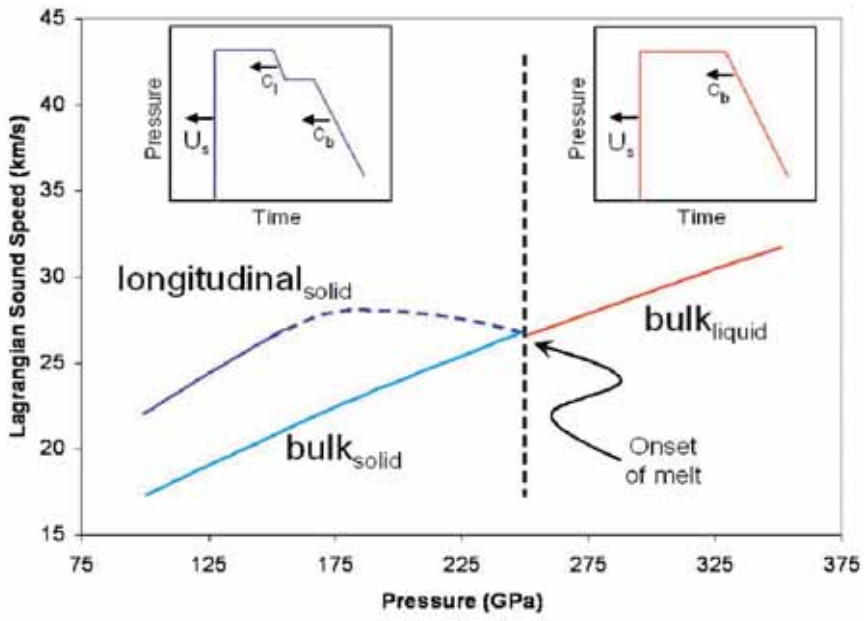
In these experiments, tiny, magnetically propelled flyer plates impacted samples of artificial diamond to create the extreme pressures required. The plates, powered by Z's intense magnetic field, flew a few millimeters at a speed of about 20 times that of a rifle bullet. They then slammed into test sheets of the thin, artificial diamond. By varying the velocity of the disks and analyzing the results, Marcus could determine when the pressure wave resulting from the impact traveled more slowly, as though it were passing through a liquid rather than a solid. He could translate this into the number of Mbars (millions of atmospheres) at which the liquefying process began.

Marcus' search for the melt boundary was aided by Mike, whose work in advanced quantum-molecular simulations predicted an entry into the melted state at 6.9 Mbar, and completion of melt by 10.4 Mbar.

Marcus found that Mike's figures were right on the money: Diamond begins to melt under shock-induced compression at about 6 to 7 million times greater pressure than exists at sea level.

The program also predicted a complete melt at over 10 Mbars, which also appears to be consistent with Marcus' measurements.

For the purpose of evenly compressing a capsule, the wide range of pressure in which diamond exists both as solid and liquid is a defect, because pressure waves transmitted by the two states could cause perturbations and upset the symmetry of the capsule implosion.



Conceptual plot of sound speed as a function of pressure. In the experiment a steady shock is produced, followed by a rapid release in pressure. The character of the release wave following the shock front is highly dependent on whether the shocked state is a solid or liquid. A solid material has the ability to resist deformation, a property referred to as strength. Due to the strength of the material, the release wave breaks up into a two-wave structure, as shown in the upper left hand inset. The initial release travels at the longitudinal sound speed, cl, and the subsequent release travels at the bulk sound speed, cb, with cl>cb. As the material approaches melt, the strength decreases and the difference in cl and cb becomes smaller. For a strong enough shock the material will begin to melt. At this point the shocked material loses all strength and will only support a single release wave traveling at the bulk sound speed, as shown in the upper right hand inset.

Robots, space elevators, moon landers, and rockets at X PRIZE Cup event

With the Oct. 20-21 X PRIZE Cup event at the Las Cruces International Airport, coupled with the establishment of the New Mexico Spaceport at White Sands, New Mexico is carving out a reputation as a leader in the next, open-source era of space exploration. And Sandia, an exhibitor at the X PRIZE Cup event, is in on the ground floor. The event drew thousands of attendees over the two days, demonstrating the enduring interest in space exploration in the technical community. The event focused on several key technologies, including space elevators (a concept suggested by the Arthur C. Clarke novel *The Fountains of Paradise*), next-generation moon landers (a technology NASA is actively interested in), and high-energy rocketry. Sandia displayed its robotics technology (see photo at left), with robots performing complex retrieval tasks, demonstrating capabilities that may be vital in future lunar and planetary exploration. The Labs also exhibited microsystems technologies that offer the promise of significant weight reductions in instrumentation, a big consideration in any space mission. In the photo at right, Sandian Vipin Gupta talks to students about the opportunities available at Sandia.

(Photos by Neal Singer)

Brain trauma

(Continued from page 1)

ber of US soldiers returning home from Iraq with head injuries caused by blast waves from discharged improvised explosive devices.

Paul says that modeling brain injury is a far more humane way to study scenarios leading to TBI than the traditional trial-and-error approach using laboratory animals.

The two researchers started by importing a digitally processed, computed tomography (CT) scan of a healthy female head into the Sandia-developed shock physics computer code, CTH. The CT scan was digitally processed to segment all soft tissue and bone into three distinct materials — skull, brain, and cerebral spinal fluid (CSF).

"We want to create a higher-resolution simulation capability that better represents the various portions of the brain to provide detailed specificity of our results."

Computer models were then constructed representing the skull, brain, CSF, and windshield glass. The simulations were run on Sandia's Thunderbird parallel architecture computer using 64 processors for each simulation.

"The results of our simulations demonstrate the complexities of the wave interactions that occur among the skull, brain, and CSF as the result of the frontal impact with the glass windshield," Paul says.

The modeling represents what would happen to an unrestrained person hitting the windshield of an automobile in a 34 mph head-on collision with a stationary barrier.

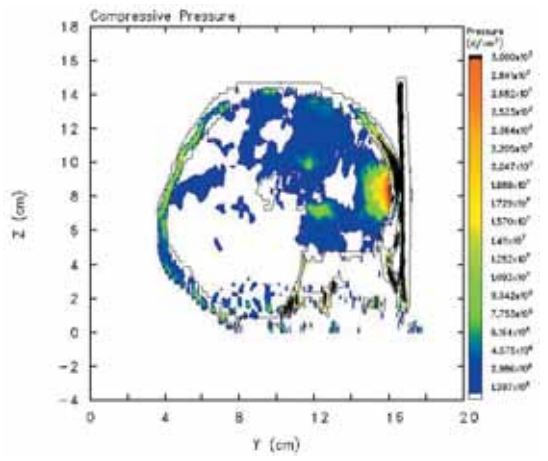
In discussions between Paul and Corey, it became apparent that different types of cell damage might occur depending on the type of stress to which the cells are exposed. "Isotropic stress," commonly called pressure stress, imposes density changes that can damage a cell's internal structure. "Shearing stress" acts as a tearing mechanism that damages the cell wall and membranes, giving rise to apoptosis, or cell death. Both are likely at play in most incidents leading to TBI.

Each type of stress is displayed on two different views of the brain — the sagittal view — where the brain is cut between the left and right hemispheres — and an axial view in a plane perpendicular to the longitudinal axis of the body just above the eyes and ears.

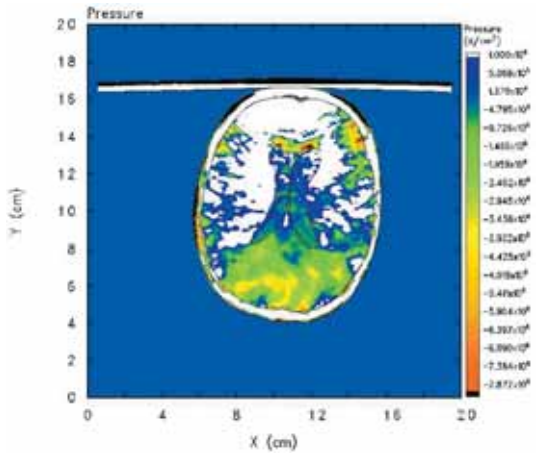
"Through our modeling we were able to predict early-time stress focusing within the brain during an impact event. However, we have yet to identify what specific levels of stress will lead to TBI," Paul says.

"This is the focus of our future research effort. Furthermore, our current models simulate the brain as homogeneous. We want to create a higher-resolution simulation capability that better represents the various portions of the brain to provide detailed specificity of our results."

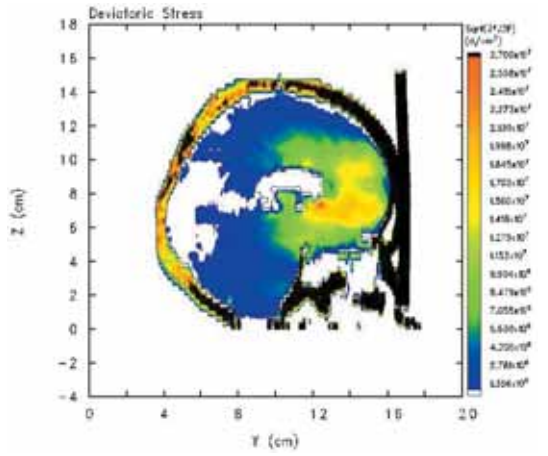
Such capabilities may allow Paul and Ford to have a better understanding of how the early-time stress contributes to TBI and aid in the design of better protection devices such as headgear for sports and military personnel.



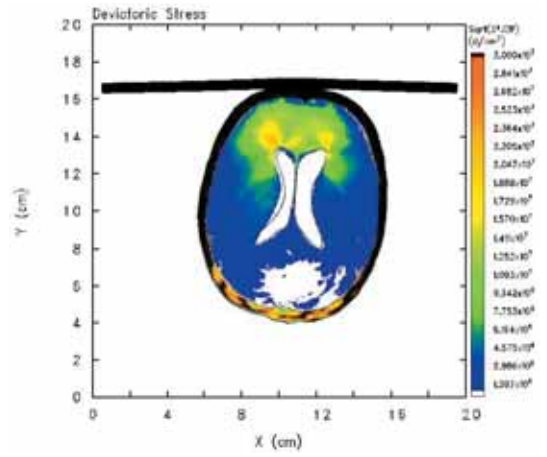
SAGITTAL VIEW of compressive pressure in head model (glass at right); pressure highest at impact or Coup site. Pressure scale - red: 30 atmospheres, blue: 1 atmosphere.



AXIAL VIEW of tensile pressure in head model (glass at top); tensile pressure highest at back of head (Contrecoup site). Pressure scale - red: 8 atmospheres tensile, blue: 1 atmosphere compressive.



SAGITTAL VIEW of shear stress in head model (glass at right); shear stress highest at brain-ventricle interface. Stress scale - red: 27 atmospheres, blue: 1 atmosphere.



AXIAL VIEW of shear stress in head model (glass at top); shear stress highest at brain-ventricle interface. Stress scale - red: 30 atmospheres, blue: 1 atmosphere.

A new home — and a new name — for the National Atomic Museum

THE NATIONAL ATOMIC MUSEUM, which has been located in a temporary facility in Albuquerque's Old Town area since moving out of its longtime Kirtland Air Force Base home in the wake of the 9/11 attacks, will be getting a new permanent home on Eubank Ave. SE. The new location, with ample space, will allow the museum to display many of the aircraft and rockets that stayed behind at KAFB when the museum relocated to Old Town. The new facility will open in 2008. The museum, in addition to its new home, will get a new name: The National Museum of Nuclear Science and History. Participating in the groundbreaking ceremony are, from left, Marc Wunder, field representative for Sen. Jeff Bingaman, D-N.M.; KAFB Vice Wing Commander Mohsen Parhivkar; Hugh Smith, Public Service Co. of New Mexico; Greg Morrison, president of the National Atomic Museum Foundation; Labs Director Tom Hunter; Sen. Pete Domenici, R-N.M.; Rep. Heather Wilson, R-N.M.; NNSA Administrator Linton Brooks; NNSA Sandia Site Office Manager Patty Wagner; Jackie Kerby Moore, Sandia Science and Technology Park director; Laurence Pernot, AREVA (a museum exhibit sponsor); and Charles Loeber, project director for the National Atomic Museum Foundation. (Photo by Randy Montoya)

Old college friends research together

Paul Taylor and Corey Ford started working on the head trauma modeling project about five years ago. Their initial funding came through the Touch Program, a medical teaching program headed by television personality Dr. Dale Alverson.

But Paul and Corey's relationship goes back a lot further than five years. They were college roommates at Penn State University.

"We moved to Albuquerque, at different times, and our families would dine together a lot," Paul says. "We talked about areas of science that we were both interested in. Modeling brain trauma became a natural because Corey is a neurologist and I'm an engineering scientist with a biomechanics background. This project became a nice way to work with an old friend and make an impact on a topic of significance to the general public."

Aerion tests supersonic business jet wing at sled track

Aerodynamic experiment at Sandia sled track is first of its kind

THE SHAPE OF WINGS TO COME — The Aerion supersonic business jet concept relies on a patented supersonic natural laminar flow technology. The wing shape (seen here in a nighttime photo) is mounted on a sled at Sandia's rocket sled track, which Aerion engineers determined to be the best place to test the wing in real-world conditions.

By Michael Padilla

In the not-so-distant future, business travelers will be able to take off from Paris at 8 a.m. for a breakfast meeting in Manhattan or fly from New York to Tokyo in less than 10 hours.

That's the vision of supersonic business jet (SSBJ) designer Aerion Corporation. To help make this vision become reality, Aerion turned to Sandia for assistance, hiring the Labs to conduct a Mach 1.6 test at the rocket sled track.

Jason Matisheck, Aerion business manager and manager for the Sandia tests, said Aerion performed an aerodynamic experiment that, to his knowledge, has never been attempted with a rocket sled.

"The rocket sled had several advantages when compared to other means of aerodynamic testing, such as wind tunnels and flight experiments," Matisheck says. "Prior to the test we were concerned that the laminar flow would be adversely affected by the sled vibration, rapid change in speed, and short duration of the test."

Despite the concerns, Aerion engineers were convinced the rocket sled represented a unique opportunity to validate at full-scale aerodynamic conditions the performance of the company's patented supersonic natural laminar flow technology that substantially reduces drag at supersonic as well as high-subsonic cruise speeds.

"Aerion and Sandia engineers worked through several design challenges to create a viable test article for the experiment," he says. "The test gave us the chance to record several types of data."

Sandia tested the natural laminar flow design at Reynolds numbers approximating those on a full-scale wing at supersonic cruise conditions. The Reynolds number is the dimensionless ratio of inertial forces to viscous forces in flowing fluids and is used here to relate aerodynamic forces on wings of different scales.

The test was designed to measure data that would allow validation of the drag-reducing natural laminar flow design that is key to the SSBJ's ability to cruise efficiently at subsonic as well as supersonic speed. Two proof-of-concept test shots were performed to prepare for the large-scale test. All three shots provided valuable information to the program.

Neil Davie (1535), lead Sandia test engineer, says the Sandia and Aerion team had to respond quickly to design and fabricate the rocket sled and test apparatus in order to meet Aerion's schedule.

"The test approach was unique and could be described as a wind tunnel experiment in reverse, where the test item is propelled through the air instead of the other way around," Neil says.

Sandia also implemented unique measurement capabilities with high-resolution infrared (IR) imaging through the Laser Tracker, which provided laser-guided imaging of the test wing as it accelerated from rest through Mach 1.6, Neil says. The IR imaging allowed visualization of the different aerodynamic heating rates of the laminar and turbulent boundary layers. The team recorded measurements on the test wing using an onboard digital recorder developed by Sandia.

NEIL DAVIE (1535) makes final adjustments on instrumentation mounted to the Aerion wing.

Boundary-layer total pressure probes mounted at the trailing edge of the wing measured the thickness of the boundary layer, and accelerometers on the non-imaged side of the wing helped characterize the vibration of the wing.

The wing model used for the test was one-sixth the size of the actual wing. A cluster of five-inch-diameter rocket motors accelerated the wing at 30 gs to a speed of Mach 1.6 and maintained that speed for 1.7 seconds before hitting a water brake at the far end of the 10,000-foot-long track.

"We are still analyzing the results of the large-scale test and discussing options for a follow-on test series with Sandia," Matisheck says.

Sandia lead team includes Mike Valley, Neil Davie, and Bryon Demosthenous (all 1535). Additional assistance came from: Tom Reecer, John Arnold, Ed Garavaglia (all 1534), Carissa Grey, Duane Patrick, and Dale Shamblin (all 1535).

Honoring Glenn Fowler, remarkable Sandia pioneer

Members of the Laboratory Leadership Team adjourned from their regular Monday meeting this week to join a who's who of retired Sandia leaders to honor Emeritus VP Glenn Fowler with a special ceremony and presentation of a commemorative plaque. With Glenn looking on, Labs Director Tom Hunter recounted the Sandia pioneer's career highlights, including his pre-Sandia contributions to the development of radar during World War II (which, as Tom noted, has been cited as the most important technology of the 20th century) and the Manhattan Project (Glenn saw the Trinity explosion from the air).

Tom reminded his listeners of "Fowler's Law," which Glenn postulated early in his career: "No matter what the rules say, don't do anything stupid."

As the plaque notes, "Glenn became the first head of Test Operations in 1945 while Sandia was still Z Division. He established the independent, capable culture of field test and was instrumental in the selection of the Tonopah Test Range as Sandia's primary weapon test facility. Universally respected for his leadership and communication skills, he was influential in bringing basic scientific research to Sandia and the related promotion of advanced education for the technical staff. Under his guidance, Sandia leveraged these new abilities and diversified, taking on work in satellites, space nuclear power, sensors, advanced telemetry, and, eventually, nuclear security systems and energy programs."

The plaque will be displayed in the lobby of Bldg. 800. (Photo by Randy Montoya)

New tool helps prevent repetitive strain injury

Software reminds, guides office workers in stretch breaks

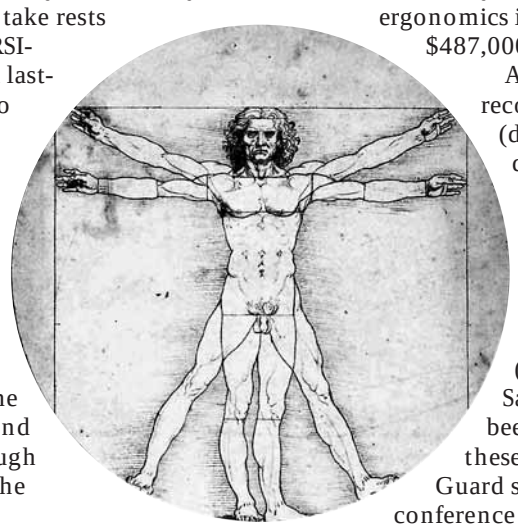
By Julie Hall

Working in an office may seem relatively safe, but an unseen hazard — repetitive strain injury (RSI) — can creep up on cubicle jockeys over the years, causing pain and even disability if left untreated.

Fortunately, RSI can be prevented and treated, and Sandia is rolling out two new software tools to help do just that. One, RSIGuard Stretch Edition, is designed to prompt workers to take stretch breaks after periods of prolonged, intense computer use. The other, Office Ergonomics Suite, will help Sandia's ergonomics experts systematically and more efficiently assess and track workers across the Labs, especially those whose jobs and work habits put them at high risk for RSI. Through an extensive survey, OES also analyzes posture, ergonomics, work habits, and job requirements, and provides training and assessment for workers to help them decrease their risk for RSI.

RSIs are a group of conditions, including carpal tunnel syndrome, resulting from overuse and affecting muscles, tendons, and nerves in the hands, arms, and back. RSIs can occur in office workers, assembly line workers, athletes — anyone repeating the same physical action, usually over a period of years.

RSIGuard is like having your own ergonomics specialist standing over your shoulder, monitoring your work habits, and encouraging you to take breaks. It was developed by a computer programmer who developed a repetitive strain injury and wanted to help other computer users remember to take regular breaks and stretch. While earlier, similar programs used the "egg-timer" approach — recommending breaks at regular intervals — RSIGuard is more sophisticated, measuring both the amount of time and the intensity with which someone uses a mouse and a keyboard. Every 37 minutes — less often if you take rests and work less intensely — RSIGuard recommends a break lasting a minute or more. It also reminds people (on the default setting) to take 15-second "microbreaks" every 10-15 minutes. Small screens pop up with messages like "Close your eyes and breathe" or "Are your shoulders and arms relaxed as you type?"



Users can customize the program so that it suggests and demonstrates stretches through brief videos that appear on the screen.

For those who anticipate they will resist taking recommended breaks, the software can be set up so it will actually lock the keyboard and prevent further work. Another feature is Autoclick, which eliminates the need to click the mouse, potentially a major source of strain.

RSIGuard is now available for free at http://ergo.sandia.gov (click on RSIGuard Installer under Job Aids). OES will be available for download in early November.

Due to a limited number of licenses available, Sandians are asked to only download RSIGuard if they think they will actually use it, says ergonomist Rebecca Salzbrenner (10322), who oversaw the contract with software company Remedy Interactive. To try it out first, she suggests going to www.rsiguard.com/download.html to download a 45-day free trial.

Sandia purchased licenses for RSIGuard and OES because of Sandia/California's success in using them and their ability to centralize the assessment and tracking of employees' risk status, says Salzbrenner. The CSU Technology Development Team (4537) and Cyber Security (4312 and 8965) partnered with ES&H Center 10300 to develop a Labs-wide solution.

"An estimated 85 percent of repetitive motion injuries at Sandia are from computer usage," Rebecca says, amounting to about 65 of Sandia's 600 recordable injuries in calendar year 2005. DOE conservatively estimates the average cost of an ergonomics injury to be $7,500, amounting to $487,000 for 2005, she says.

At Sandia/California, office-related, recordable repetitive motion injuries (diagnosed by a physician) have declined since 2005 from four to zero while the number of workers at high risk and moderate risk for RSI has been reduced by about half, to slightly more than 100 and 50, respectively.

Ergonomist Judy Tejada (8517) believes the injury rate at Sandia/California would likely have been much higher had it not been for these two tools. She learned about RSIGuard several years ago at an ergonomics conference and thought it would be good for "those people I can't get to take a break." Judy, diagnosed with bilateral carpal tunnel syndrome in 1999, says people need to pay attention to the warning signs of RSI (see sidebar) and get help immediately.

"Once you feel the symptoms, the damage has already been done," she says. "They don't call it cumulative trauma or repetitive motion injury for nothing."

OES was also helpful in reducing risk and injuries, Judy says. When installed on an individual's computer, the software analyzes posture, ergonomics, work habits, and job requirements through a series of survey questions, and assesses that individual's risk for RSI. Most employees make at least one ergonomic adjustment as a result of their initial assessment; these adjustments as well as computer users' risk profiles are captured and made available to Sandia ergonomics specialists, who can then track their progress and follow up if needed.

"It [OES] helps identify those people who are at risk, rather than waiting for them to come to us and say 'I'm having a problem here,'" says Judy. "It's amazing how many people can change themselves from high risk to moderate or low risk simply by following the recommendations of the software," she says.

Repetitive strain injury symptoms

- Recurring pain or soreness in neck, shoulders, upper back, wrists, or hands
- Tingling, numbness, coldness, or loss of sensation
- Loss of grip strength, weakness, or fatigue
- Pain or numbness in hands and arms while lying in bed

Sandia recycling program bigger than you may know

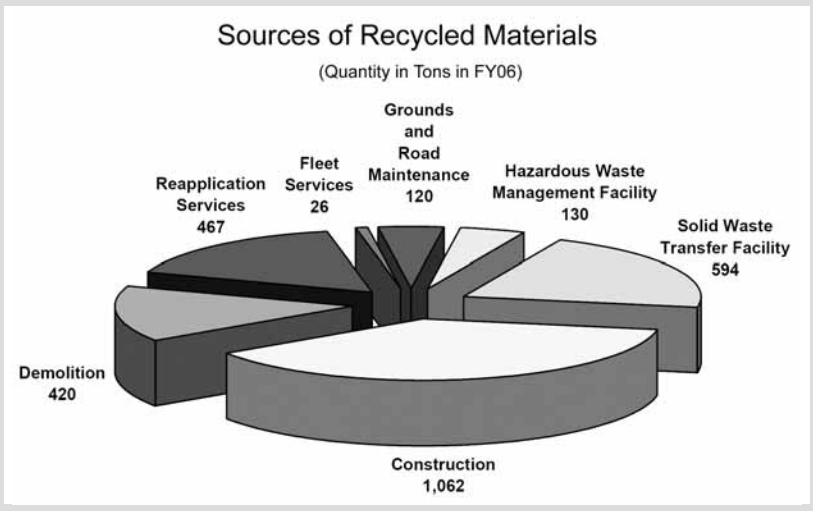
November is New Mexico Recycling Awareness Month, and Sandia's Pollution Prevention Team wants everyone to know what the Labs is doing to recycle and reuse materials and even bring in some additional revenue.

"When most people think of recycling at Sandia, the bins of used white paper, aluminum cans, and plastic bottles come to mind," says Margie Marley (10331), Pollution Prevention Team member. "But we capture so many other materials. For example, every year we recycle tons of metal, cardboard, wood, concrete, landscaping materials, tires, and batteries. In FY06, we recycled 2,857 tons of materials."

Several programs and activities at Sandia/New Mexico recycle. In FY06 the Solid Waste Transfer Facility, which processes cardboard, paper, plastic, and aluminum cans, accounted for only 21 percent (by weight) of all materials being recycled. Construction, which recycles metal, concrete, wood, and wallboard, recycled 38 percent in weight. Other contributors include Reapplication Services, 17 percent; demolition (materials coming from buildings being demolished), 15 percent; and the Hazardous Waste Management Facility, Grounds and Road Maintenance, and Fleet Services, combined, 9 percent.

Sandia began recycling in the mid-1990s and has been steadily working on increasing the quantity of materials as well as the number of different materials that are recycled. The result is reduced solid-waste disposal and conservation of resources.

An additional benefit is that reusing or recycling avoids disposal costs and generates revenue. During FY06, materials being sent for recycling earned $150,000 with about half of that coming in the sale of recovered metals. The other $75,000 was received for cardboard, paper, plastic, and other materials. This recycling revenue is used to reinvest in program equipment and infrastructure.



Margie says that metal and cardboard have excellent market value. Sandia is particularly successful at recycling metals that come from construction, demolition, Reapplication Services, and the Solid Waste Transfer Facility, but that cardboard recovery has room for improvement.

Metals and concrete comprised 61 percent of Sandia's recyclable materials by weight in FY06. Margie says, "In the past our concrete has been going to the Kirtland Air Force Base Landfill, but this year we established a concrete and asphalt accumulation area to store these materials for crushing and reuse. The crushed materials are available for use around the site by construction and other projects."

This year several new items have been added to Sandia's recycle list, including packing peanuts, transparencies, clean room garments, and Tyvek® envelopes.

Sandia's recycling efforts are driven by Executive Order 13101 and the desire to excel as environmental stewards by preserving and conserving natural resources, and minimizing disposal of reusable/recyclable materials. In the past three years, Sandia's Pollution Prevention Program has received nine awards for recycling and waste minimization efforts from the Office of the Environmental Executive, US Environmental Protection Agency's WasteWise program, DOE, and New Mexico Recycling Coalition.

Nationally, President George W. Bush has declared Nov. 15 as America Recycles Day and encourages communities throughout the US, the District of Columbia, and Puerto Rico to "make every day America Recycles Day."

More information about Sandia's recycling program can be found at www-irn.sandia.gov/esh/p2/recycling.htm.

— Chris Burroughs

'The fragrance always remains in the hand that gives the rose'

Sandia 'blanketeers' help Project Linus create and distribute more than a million blankets to kids

By Iris Aboytes

SECURITY BLANKETS — Handmade quilts sewn by volunteers await distribution to children in crisis. (Photo by Randy Montoya)

A newborn baby is wrapped in a soft blanket, its security and shield from harm, as it enters the world. Project Linus works at achieving the same security by furnishing blankets to hurting children.

On Christmas Eve 1995, an article titled "Joy to the World" appeared in *Parade Magazine*. It was written by Pulizer Prize-winning photojournalist Eddie Adams. Part of the article featured a child who had been going through intensive chemotherapy. She said her security blanket helped her get through the treatments.

After reading the article, Karen Loucks decided to provide homemade security blankets to Denver's Rocky Mountain Children's Cancer Center. Project Linus was born.

Project Linus is a 100-percent volunteer non-profit organization to provide love, a sense of security, warmth, and comfort to children who are seriously ill, traumatized, or in need through the gifts of new, handmade blankets and afghans created by volunteer "blanketeers." It also strives to provide a rewarding and fun service opportunity for individuals and groups in local communities for the benefit of children.

As of last March, 1,639,630 blankets had been donated to 385 chapters throughout the United States.

New Mexico's chapter, now in its seventh year, has provided more than 15,000 blankets to New Mexico children.

The chapter's blankets go to children in the pediatric intensive-care wards of hospitals around the state and to shelters for homeless and abused children. They also go to local fire and police departments for distribution to children who have just lost their homes, been in an auto accident, or involved in some other crisis.

Sometimes this blanket is the only possession a child can call his or her own. It is the comfort that helps calm and soothe a young life in turmoil.

On the first Saturday of every month, a group of Sandians who enjoy sewing get together to make quilts for Project Linus. Since September 2005, the blanketeers have made approximately 100 blankets. If you enjoy sewing, crocheting, or knitting and have an interest in joining Project Linus, contact Darline Polonis at 284-8340 or dpoloni@sandia.gov.

A quilt show presented by Sandia blanketeers will be on display on the first-floor lobby of Bldg. 802 during November. This is your opportunity to see the incredible quilts presented to Project Linus on behalf of Sandia.

A quote by Heda Bejar sums up Project Linus: "The fragrance always remains in the hand that gives the rose."

HMTech 20th anniversary highlights success in promoting education

The Hands-on, Minds-on Technologies (HMTech) program recently marked 20 years of success in exposing students of African heritage to science, math, and technology, and working to ensure those students are aware of and embracing the full range of educational options. The program encourages youths to consider careers in science and engineering.

HMTech began 20 years ago as a grassroots effort involving African-American scientists and engineers from Sandia (along with other community members) to volunteer their time as instructors and facilitators working with African-American youths.

KEYNOTE SPEAKER Roberta Ingram, left, challenged her audience to "give a child a passion for learning." Speaking with Ingram is Patricia Salisbury, co-founder with Ingram of the HMTech program.

With the Sandia Summer Science Camp as its forerunner and model, HMTech began as a single computer class. Over the years, it has grown to include courses such as math, drafting, anatomy, sports medicine, SAT/ACT preparation, crime scene investigation, robotics, and physics.

In a 20th anniversary celebration at UNM's Student Union Ballroom recently, participants from over the years heard keynote speaker Roberta Ingram, cofounder of the program, recount the early years and how the passion of volunteers to teach and inspire children cemented the program's success. The celebration's theme, "Yesterday's Beginnings, Today's Legacy, and Tomorrow's Stars," provided a framework for comments by Ingram and other speakers. Ingram wrapped up her comments with a charge to the community: "Continue to help kids find their voice and that latent genius that is in all of our children. Give a child a passion for learning."

Two students who participated in the program spoke about HMTech's impact on their lives. D`ante Stamps, a 7th grader at McKinley Middle School and a current HMTech student, spoke about his experience in the anatomy, computer programming, and sports medicine courses.

"HMTech is good because it keeps kids off the street and gets their minds better focused," Stamps said.

Gabriella Hernandez, a former HMTech student now working for Pfizer Pharmaceutical, said taking SAT/ACT and math courses helped her develop her skills and gave her a strong mathematical background that she has used throughout her studies.

KEN WASHINGTON

As part of the evening's celebration, students from the current HMTech program were recognized for their achievements. Awards were given to middle-school students from HMTech's Amazing Math course; these students excelled beyond their pre-test and post-test standardized test scores. Some of the children reached 120 percent improvement over their baseline scores.

Sandia Chief Information Officer Ken Washington closed the celebration with remarks about the future of the program. "The HMTech program occurred because people had a vision and people engaged to make that vision happen. The next 20 years needs to be a lot different. Our children are counting on us. We need to continue to give back to the community."

Feedback

Rules for checking your 401(k) online; some questions about Travelocity services

Q: *What are the rules about checking on your 401(k) online or talking with one of the representatives from Fidelity during working hours?*

A: The Sandia policy that addresses your question is the Incidental Personal Use policy, which is defined in CPR400.2.10, Using Information Technology Resources.

According to this policy, use of Sandia information technology resources to check your 401(k) or to talk with a Fidelity representative is allowable if such use is minimal (i.e., incidental) and does not violate any of the other incidental personal use requirements stated in the CPR.

Any personal use of Sandia's information technology resources that is unlawful or for personal gain, causes Sandia to incur additional expense, negatively impacts employee job performance, wastes Sandia's time, harms Sandia's reputation, or requires modification to Sandia resources is prohibited by the Incidental Personal Use policy. — *Nancy Marsh (4601)*

* * *

Q: *Lockheed and Sandia are going to be (or already started) using Travelocity services. From my personal experience with Travelocity, I know that their call centers are located in India, a sensitive country. Isn't it a bit odd that foreign nationals from a sensitive country might be arranging travel for all of Sandia official business?*

A: The contract that Lockheed Martin has negotiated with Travelocity Business has its call centers in San Antonio and Southlake, Texas, exclusively. Should you need additional information, or a personalized presentation about the conversion to Travelocity Business, please call the Travel Helpline at 845-YESS.

— *Barbara Cochrane (10507)*

Mileposts

Photos by Michelle Fleming

Robert Anderson
35 1821

Donald Evans
35 12346

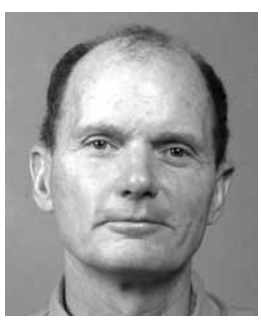
Al West
35 1000

Wayne Einfeld
30 6334

Ron Hartwig
30 2100

Clifford Sharp
30 5351

Rick Stulen
30 1000



William Wampler
30 1111

Eric Disch
25 2125

Joseph Jung
25 1542

Yolanda Padilla-Vigil
25 10312

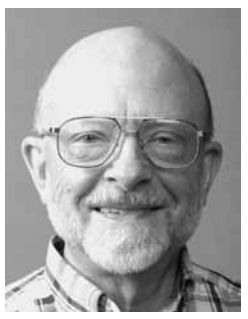
Randall Summers
25 1431

Esther Sandova Hernandez
20 3010

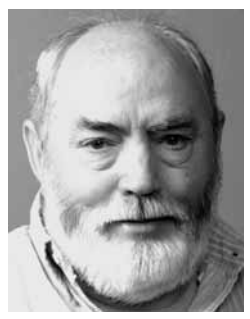
Mary Ortega
20 10264

Recent Retirees

David Berst
45 2667



Tom Wedel
38 2717



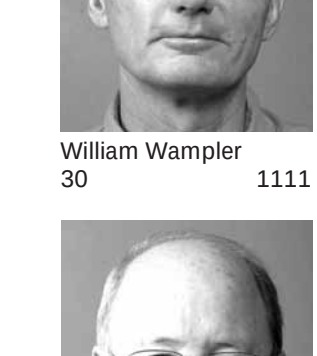
Ronald Ward
37 2433

Steve Shope
34 5445

Carmen Ward
26 6037

Peter Winokur
22 12120

50 years ago . . . Electronic Analog Computer Substitute for Physical Tests — There's a "brave new world" electronic computer in Mathematical Services Division 5242 that saves Uncle Sam money. Under the skilled direction of programmers, this analog computer can simulate the fall of a missile from an airplane to the target area below. There's no airplane, no Air Force crew, no tracking cameras, no ballistic shape in the test. There's only the computer into which is fed information on weight, velocity, altitude, and other factors. The device will predict the movement of the object and show its trajectory, including all gyrations of roll, pitch, and yaw in the hypothetical plunge to the earth. . . . The Atomic Energy Commission and Sandia Corporation announced that a $5,000,000 building project for Sandia's Livermore Branch was approved. Plans were being drawn for a permanent facility for the Livermore Branch of Sandia Corporation. The Corporation began setting up the Livermore Branch in late 1955 to work with the University of California Radiation Laboratory in Livermore on the design and development of atomic weapons.



CONTROL PANEL of the analog computer is a maze of knobs, dials, gauges, and patch cords. Programmers Eugene Aronson (left) and Bob Crabb go over a problem to be fed into the machine. They expected the answer in 20 seconds.

40 years ago . . . John A. Hornbeck Assumes Sandia Corporation Presidency — John Hornbeck assumed the presidency of Sandia Corporation Oct. 1, 1966, after four years as president of Bellcomm, Inc. He was Sandia's sixth president and served from 1966 to 1972. He served as president of Bellcomm from March 1962 [to 1966] when it was created to provide systems engineering assistance to the National Aeronautics and Space Administration for Project Apollo, the nation's manned spaceflight mission to the moon. . . . Preliminary tabulations of ECP payroll deduction cards showed a total of $209,000 pledged with some 2,000 cards yet to be collected.

JOHN A. HORNBECK assumed the presidency of Sandia Corporation on Oct. 1, 1966, after four years as president of Bellcomm, Inc. In the foreground is a model of the Project Apollo vehicle.

30 years ago . . . Executive VP Jack Howard was in Geneva, Switzerland, as a member of the US delegation to the fall session of Strategic Arms Limitation Talks. He represented the Secretary of Defense on this SALT negotiation. . . . George Duke, Marvin Plugge, and Martin Kodlick developed an ingenious vault door that could be used to enhance physical security at assembly or manufacturing facilities. The work was an outgrowth of the Safeguards program and was done in Facilities Systems Development Division 1752. The security concept recognizes that well-prepared terrorists might ultimately breach any barrier, however formidable, given enough time. The vault door is designed to thwart their efforts for a sufficiently long time to allow our own response forces to neutralize them.

TO SAFEGUARD nuclear material at an assembly or manufacturing location, Marv Plugge, George Duke and Martin Kodlick developed this hydraulically or gravity operated vault door, which could be remotely or locally closed.

10 years ago . . . New and Improved National Atomic Museum Reopens, Features More and Better Exhibits — Some 50 Sandia employees and DOE representatives applauded Oct. 1 as the morning's first two visitors to the National Atomic Museum snipped a ribbon signifying the reopening of the museum's remodeled high-bay exhibit area. The museum's primary exhibit areas reopened Oct. 1 following a two-week closure for renovations. The aim of the remodeling project was to arrange the exhibits chronologically and to put the US nuclear weapons program into historical perspective. Sandia's plans include moving the museum to a site off Kirtland Air Force Base.

— Janet Carpenter

‘I have been on a train, but they don’t let me blow the whistle’

Al Foster celebrates 50 years at Sandia

By Iris Aboytes

The sound is deafening as a PT-17 enters the screen. The cockpit is open and the pilot is wearing a helmet, goggles, and a scarf that blows in the wind. The pilot in that WWII movie could have been Al Foster (5431), who was a pilot before he came to Sandia. Al recently celebrated his 50th anniversary at Sandia.

AVIATION CADETS beside a Stearman PT-17 trainer aircraft during 1944 primary flight training. (Al Foster in center, with foot on the aircraft wheel).
(Historic photos courtesy of Al Foster)

He grew up in Gibsonburg, Ohio, population 1,300. Growing vegetables and hunting kept the family going. There were no extras for his family, which included three children. He worked for the Great Atlantic and Pacific Tea Company, a grocery store chain, (the A&P) and earned 45 cents an hour to start and 67 cents as an assistant manager. He saved his money to take flying lessons 50 miles away for $10 an hour.

World War II and the Korean War

After his best friends were called into military service, he too wanted to “join up” to become an aircrew member. Al hadn’t taken college preparatory courses, especially algebra, so he feared being tested for classification. “Heck, I couldn’t even spell algebra, much less know what it was,” says Al. So while working at the grocery store, Al did some self-tutoring in algebra and took the military entrance tests. He missed the passing grade by one point, so it was “back to his job and more studying.”

LT. AL FOSTER

In late 1942, Al volunteered for military service but preliminary physical tests indicated scarred tissue in his lungs, so he was rejected and given a 4F rating. “I knew they were wrong in their final analysis,” says Al. “The scarring was from an infection that had already healed. I went back to a nearby hospital and paid for a more thorough medical exam. The 4F was lifted, and I was able to go into the Army Air Corps. There was no Air Force at the time.” He went for basic training in Florida. “It was great,” he says. “I got to smell orange blossoms, and it was very warm. I got to see another part of the world.”

“Basic training over,” says Al, “someone higher up must have decided that the US needed more soldiers somewhere else in the war effort, so I was trained as a draftsman to draw detailed maps and plot and filter intelligence information of enemy movements. Radar at that time was a new word for me.”

Al did not forget his dream of flying. While in the Signal Corps, he went to a nearby Air Corps base and retook the flight aircrew entrance exam. He was notified he passed the exam and a few weeks before going overseas was reassigned to the Air Corps.

Following six months of college training and more extensive tests, Al was assigned to the pilot training program. He was in the first graduating class to have flown B-25s in advanced training.

After the war, he headed to Ohio State University in Columbus, Ohio, and earned a degree in aeronautical engineering. “At that time, a veteran got $50 a month, but no pay for flying in the reserves,” he says. “I was single and it was a lot of fun, but I had to get more education so I could get a better job in the future.

“The fun slowed down when my Air Force wing was recalled to active duty for the Korean War, the same month I graduated from college,” says Al. First Lt. Foster was stationed in Japan, where his primary duty was as Chief Information and Education Officer for an air division that included three air bases. “I evacuated wounded troops, as well as troops and cargo back and forth to Korea.”

LT. AL FOSTER standing with his parents, Amelia and Carl Foster, beside his Pontiac in 1945.

When his tour of duty ended, Al sought a better full-time job. He went to work at the engineering department of North American Aviation Corporation in Columbus as an aeronautical engineer. He was a senior engineer working on the design and wind tunnel testing of fighter and bomber aircraft for the Navy for four years.

Indications that the aviation industry was in trouble were evident as several companies folded. Al decided he would try to get another job. He interviewed at four other companies and was hired at Sandia.

Long career at Sandia

Bldg. 880 was Al’s first home at Sandia. It was a big warehouse where cables hung from the ceiling to connect to computers. “The computers then weren’t the computers we have today,” says Al. “Our excellent team came from a variety of backgrounds. We didn’t have fast-speed computers; we just scratched our heads a little bit more. In the early days the atmosphere was more like a college campus. Camaraderie was unique and my coworkers were outstanding.”

“My long career at Sandia has been a varied one, not all aeronautical engineering,” says Al. “I like diversity, it keeps me thinking and gives me a better understanding of the many facets and functions of the structure of Sandia. I went where I was needed or when I was asked to help. A few times, I volunteered to support various projects. My work assignments have been in the capacity of some phase of aeronautical, mechanical, and hydrodynamic engineering. I have been a project and team leader, systems and soil penetrability analyst, as well as a documentation specialist.

CELEBRATING 50 YEARS OF SERVICE, Al Foster reminisces about his career and ponders his future at Sandia.
(Photo by Bill Doty)

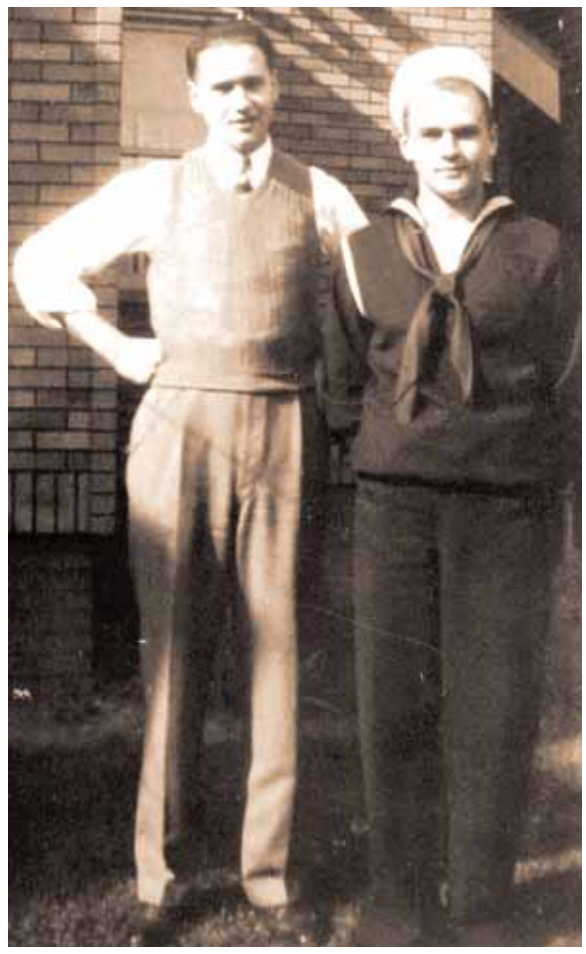
Where has the time gone?

“In the 50 years, I have not had a dull day,” says Al, “maybe half a day. Everyday has been a challenge. Necessary changes in policy and different requirements place different restrictions on getting the job done today. The facility is run more like a business, and that is OK. When I first came to Sandia, Congress and the Atomic Energy Commission wanted us to do the best we could and our customers were amiable to that. It was the Cold War and funding was one of the lesser problems.”

“Sandia, its structure, and policies have kept me here,” says Al. “I have been lucky to be healthy and will take it as long as I can. There are no life guides. You just live one day at a time.”

“I have been an engineer and have been able to marry things together at the proper time,” he says. “My work is still challenging, but now a constant quandary exists to become diversified. I have become a jack-of-all-trades and master of none.”

“Sharing, caring — that’s what really counts,” says Al. “That is what it takes to make a more balanced world — not money or age. I have been on a train, but they don’t let me blow the whistle.”



AL FOSTER and his brother Bill, in 1942, while Bill was home on leave from the Navy.