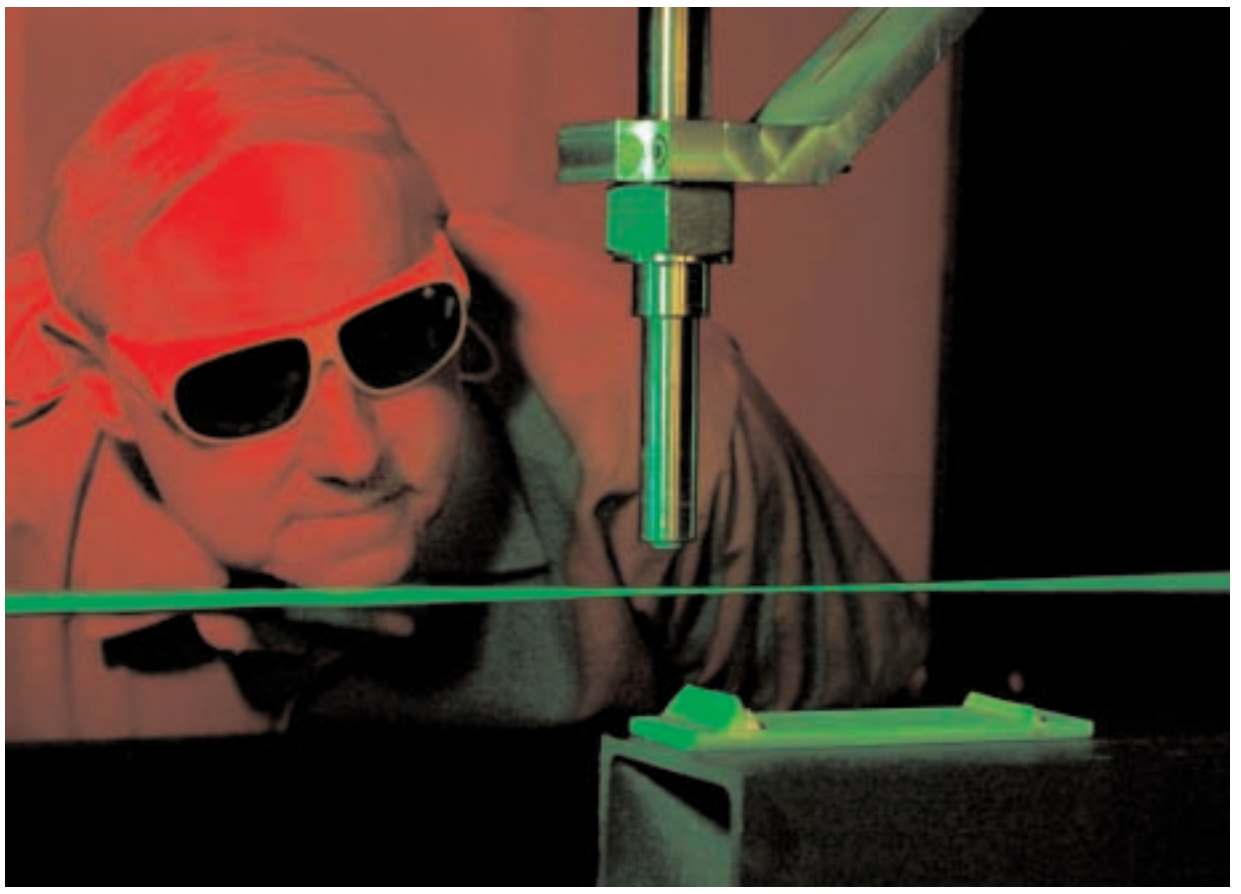
Industry warms up to promises of Cold Spray™

Sandia helps eight-member consortium of US manufacturers explore frontiers of splat science



PARTICLE COP — Mark Smith (1833) uses what amounts to a laser version of a radar gun — a laser velocimeter system — to measure the speed of tiny metal particles shooting toward the work surface during Cold Spray deposition. (Photo by Randy Montoya)

By John German

Sandia is studying the science of splat.

Working with a consortium of eight US companies that includes automakers and aircraft engine manufacturers, researchers at Sandia's Thermal Spray Research Laboratory are using experimental and computer-modeling capabilities to improve the world's fundamental scientific understanding of an emerging manufacturing technique called Cold Spray™ (*Lab News*, Jan. 26, 2001).

Cold Spray involves injecting microscopic powdered particles of metal or other solids into a supersonic jet of rapidly expanding gas and shooting them at a target surface. When these 10- to 50-micron-wide particles hit the substrate, they splat so hard they stick — like a bug to a windshield.

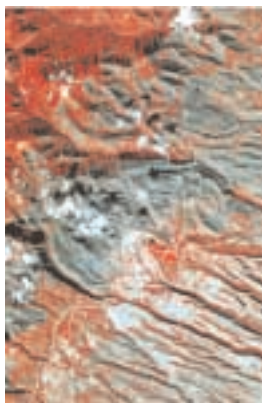
Building a reputation

Consortium members want to use new Cold Spray processes refined at Sandia to create wear-resistant coatings on car- or aircraft-engine components, for instance, or to deposit layers of reactive metals such as aluminum or copper onto substrates for use as heat-tolerant circuits.

The Sandians ultimately want to employ successfully commercialized Cold Spray processes, which originated, ironically, at a Soviet-era research lab in Siberia, to improve US nuclear weapons components. (See "The promise of Cold

(Continued on page 8)

Happy birthday! MTI satellite is one year old



The Multispectral Thermal Imager (MTI) satellite, developed by a Sandia-led team, was launched last March. To celebrate the anniversary, the *Lab News* is pleased to publish three of the satellite's most memorable images — in color. See them on **pages 6-7.**

Sandia LabNews

Vol. 53, No. 8 April 20, 2001

Sandia National Laboratories

Extreme excitement: Celebration marks EUVL microchip milestone

California site hosts industry-labs-government dignitaries and media; event marks 'huge step' toward next-generation microchips

By Nancy Garcia

"It seems that EUV is winning out," Craig Barrett, president and CEO of Intel Corp., observed at a big celebration event at Sandia's California site last week.

EUV, extreme ultraviolet lithography, is being developed through an industry-funded consortium by Sandia, Lawrence Livermore, and Lawrence Berkeley national laboratories as a way to create ever-finer features on microchips. (See April 6 *Lab News* for a four-page retrospective on the entire research project and partnership.)

When it was first made feasible in the 1990s, Barrett said at the April 11 event held in the Combustion Research Facility auditorium, EUV lithography "was perhaps one of the dark horses" among competing potential approaches under consideration for next-generation chip-making lithography. Now, he said, "it has become more the leading horse in the race."

A new approach is needed because the current chip-printing technique, traditional optical lithography, is hitting a physical limit around 2005 and won't be able to continue increasing functionality by doubling the number of transistors that can be etched on a sliver of silicon every 18 months or so — a pace the semiconductor industry has enjoyed since the 1960s.

In the last four years, an industry consor-

(Continued on page 3)

Sandia Senior Scientist Jeff Brinker's paper on nanostructures that report on their environment by changing color is being published this week in the journal *Nature*. Above, colorless transparent nanostructure films change colors as conditions they are exposed to change. See the story on **page 5.**

Paul Robinson paper considers nuclear weapons policy for a new century

By Bill Murphy

Do nuclear weapons still have a role to play in US national security? Does the nation's nuclear stockpile as it is now configured provide the range of deterrent options needed in the post-Cold War era? For that matter, does US policy regarding nuclear weapons reflect the 21st century threat in all its many dimensions?

These questions — or variations of them — are part of a policy debate that has been going on in the highest levels of the nation's national security establishment since the Manhattan Project. After several decades during which the answers seemed mostly settled and agreed upon, the questions have taken on a new urgency. The dissolution of the Soviet Union, the proliferation of nuclear weapons among nations not necessarily friendly to the US, the emergence of rogue states and sub-state groups with the potential to threaten US interests with weapons of mass destruction (chemical, biological, radiological, and nuclear) — these developments have added new levels of complexity that make the strategic calculations of the Cold War era seem almost simple by comparison.

Now, Labs Director C. Paul Robinson has weighed in publicly with a white paper offering his voice to the debate. The paper, "Pursuing a New Nuclear Weapons Policy for the 21st Century," rep-

(Continued on page 4)

This & That

New longevity leader — Technical staffer Merrill Jones (5743) now has the Sandia record for most years of service. Merrill has worked here 52.7 years, breaking the old record of 52.2 established by Roy Crumley, who retired in late 1999.

Ten more Sandians have been at the Labs 43 years or more (with organization numbers and years of service in parentheses, current as of April 5): Horace Poteet (5933, 49.4), Donald Robbins (2993, 48.5), Gordon Boettcher (2616, 47.7), Donald Lewis (12332, 45.7), Ben Sedlack (2954, 44.7), Alfred Foster (15413, 44.5), Robert Foster (2544, 43.8), Harold Spahr (9115, 43.8), Diana Mares (3341, 43.3), and Mary James (10501, 43.1).

Thanks to Bonnie Vigil (3051) for providing this information.

* * *

Husband/wife record? — Checking the list above reminded me that a Sandia husband/wife team whose pictures were in the last issue will retire with a whopping combined 77-plus years of service.

George Kolesar (5744), who officially retires in a few weeks, has 39-plus years, and his wife Mary (retired April 6) had 37-plus. (It totals more than 77 when their extra months are added in.) Anyone know whether any other husband/wife team here ever accumulated more total service?

* * *

Big dealing at the CU — Someone does a good job training Sandia Lab Federal Credit Union employees to stay friendly even under trying circumstances, such as when typical Sandians count their change twice — *carefully.*

When I visit the CU, I sometimes assume the role of "Mr. Trying Circumstances" just to spice up the employees' day, but I may have overdone it recently. When I asked to cash a $50 check at the CU a month or so ago, a pleasant young teller asked how I wanted the money. I said, "Three twenties would be fine." She smiled, saying, "I don't think I can do that, sir." So I told her I was just kidding and would like my $50 in shiny new dollar coins. She took a brief look at her cash drawer before looking up to see whether I was serious. I gave her a sheepish look and said, "OK, I'll be serious now. Just give me a twenty, three tens, and two fives and I'll get out of your hair." She'd had enough, handing me two twenties and a ten and said, "That's the best deal you're getting here today!" I've been back several times since, but haven't seen her again. I may have guided her into a new career.

* * *

A "shining light" for pensioners — Speaking of money, if you read our April 6 pension story, you know Sandia management will soon have a new pension plan improvement proposal ready to discuss with Lockheed Martin and DOE. We hear from quite a few Sandians who are quickly tiring of pension improvement talk and eager for some action. We promise to keep you posted about any new developments. In the meantime, keep in mind that K-Mart has reinstated its blue-light specials, that day-old bread stores have some fine deals if you get there early, and that if you look hard enough, you can find some "spiffy duds" at your local Goodwill store.

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

Sandia to host 11th International Arms Control Conference

Some 300 government officials and foreign affairs experts representing the United Nations, NATO, and more than 40 countries will gather in Albuquerque this weekend, April 20-22, to discuss the threat of chemical, biological, and nuclear weapons and the policies needed to control them.

The 11th Annual International Arms Control Conference, hosted by National Security Programs Div. 5000, will feature panel discussions on:

- New Paradigms in Arms Control: Offense versus Defense
- US-Russia Cooperative Efforts in Threat Reduction: Lessons Learned and Future Concerns
- The Century of Biology: Implications for Global Security and Arms Control
- Getting the Democratic People's Republic of Korea Out of the Proliferation Game
- Homeland Defense: Is It Real?

Keynote addresses will be given by Gen. Charles Boyd (ret.), Executive Director, U.S. Commission on National Security/21st Century; and Amb. Wolfgang Hoffmann, Executive Secretary, Comprehensive Test Ban Treaty Organization.

Labs President Paul Robinson and VP-5000 Roger Hagengruber also will speak.

"This conference brings together key leaders and policymakers in the arms control and nonproliferation communities to discuss issues that are of concern to nations around the world," says conference chair Jim Brown (5325). "Previous conferences have allowed for a creative exchange of ideas and have resulted in valuable relationships among some of the world's top arms control and nonproliferation experts."

Occupational health concerns? Review document on web site

Labs employees, a written occupational health program is available for your review. The need for a review by affected personnel is a regulatory requirement stipulated by the Occcupational Health and Safety Administration. The Sandia/New Mexico Confined Space Program document may be accessed at: http://www-irn.sandia.gov/ corpdata/ esh-manuals/confined_space/index.htm.

Instructions for submitting review comments are given on the web site. All comments must be received by Friday, April 27.

Sandia LabNews

Sandia National Laboratories

http://www.sandia.gov/LabNews

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LOCKHEED MARTIN

Sandians to participate in four-part radio series focusing on the nation's energy crisis

Two dollars a gallon for gas, soaring home heating bills, rolling blackouts in California — what's next? Does anybody know where we're going in our energy future? What's on the horizon — Wind? Solar? Clean coal? Nuclear?

These and many other questions about the energy crisis we're facing will be explored in a four-part, locally produced radio series titled *Running on Empty*. The series will air on four consecutive Wednesdays, starting May 2, on Albuquerque KUNM, public radio 89.9 FM, at 8:30 a.m. following NPR's Morning Edition.

Sandia Directors Margie Tatro (6200) and Tom Blejwas (6400) and UNM Professor Timothy Moy, a Sandia consultant, are among the energy experts featured in this in-depth examination of America's energy landscape. The program is produced by retired Sandian Howard Stephens, his wife, writer Virginia Stephens, and local media producer Jim Cochran. The program is a project of Vision Trust, a New Mexico-based nonprofit organization.

Meetings scheduled May 1-3 to discuss health care plan costs, potential changes

Human Resources Div. 3000 VP Don Blanton, Benefits and Health Services Center 3300 Director Dr. Larry Clevenger, and Benefits Dept. 3341 Manager Becky Statler will discuss health care plan cost projections and plan design strategies at a series of employee meetings in California and New Mexico.

While any changes to Sandia's health care plans and options available to employees will not occur before next January, the Benefits management team is using the series of meetings as a way to brief employees on the current status of its negotiations.

Here are the times, dates and locations for the meetings:

- Tuesday, May 1, 12-2 p.m., Bldg. 904 Auditorium for California Site managers
- Tuesday, May 1, 2:30-4 p.m., Bldg. 904 Auditorium for California Site employees
- Wednesday, May 2, 1:30-3:30 p.m., Steve Schiff Auditorium for New Mexico managers
- Thursday, May 3, 1-2:30 p.m., and 3-4:30 p.m., Steve Schiff Auditorium for New Mexico employees.

Congratulations

To Susan Boggs and Russ Jarek (1812), a son, Christopher, March 3.

EUVL

(Continued from page 1)

tium that is funding research at the three labs has grown to six members, and now includes Intel, AMD, Motorola, Micron Technology, Infineon, and IBM.

Huge step, leading choice

Sunlin Chou, an Intel senior vice president and manager of technology and manufacturing — who heads the industrial consortium, the EUV Limited Liability Company — called EUV lithography a promising "huge step" that won't require the ordinary, slow, and expensive development of new materials for each successive generation of microchip manufacture.

Instead, he said, EUV would allow "many, many" generations of microchip manufacture. He considers it the leading choice for use in the second half of this decade and beyond, saying it will meet industry needs for more than a decade. In a process similar to photographic printing, it uses a wavelength an order of magnitude smaller than those in use today to inscribe features that could be as small as 20–25 nanometers. This breakthrough required many developments to achieve, so the light, invisible to the eye, could be used to create smaller and faster circuits for memory chips, microprocessors, and application-specific integrated circuits.

LUMINARIES — Appearing on stage at the EUVL Milestone Celebration were, from left, Div. 8000 VP Mim John, NNSA Director John Gordon, Intel CEO Craig Barrett (at podium), Rep. Ellen Tauscher, and Sunlin Chou, an Intel VP and chair of EUV LLC management board.

'Wonderful, heart-warming'

Barrett lauded the cooperation that has made the pre-competitive collaboration possible, calling it "wonderful, heart-warming, and just phenomenal." He said consortium members will ultimately use the new technology to go on to "beat each other over the head in the marketplace — which is as it should be."

Representatives of semiconductor equipment manufacturers attended. They will use the tool assembled at Sandia to craft their commercial products for industry. "We look forward to getting one of these machines on the production floor in a couple of years," Barrett said.

The initial prototype, called the Engineering Test Stand, is not just a gleaming and complicated research tool occupying a 10x10-foot floor space, Chou said. It also represents "a history-making achievement."

Representing the three Department of Energy labs, which joined efforts in the partnership in a Virtual National Laboratory, John Gordon, Director of the Nuclear National Security Administration, said the tool's ability to print features that may one day measure as small as 20 to 40 atoms across "probably wasn't even a dream for today's pioneers in the industry."

At $250 million from 1997-2002, this largest industry-funded CRADA ever undertaken by the DOE, he said, "really is a partnership that works in every direction." The challenge has kept researchers on the cutting edge of their fields as they apply their expertise — gained in national security projects — to this problem. He said their efforts advance a strategic industry considered critical to the United States and demonstrate that a public-private partnership "can really work."

'We've done it'

Hosting the speakers, 8000 VP Mim John acknowledged the staff who are pushing the envelope of technology to its practical, theoretical limit for microchip patterning. Like the speakers who followed, she remarked on the foresight of the partners who supported the effort despite what Chou called "really intimidating risks."

"People four years ago said you can't do this," Mim said, "and by God, we've done it."

Chou pointed out that members of his company have worked on smaller collaborations with the DOE labs for "many, many years," and were always impressed. "It sometimes seemed literally magical — things that it seemed couldn't be done were done."

In her remarks as the only member of Congress with two national labs in her district, Ellen Tauscher (D-Calif.), savored her role "representing the smartest people in the world."

"We like people who are smart," she said, "and we believe in the state of the art." She praised the relatively new National Nuclear Security Administration for helping remove Defense Program laboratories "from the bureaucratic kudzu," saying she was proud to show the business community that government can be "smaller, smarter, and leaner — but not meaner."

Tauscher closed by predicting the partnership will create quality jobs, urging her listeners, "Let's get back to work."

NEWSWORTHY — Div. 8000 VP Mim John talks with a member of the media covering the event.

Sandia CaliforniaNews

International EUVL participation

In early 1998, the EUVL team attracted media criticism for considering the inclusion of a Japanese company as a possible licensee. "Why give foreigners technical information generated by US tax dollars?" the argument ran. For their part, the US companies believed they could move ahead faster if they had access to Japanese optics technology, but when members of Congress began to criticize the impending partnership, the Japanese withdrew.

But this didn't put a stop to the idea of international cooperation. In February 1999, DOE announced an agreement whereby Dutch-based ASML would become a licensee. "For EUV to gain market acceptance, it must be accepted internationally," said a DOE statement. "Collaborative participation on a pre-competitive basis among these leading lithography tool suppliers is the best approach for strengthening the overall technology and assuring its international acceptance."

Jim Glaze, who was appointed VNL's executive director in October 1998, spent much of his first six months maneuvering the ASML agreement into reality. "We're in the business of growing a new industry and — while I don't particularly like the term — managing a paradigm shift that must be accepted worldwide in order to be accepted.

ASML is a producer of state-of-the-art lithographic machines and one of the world's three top suppliers to the lithography industry. And it was willing to meet the stringent criteria that were set by the US government."

"The reason is market share," explains Rick. "If you look at worldwide sale of steppers, SVGL has 7-8 per cent of the total market, Ultratech Stepper has 2 per cent. So, at a maximum, US companies hold only 10 percent. That meant we needed participation of a company with a much larger market share, along with the ability to deliver lots of tool." — *Nigel Hey*

EUVL event attracts major media coverage

The EUVL announcement attracted significant media interest, with major national news organizations reporting in depth on the Sandia/California event and the EUVL technology. Reporters from the Associated Press, CNN, trade publications, and other national media groups attended, as well as reporters from Bay Area publications and broadcast outlets. The *Wall Street Journal* acknowledged the event with a story at the top of its Technology page.

Perhaps most visible and defining was the treatment by ABC World News Tonight with Peter Jennings the evening of April 11. Introducing the regular "Cutting Edge" high-technology feature, Jennings noted that Moore's Law — which derives from Intel founder Gordon Moore and states that computer power doubles every 18 months — has just won an indefinite extension. Then reporter John Yang explained the EUVL R&D effort, highlighting the collaboration among three national laboratories and the industry consortium.

Yang's report featured comments from Sandians Rick Stulen (8700) and Bill Replogle (8421) — the only researchers featured on-camera. Bill's comment, especially, should help the average citizen understand the technology. He said, "It's analogous to writing — the finer the tip of your pen, the smaller the features you can write. Smaller wavelength, smaller features: more powerful chip."

White paper

(Continued from page 1)

resents Paul's long years of thinking about this most serious matter. (Paul has for decades lived and breathed this issue, but usually in a less visible role.)

The 6,000-word white paper is available in its entirety on Sandia's web site at http://www.sandia.gov/media/whitepaper/2001-04-Robinson.htm. A thousand-word except was published last week in the *Albuquerque Tribune*. In the paper, Paul argues that though the Cold War face-off between two superpowers is a thing of the past, nuclear weapons will continue to be of paramount importance to the nation's security. He writes that nuclear weapons "must have an abiding place in the international scene for the foreseeable future." He emphasizes that nuclear weapons should "never be thought of as war fighting tools." Rather, the nation should view them as "war prevention" or "war termination" tools — when termination cannot be achieved by other means.

Paul proposes that the 21st-century US nuclear arsenal, which evolved to address and counter — almost to the exclusion of any other considerations — the potential of the Soviet Union to literally destroy the nation, needs to be reconfigured to address new threats.

Capability One and Capability Two

That configuration, he writes, should have two components: Capability One and Capability Two. Capability One represents what Paul calls "central deterrence": an on-going ability to maintain a viable deterrent to Russia's still very substantial nuclear arsenal. (Other nations may someday pose a risk of the same scale as Russia; today only Russia has the capability to utterly destroy American society.) Capability two, Paul writes, should be thought of as the "non-Russian force," a force scaled and deployed to deter threats from rogue states and sub-national movements.

In an interview, Paul told the *Lab News* the timing was right for him to offer public comments on the issue. He said a new century, a new administration, and new, more complex threats to the nation's security demand a new round of hard thinking about nuclear weapons. "What you're seeing in that paper," Paul says, " is my attempt to put down on paper some suggestions for the upcoming strategic review."

Need for new policy obvious to many

"I would say it has been fairly obvious to a number of people for the past few years that we really needed to start thinking much more broadly than just US-Russian deterrence and that policy. Now, the strategic review, which is held usually at the start of each new administration, seemed to be the best opportunity to influence thinking and get people thinking in new ways."

Paul noted that while he has served for eight years as chair of the US Strategic Command Strategic Advisory Group policy subcommittee, and has learned much from his STRATCOM experience, the thoughts in the white paper are his own.

"I don't claim that this is a consensus opinion of anybody. . . . It really is my own food for thought that I'm contributing to help the discussion along."

Paul recognizes that there will be skeptics who consider his involvement in the discussion as motivated by a desire to stimulate jobs at the national labs. One local newspaper account, for example, characterized Paul's public advocacy of his policy views as "seeking ways for the nation's nuclear weapons complex to remain relevant in the post-Cold War world."

"What was most wrong with that characterization," Paul says, "is that there is not a first- or even second-order connection between the numbers of weapons in the stockpile and the amount of design work which Sandia does. It [the motivation for writing the white paper] really was, the world has changed enough that we were running out of policy. That, and the fact that I've been exposed to this [the policy debate over America's nuclear weapons posture] for so many years decided I ought to set my hand at trying to make some contributions. What value these ideas will have in the nuclear posture review, I don't know. This is input in that process and it comes from the unique background I've had."

Paul is convinced that the nation's deterrent policy for the 21st century needs to incorporate nuclear weapons and not rely (as some even in the military have advocated) solely on advanced conventional arms. He comes to this perspective not from his role as a laboratory director but from personal experience and observation during his tenure as an arms control negotiator in Geneva.

Monuments to failed deterrence

"I've never believed that we could rely on conventional weapons alone for deterrence. When I'd get a chance to take a ride through Europe, which was a battleground twice last century, I used to point out to people that in every little town, there'd be a monument to the folly of conventional deterrence — with lots of names on it, just like the Vietnam wall. And so I found myself when I set out to write this paper saying, 'I need to make some of those thoughts known — that nuclear weapons really did change things, and their purpose has not been well-understood between war-fighting and deterrence. If you look at the mission statement of the military services, they've all had statements that have incorporated the words 'To fight and win the nation's wars.' Deterrence is not that. Deterrence is to prevent the war from ever occurring." And nuclear weapons, even in a post-Cold War world, are the most potent tool for deterrence the world has yet found. Or, as Paul wrote in his paper, citing Margaret Thatcher's quotation of a warning from Winston Churchill: "Be careful above all things not to let go of the atomic weapon until you are sure, and more sure than sure, that other means of preserving the peace are in your hands."

'Pursuing a New Nuclear Weapons Policy for the 21st Century': Excerpts from Paul Robinson's white paper

Note: The following excerpts are taken from Sandia Labs President C. Paul Robinson's white paper. These selected excerpts are not intended to provide a contextually complete synopsis of Paul's views, but rather a flavor of his language and his thinking on the issues addressed. To understand and appreciate the arguments Paul is putting forward here, download the entire paper from Sandia's web site — http://www.sandia.gov/media/whitepaper/2001-04-Robinson.htm.

It is abundantly clear (to me) that formulating a new nuclear weapons policy for the start of the 21st Century will be a most difficult undertaking. While the often over-simplified picture of deterrence during the Cold War—two behemoths armed to the teeth, staring each other down—has thankfully retreated into history, there are nevertheless huge arsenals of nuclear weapons and delivery systems, all in quite usable states, that could be brought back quickly to their Cold War postures. Additionally, throughout the Cold War and ever since, there has been a steady proliferation of nuclear weapons and other weapons of mass destruction by other nations around the globe. The vast majority of these newly armed states are not U.S. allies, and some already are exhibiting hostile behaviors, while others have the potential to become aggressors toward the U.S., our allies, and our international interests.

* * *

It seems inescapable that the U.S. must carefully think through how we should be preparing to deal with new threats from other corners of the world, including the role that nuclear weapons might serve in deterring these threats from ever reaching actual aggressions.

* * *

I personally see the abolition of nuclear weapons as an impractical dream in any foreseeable future. I came to this view from several directions. The first is the impossibility of ever "uninventing" or erasing from the human mind the knowledge of how to build such weapons. While the sudden appearance of a few tens of nuclear weapons causes only a small stir in a world where several thousands of such weapons already exist, their appearance in a world without nuclear weapons would produce huge effects. (The impact of the first two weapons in ending World War II should be a sufficient example.)

"It seemed to me that it was time for someone to step forward and articulate the other side of these issues for the public. . ."

* * *

It seemed to me that it was time for someone to step forward and articulate the other side of these issues for the public: first, that nuclear weapons remain of vital importance to the security of the U.S. and to our allies and friends (today and for the near future); and second, that nuclear weapons will likely have an enduring role in preserving the peace and preventing world wars for the foreseeable future. These are my purposes in writing this paper.

* * *

Let me first stress that nuclear arms must never be thought of as a single "cure-all" for security concerns. . . . Nuclear weapons must never be considered as war fighting tools. Rather we should rely on the catastrophic nature of nuclear weapons to achieve war prevention, to prevent a conflict from escalating . . . or to help achieve war termination when it cannot be achieved by other means, e.g., if the enemy has already escalated the conflict through the use of weapons of mass destruction. Conventional armaments and forces will remain the backbone of U.S. defense forces, but the inherent threat to escalate to nuclear use can help to prevent conflicts from ever starting, can prevent their escalation, as well as bring these conflicts to a swift and certain end.

* * *

Noting that the U.S. has always considered nuclear weapons as "weapons of last resort," we need to give constant attention to improving conventional munitions in order to raise the threshold for which we would ever consider nuclear use.

* * *

If high effectiveness defenses can be achieved, they will enhance deterrence by eliminating an aggressor's confidence in attacking the U.S. homeland with long-range missiles, and thus make our use of nuclear weapons more credible (if the conflict could not be terminated otherwise). Whereas, nuclear weapons should always remain weapons of last resort, defensive systems would likely be our weapons of first resort.

* * *

[Based on years of experience in sophisticated war games] It also seemed abundantly clear that any use of nuclear weapons is, and always will be, strategic. Thus, I would propose we ban the term "nonstrategic nuclear weapons" as a non sequitur.

* * *

Let me then state my most important conclusion directly: I believe nuclear weapons must have an abiding place in the international scene for the foreseeable future. I believe that the world, in fact, would become more dangerous, not less dangerous, were U.S. nuclear weapons to be absent. The most important role for our nuclear weapons is to

(Continued on page 9)

Intelligent nanostructures report on their environment

Sandia-UNM group's conjugated polymers easily implanted in rigid structure

By Neal Singer

Intelligent nanostructures that report on their environment by changing color from blue to fluorescent red under mechanical, chemical, or thermal stress have been created by researchers at Sandia and the University of New Mexico.

Most immediately, the durable, self-assembling nanostructures may lower costs by reducing the need for manufactured devices like stress detectors, chemical analyzers, and thermometers.

"The material can distinguish between different solvents," says Sandia senior scientist and UNM professor Jeff Brinker (1841). "There's a high correlation of color with the polarity of the solvent."

The material is also able to report changes in mechanical stress and temperature. When the environmental disturbance is removed, the structures change back to their original color in some cases, making them potentially reusable.

The elegantly simple method is published this week in the April 19 *Nature*.

Robust housing for fragile molecules

Perhaps more important, the method is a generic, efficient solution to a problem that has puzzled modern materials science: how to efficiently distribute conjugated polymers — inexpensive organic molecules that carry electric current — within a hard, protective structure.

In seconds, the new Sandia-UNM method evenly pre-distributes materials for polymers within a silica matrix through self-assembly. Polymerization results in polydiacetylene/silica nanocomposites that are mechanically robust and optically transparent and that produce telltale changes of color under changing environmental conditions.

Discovery of conjugated polymers themselves is considered important enough that the Nobel Prize was awarded last October to Alan Heeger, Alan MacDiarmid, and Hideki Shirakawa for initially developing the field. In 1977, they oxidized polyacetylene (a solid polymer prepared from the flammable gas acetylene) with iodine to yield a material many times more electrically conductive than the untreated, semiconducting polyacetylene.

A still-open question is how best to fashion a working structure for these potentially useful but fragile extended molecules. Inexpensive conjugated organic polymers could substitute for metals or semiconductors when electrical or optical potentials are needed.

Sandia researchers Alan Burns and Darryl Sasaki (both 1140) had characterized the responsiveness of two-dimensional films of these polymers to local stresses and temperature changes. However, their work, published last year in the American Chemical Society journal *Langmuir*, showed the organic materials to be "soft" and lacking the robustness required in harsh environments.

Conjugated polymers while you wait

While this problem could be solved by incorporating the polymers in "hard" silica scaffolds, previous research groups at other institutions had found implanting conjugated polymers into pre-existing silica structures to be a time-consuming, inaccurate, and relatively expensive process.

A significant step was performed by Darryl, who was able to synthesize the diacetylene precursor monomer of the polymer. His synthesized two-sided (detergent) molecule served as both the structure-directing agent for self-assembly and as the monomer of the electrically conducting, conjugated polymer polydiacetylene. UNM postdoc Yi Yang and former Sandia postdoc and UNM graduate student Yunfeng Lu discovered how to self-assemble the detergent molecule with silica to form a nanocomposite.

The self-assembly method is based on the scientifically well-known tendency of two-sided detergent molecules, composed of hydrophilic (water-loving) and hydrophobic (water-hating) portions, to spontaneously form spherical molecular assemblies and periodic three-dimensional nanostructures in solutions of water. These assemblies organize inorganic molecules around their hydrophilic exterior while the precise alignment of the hydrophobic portions position the monomers (built into the hydrophobic portion) so they can be polymerized.

In the Sandia-UNM process, evaporation accompanying dip- or spin-coating drives self-assembly of an initially homogeneous solution. Exposure to ultraviolet light followed by a low-temperature heat treatment or exposure to a catalyst polymerizes the organic polymer within nanostructured compartments of silicon dioxide.

This process was used originally by the Brinker group to fabricate a structure composed of alternating silica/polyalkylmethacrylate layers to mimic the layered hard-soft construction of seashells.

In the current work, it is the polymers themselves — already evenly distributed through self-assembly — that are of interest.

The Laboratory-Directed Research and Development (LDRD) program, DOE's Office of Science, the US Air Force Office of Scientific Research, and NASA co-funded this work.

The achievement is the Sandia-UNM group's latest in making use of self-assembling two-sided molecules. The earliest, simplest version of the method was first reported in *Nature* in September 1997. In that paper the group described how detergent molecules, alcohol, silica, and water could be used to self-assemble a thin film with precisely defined pores for membranes, sensors, and low k dielectrics.

Since then, this inexpensive process has been used in increasingly complex procedures, all reported in *Nature* and in *Science*. The process has produced a seashell-like layering at once very strong and nonbrittle, nanoscopic spheres that can hold medicine, intelligent ink that assembles during ink-jet printing, and self-assembled nanostructures with pore sizes alterable by light to a fineness of 0.2 angstroms.

Sandia releases latest version of ALEGRA this month

Computer framework models Z-machine implosions and hostile environments

By Chris Burroughs

The latest version of ALEGRA, a computer code used by departments Labs-wide to model Z-machine implosions and hostile nuclear weapons environments, was released earlier this month.

"This release is significant because the new version turns ALEGRA into a true code framework," says Dan Carroll (9231), ALEGRA team leader. "It now can be much more easily used for a wider array of applications."

Besides departments at Sandia, some Department of Defense customers also employ ALEGRA to model non-nuclear weapons effects.

ALEGRA (the name stands for Arbitrary Lagrangian Eulerian General Research Application) is one of two code frameworks being developed by DOE's Accelerated Strategic Computing Initiative (ASCI) program. The idea behind these frameworks is to develop certain common capabilities needed by many application codes only once and let the other codes use these capabilities.

Dan says that ALEGRA has been "morphing" into a framework over the last year.

"Since ALEGRA was already a successful finite element code supporting many key application areas, the decision was made to move ALEGRA in the direction of becoming a framework to better support the codes in these application areas."

The culmination of this effort is the recent release of Version 4.0.

Sandia researchers initially developed ALEGRA in 1991 as a shock wave physics code used to model high-speed impact and penetration phenomena involving a variety of materials. As computer hardware evolved, the code was rewritten to accommodate the newly developing massively parallel computational engines, like Sandia's Teraflop computer, ASCI Red.

In 1995 ALEGRA was expanded to model electromechanical properties — piezoelectric materials — giving researchers a new tool to simulate the shock-activated power supply in the neutron generator, for example.

Three years later ALEGRA integrated another advanced physics model with the capability to model magnetohydrodynamic (MHD) phenomena — the interaction between magnetic fields and electrically conducting materials.

For researchers working with the Z accelerator, this aspect opens new horizons. ALEGRA provides the ability to understand the complexity of the formation and compression of hot plasmas to generate the extreme X-ray environment needed to simulate a nuclear explosion.

SOME ALEGRA TEAM MEMBERS are, from left, Dan Carroll, Allen Robinson, Kent Budge, and Sue Carroll (all 9231).

"ALEGRA is critical to the future success of the high-energy-density physics research performed in the Pulsed Power Center," says Tom Mehlhorn, Manager of Target and Z-Pinch Theory Dept. 1674. "It is already being used to understand and design experiments on the Z accelerator. As the capability matures, it will provide simulations that will lay the foundation for an upgrade to Z machine and to design and build future z-pinch machines."

He says the ALEGRA framework includes physics modules that allow his engineers and researchers to simulate most of the major activities in the high-energy-density physics program — z-pinches, shock physics, radiation-hydrodynamics, and electron-photon transport.

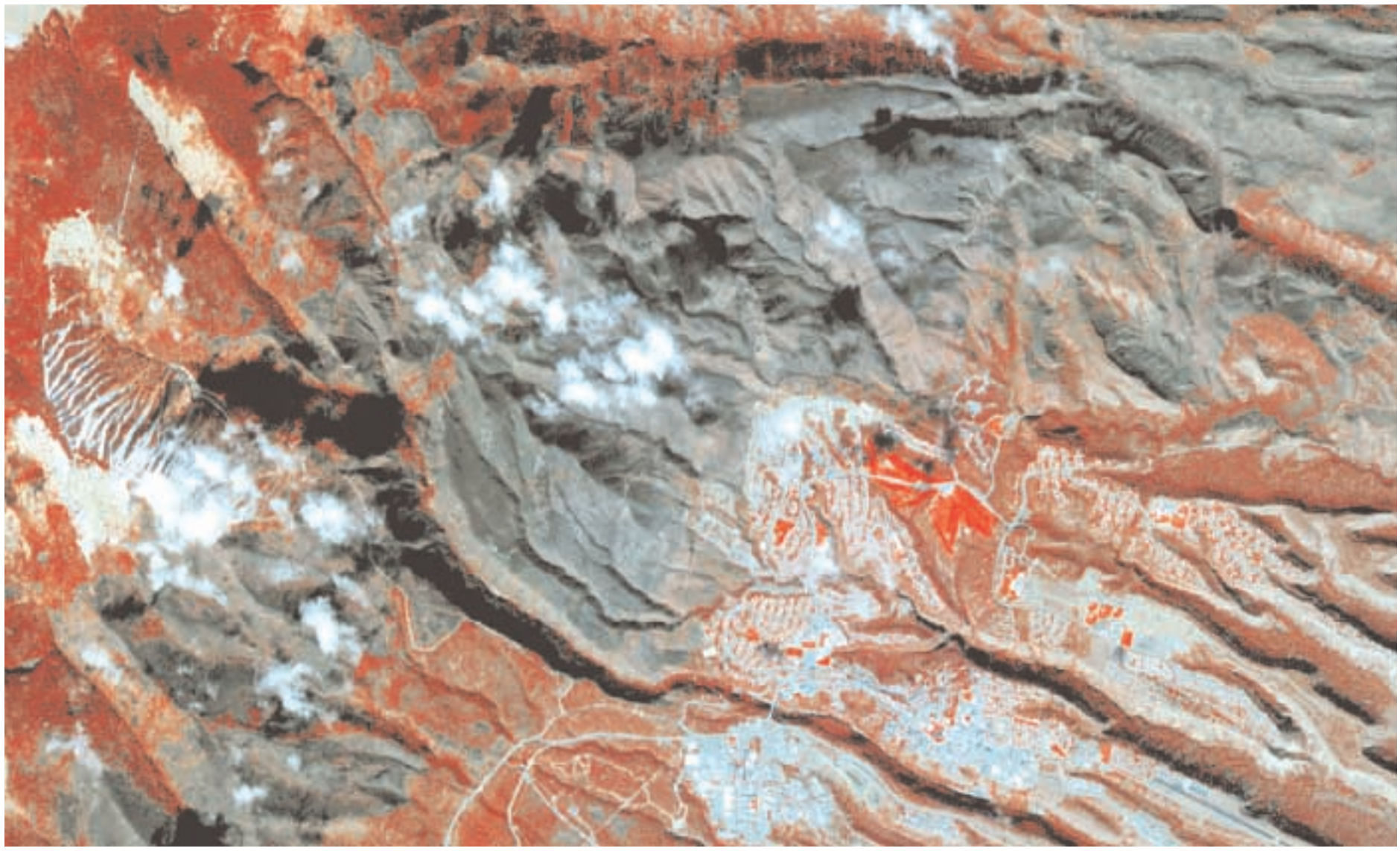
Dan says the Z machine work is only half the story of how ALEGRA is used. The other half falls in the area of modeling hostile environments — the effects of exploding nuclear weapons on another nuclear weapon. One user is Mark Kiefer, Manager of Electromagnetics and Plasma Physics Analysis Dept. 1642.

"Basically, our efforts to use the ALEGRA framework are going very well," Mark says. "We are making progress much faster than we expected would be possible. Our efforts to migrate our simulation methods to the ALEGRA framework were dictated by our realization that we are at the limit of the complexity for our current simulation codes. We really cannot take these older codes any farther without a prohibitive amount of work.

"All of our observations can be summed up

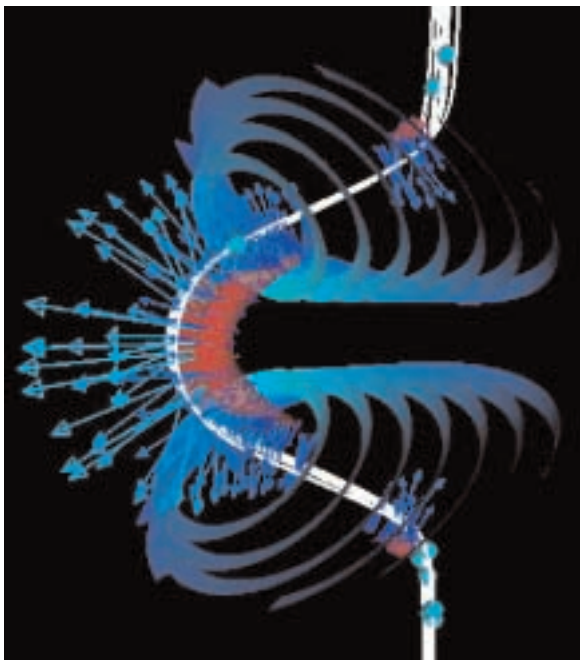
(Continued on next page)

MTI satellite team celebrates satellite's first year in orbit

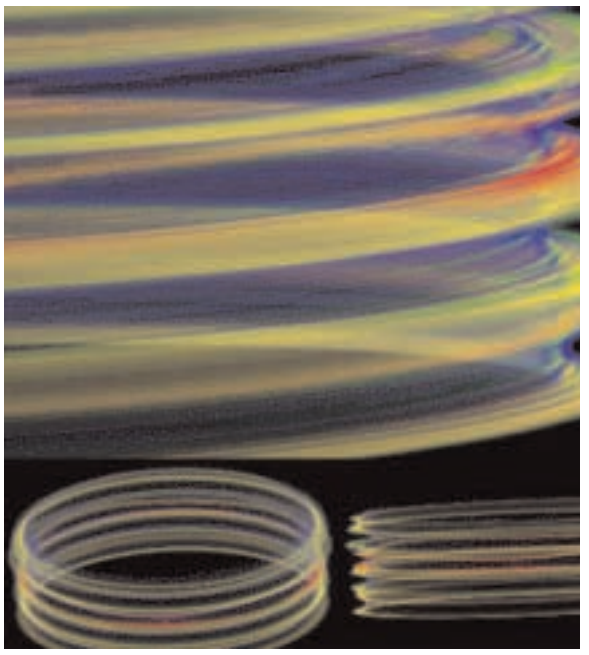


ALEGRA

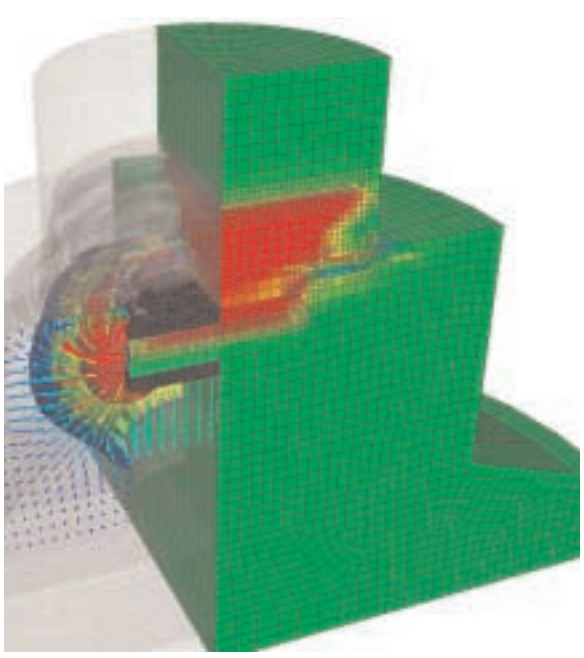
(Continued from preceding page)



ALEGRA SIMULATION of a kinked wire validation experiment performed at the Army Research Laboratory.



A FULL three-dimensional simulation of a Z-machine experiment.



ALEGRA SIMULATION of the operation of a contact fuze in the W-76.

with the conclusion that we cannot succeed in our nuclear weapon or pulsed power applications without taking advantage of the ALEGRA framework. One of the big advantages of the framework that we are looking forward to exploiting is the ability to test new models and algorithms on a short time scale. This will allow my staff of engineers and scientists more time to do science and engineering."

His area uses ALEGRA to implement full-wave electromagnetic techniques for certifying the W76-1 to normal environments, for design and performance of the W76-1 radar fuze, to couple those techniques with charged particle-in-cell techniques for certifying to hostile environments, and for modeling power flow in pulsed power accelerators.

ALEGRA effort spread across the Labs

Among those working with the framework is Scott Wunsch (8351) from Sandia/California, who attends the ALEGRA meetings via a teleconference connection.

Other code development teams working in Area 4 from Center 1600 are preparing to begin work in the ALEGRA framework.

The framework development team includes: Allen Robinson, Kent Budge, Mike Wong, Rich Drake, Kevin Brown, Randy Summers, Sharon Petney, Mark Christon, Chris Garasi, Josh Robbins, Dan Carroll, Sue Carroll, Ed Boucheron (all 9231), and Tom Haill (1674).

Others who have participated in developing ALEGRA or who are using the ALEGRA framework for further simulation development include David Turner, David Seidel, Mike Pasik, Rebecca Coats, Kelley Shaw (all 1642); Kyle Cochrane, Tom Brunner (both 1674); Scott Wunsch (8351); Randy Weatherby, James Peery (both 9142); Rebecca Brannon, and Ray Bell (both 9232).

by holding a symposium attended by 200 data users

Members of the Multispectral Thermal Imager (MTI) satellite team in March celebrated the satellite's first year in orbit by holding a symposium attended by 200 users of the data being gathered by MTI. The MTI satellite, developed by a Sandia-led government and industry team, was launched from Vandenberg Air Force Base, Calif., on March 12, 2000.

The satellite carries an advanced ground-imaging system that very accurately measures the "brightness" of ground features in 15 visible and infrared spectral bands.

During its three-year research mission, the MTI is collecting images of volunteer sites located throughout the US that have been instrumented to collect simultaneous "ground truth" data.

Researchers compare the satellite data with the ground truth data to develop engineering, processing, and analytic techniques that could be employed in future satellite systems to address a host of national needs, ranging from military and treaty-monitoring applications to hazardous waste site characterization and climate research.

The imaging instrument was assembled and tested at Sandia and calibrated at Los Alamos National Laboratory.

Researchers at DOE's Sandia, Los Alamos, and Savannah River Technology Center are focusing on treaty monitoring applications, while researchers at 50 other national defense and civilian organizations involved in the project are addressing applications of interest to their respective agencies.

About the images

THE VIEW FROM UP HERE — A few of the interesting images taken by the MTI satellite include: 1) Left page, an infrared image of the Los Alamos area taken after the Cerro Grande fire. Vegetation shows up red. The large gray swath from lower left to upper right is the devastation left by the fire. The Los Alamos town site and lab are visible in the lower right. The ski hill is visible to the left. 2) Right, a view of the Albuquerque area, imaged in November 2000 while the MTI was over El Paso, Texas. The true-color image shows parts of Kirtland Air Force Base to the south and Rio Rancho and Bernalillo to the north. A portion of the Sandia Mountains is visible at upper right, and the Rio Grande flows through the valley. 3) Below, an infrared view of the San Rafael Bridge in the San Francisco Bay area.

Cold Spray

(Continued from page 1)

Spray™ processes" below right.)

"Cold Spray has some significant advantages as a coating and fabrication tool," says Mark Smith, Manager of Joining and Coating Dept. 1833. "We think the best way to legitimize Cold Spray for use in the nuclear weapons program is to have its use proven in US industry, and to support the development of a commercial supplier base."

Members of the consortium — Alcoa, DaimlerChrysler, Ford Motor Co., The Jacobs Chuck Manufacturing Co., Ktech Corp., Pratt & Whitney, Praxair, and Siemens/Westinghouse — met at Sandia recently to discuss progress they've made toward readying the Cold Spray processes for widespread commercial use.

Cold Spray 101

Cold Spray more appropriately might be called "room-temperature spray."

Conventional "thermal spray" processes require preheating the sprayed materials so the particles are in a semi-molten state when they reach the substrate, allowing them to splash across the surface. But as the "splats" cool, they contract slightly, creating residual (stored) stresses or flaws at the interface that can cause defects later.

Cold-sprayed materials typically remain at or near room temperature until impact, slamming into the substrate so hard (travelling at 500 to 1,500 meters per second) that a tight bond is formed without the undesirable chemistry changes and stresses associated with conventional processes.

Although the science behind this bonding process is not yet well understood, the researchers think the high-velocity impact disrupts thin metal-oxide films on the particle and substrate surfaces, pressing their atomic structures into intimate contact with one another under momentarily high interfacial pressures and temperatures.

Understanding splat

Unlike thermal-sprayed materials, cold-sprayed particles experience little to no defect-causing oxidation during flight and exhibit remarkably high densities and conductivities once fabricated, the researchers have found. In addition, deposition rates comparable to traditional thermal spray processes can be achieved with Cold Spray.

"This is the logical conclusion of research thrusts in thermal spray technology during the last two decades toward faster-and-faster and cooler-and-cooler methods," says Richard Neiser (1833).

To advance the state of fundamental understanding and improve the usefulness of Cold Spray, the Sandians are combining modeling expertise in Engineering Sciences Center 9100 with experimentation in Materials and Process Sciences Center 1800.

The team has examined gas dynamics, aerosol physics, and plastic deformation during splat-to-substrate impact. Current efforts focus on avoiding fouling of nozzles with powder residue; experimenting with varying materials, particle sizes, and impact velocities; and characterizing splat patterns and Cold Spray-fabricated bulk materials.

The researchers also want to design better aerodynamic lenses that focus or spread out the spray pattern like a thumb held over the end of a garden hose.

A variety of metals have been deposited, including copper and aluminum, as well as several types of steel and nickel-based alloys. Even a few metal-ceramic composites have been successfully cold sprayed.

Revolutionary changes

The Cold Spray consortium supplies $400,000 a year for three years toward Sandia's R&D efforts, plus in-kind contributions by each member. Sandia also is collaborating with several individual member companies on proprietary Cold Spray R&D.

Cold Spray technology came to the US in 1994, ten years after its Russian inventors first recognized its potential significance while conducting high-velocity wind tunnel tests at the Institute of Theoretical and Applied Mechanics of the Russian Academy of Sciences in Novosibirsk.

One of its discoverers, Prof. Anatolii Papyrin, who holds the US patent for Cold Spray, now works for Ktech in Albuquerque, which hopes to supply fabrication equipment to a broadened Cold Spray market.

Sandia is among just a few R&D institutions in the world successfully turning improved understanding of Cold Spray science into marketable technology, says Mark.

"We think Cold Spray provides capabilities not previously possible," he says. "It's a new enough technology that we don't yet know all the possible applications, but it has the potential to make truly revolutionary changes in the way some products are manufactured."

GETTING A LOOK at Sandia's Cold Spray system recently were industrial partners (left to right) Neville Whittle of the Alcoa Technical Center, Gregg Wagner of Siemens/Westinghouse Power Corporation, and Jeff Smith of Howmet Corporation. Mark Smith (1833, far right) shows them stripes of metal deposited using the system. (Photo by Randy Montoya)

The promise of Cold Spray™ processes

Cold Spray™ processes show unique promise for creating wear-resistant coatings, fabricating durable small piece parts layer by layer, and joining chemically dissimilar materials with bonds that gradually transition from one material composition to another.

Coatings could be applied to materials that can't tolerate the higher temperatures of thermal sprays, or allow large parts to be made from lighter-weight materials without a net loss of strength — on composite automobile engine blocks, for instance.

Lower-defect crystalline materials could be consolidated without heat treatment for better-performing corrosion-resistant coatings. High-density copper lines could be used as electrical leads for heat-tolerant under-hood automobile electronics. For weapons applications, Sandia might use them to create vacuum-tight seals in metals or high-quality metal-to-ceramic bonds without heat treatment, and perhaps as a low-temperature alternative to welding.

Already Cold Sprayed materials are being evaluated as wear-resistant coatings for lightweight aluminum automobile engines. Sandia has used Cold Spray processes to reclaim an expensive "out of tolerance" satellite part, which is now destined for space rather than the scrap heap, says Mark. New industry inquiries about design and manufacturing possibilities are arriving at a steady pace, he says.

"The killer application is probably the one no one has thought of yet," he adds.

Feedback

Sandia's 401(k) program: Is it wonderful for everybody, or a 'cruel joke' for some?

Q: *I noted that in discussions concerning equity of our retirement plans, our protagonists invariably cite the "wonderful 401K plan" as a primary factor in achieving equity with our sister labs. For those whose salaries here are much below our industrial contemporaries and live hand-to-mouth, this 401K plan is a cruel joke. Participation is not possible. Drop this self-serving pretense of magnanimity and do what is right. Make our retirement plan genuinely equitable.*

A: Regarding the 401(k) plan, a study was conducted of the employees at Sandia who are in your same job classification. Those results showed that more than 90 percent of these workers participate in the 401(k) with a contribution of more than 8 percent of their salary, which is of course matched by the company at 66-2/3 percent of the first 6 percent. Even in a down market, the average balance of current employees in this group is greater than $100,000. The final analysis showed that within your same job classification there is high interest in participating in the 401(k) and receiving the company match as part of a long-term strategy to save for retirement.

Sandia's pension plans were never designed to fully replace pre-retirement income. The pension benefit was intended to be supplemented by Social Security and personal savings — the other legs in the three-legged stool of retirement security — to provide income in retirement. Given the extremely high levels of participation in Sandia's savings plans over time, we believe it is appropriate to include the value of the company matching contribution when comparing Sandia's retirement benefit to those at other national laboratories. *— Ralph Bonner (10300)*

Sandia develops TIVA, a new integrated circuit failure analysis technique

By Chris Burroughs

Ed Cole (1739), the Sandia researcher who in the mid-1990s co-invented the R&D 100 award winners CIVA and LIVA, has now developed TIVA/SEI, an optical beam failure analysis technique that detects integrated circuit defects from both the front and back of the device.

The TIVA (thermally-induced voltage alteration)/SEI (Seebeck Effect Imaging) technique finds failures in an integrated circuit quickly — as fast or faster than any of its predecessors.

The beam from an infrared laser, operating at wavelengths for which silicon is transparent, is focused on the device, heating only a small part of the integrated circuit at a time. The localized heating produces a voltage change on the integrated circuit which is biased with a constant current source.

An image of the circuit's response is generated by rastering the laser spot over the circuit with a laser-scanning microscope while recording changes in the power requirements. The laser-scanning optics also generate a reflected light image, which when registered with the TIVA image, allows for rapid localization of the failure in the circuit.

Faults and failures within the circuit react differently to the heat stimulation than operational components. In an unflawed device, the effects produced by the heat don't change the circuit's operation. However, if the power demands of the chip change due to the local heating, it is an indication of flaws. The SEI mode detects if a conductor is open, while TIVA locates a short circuit.

"TIVA is extremely sensitive and allows us to see flaws we either couldn't detect before or could locate only with significant time and effort," Ed says.

One of the significant aspects of TIVA is that it allows for scanning of the integrated circuit from both the front and back.

"This is important because the current state-of-the-art chips employ up to seven layers of metal interconnections, preventing direct observation of deeper structures from the front of the device," Ed says. "Additionally, flip-chip or upside down packaging denies direct access to the front surface. TIVA gives us the ability to evaluate the integrated circuit from both sides."

TIVA operates similarly to its older cousins CIVA (charge-induced voltage alteration) and LIVA (light-induced voltage alteration). CIVA was the first "induced voltage alteration" failure analysis technique developed at Sandia. It localized open conductors using a scanned electron beam. LIVA uses photocurrents produced with relatively short wavelength light, instead of heat as in TIVA.

TIVA has recently been successfully applied beyond the world of integrated circuits in the diagnosis of various failures in MEMS (microelectromechanical systems) devices.

ED COLE, left, and Jeremy Walraven examine a failed device with TIVA.

OptoMetrix license

Sandia has granted OptoMetrix, Inc. an optical instrumentation company specializing in failure analysis techniques for integrated circuits, a license to use the Labs-developed technologies Light-Induced Voltage Alteration (LIVA) and Thermally-Induced Voltage Alteration/Seebeck Effect Imaging (TIVA/SEI).

The license allows the company, located in Seattle, to market equipment using the technologies. The equipment could then be sold to integrated circuit manufacturers for failure detection.

While a few semiconductor manufacturers have directly licensed these technologies in the past, this agreement is the first time an equipment manufacturer has licensed these technologies for sale.

Team effort on 'IVA's'

Developing the "IVA's" has been a team effort, Ed Cole (1739) says.

The original CIVA development team included Ed, Richard Anderson, Jerry Soden, Chris Henderson (all 1739), and Bruce Dodd (no longer with Sandia).

He co-invented LIVA with Jerry Soden (1739). Others on the team included Chris Henderson, Dan Barton (all 1739), and James Rife (ret.)

Working on the TIVA effort with Ed were Paiboon Tangyunyong, Dan Barton (all 1739), and David Benson (ret.).

TIVA applications to MEMS were developed by Ed and Jeremy Walraven (1739).

Excerpts from Paul Robinson's nuclear policy white paper

(Continued from page 4)

serve as a "sobering force," one that can cap the level of destruction of military conflicts and thus force all sides to come to their senses.

* * *

Russia today is the only nation that we can conceive of with the potential to threaten the U.S. national existence. It would be exceedingly foolish to allow our deterrent forces against Russia to weaken as long as that potential remains in place. . . . The strategy and policy for continuing to deter Russia follows closely that which we developed during the Cold War. . . . I will designate that portion of our strategic force capability that continues to be devoted to deterrence of Russia as Capability One.

* * *

I believe that nuclear weapons do have a place and purpose today in other than a Russian context. Rather than inflame debates prematurely as to who is or may become America's enemies or adversaries, I would call the second force capability simply the "Non-Russian Force" or Capability Two. In my early thinking on this subject, I even referred to this second force as the "To Whom It May Concern" Force.

* * *

The whole question of, "Against whom would we really contemplate the use of nuclear weapons?" is an important political and international issue. A direct response might well be "Any nation or (targetable) sub-national entity which, if not otherwise deterred, might be tempted to employ nuclear weapons (or other weapons of mass destruction) against the United States, our forces, or our allies."

* * *

Among the fundamentals of a policy, the U.S. should reemphasize the principle it has embraced for most of the Cold War, namely that we will never directly or systematically target civilians. This principle has been a foundation of our Russian deterrence policy as well, although far too few are even aware of it.

The fact that civilians in these nations have no voice in developing the policies of their government would make their slaughter abhorrent to Americans, as it would be to any well-meaning peoples of the world. Targeting the leadership, along with military forces and military capabilities — the very tools of aggression — as was done against the Soviet Union; these are the appropriate primary targets that should be held at risk under any U.S. deterrent policy.

* * *

While we should remain ambiguous about the details of what our specific responses to their acts of aggression would be, we must make abundantly clear that our actions would have terrible consequences for them. Finally, the most important foundation for our policies and actions, and the most important part of our communications to the other side in an impending crisis must be that we have the national will, as well as the full means, to carry out our intended actions.

* * *

I believe it will be important to make a part of our declaratory policy that the United States ultimate intent, should it ever have to unleash a nuclear attack against any aggressor, would be to threaten the survival of the regime leading that state. Here, I do not mean that the aggressor state would cease to exist as a nation, but that governance under the existing national government could no longer be tolerated.

* * *

In a somewhat obvious way, aside from the still perplexing issues of how to hold at risk hardened or deeply buried underground targets, I believe that we would desire primarily low-yield weapons with highly accurate delivery systems for deterrence in the non-Russian world.

Here, I'm not talking about sub-kiloton weapons (i.e., "mini-nukes") as some have advocated, but devices in the low-kiloton regime, in order to contemplate the destruction of some buried or hidden targets, while being mindful of the need to minimize collateral damage.

I believe we can achieve the low-yield levels that are likely to be most appropriate for deterring wider threats, particularly if we are unable to design and test new weapons under a nuclear testing moratorium, by depending on the features inherent in many designs in the current U.S. stockpile.

An obvious and also very effective approach to obtain low-yield devices would be to use dummy secondaries as a way of quickly achieving single-stage yields (primary-only yields) without having to modify the devices, or to repeat flight tests for the delivery systems, or to conduct additional nuclear testing.

Mileposts

New Mexico photos by Iris Aboytes
California photos by Lynda Hadley

John Jewell
35 1741

Dahwey Chu
25 1745

Rod Geer
25 12640

Chris Morgan
25 7002

James Muntz
25 9329

Rita Pitts
25 7852

David Samuel
25 2992

Louetta Tidwell
25 7123

David Hebron
20 1677

Margaret Jacobs
20 5907

Consuelo Martinez
20 10205

Jennifer Simmons
20 2995

Bradley Smith
15 1746

Judith Case
15 9000

David Cocain
15 12336

James Gollnick
15 8411

Rosalie Lopez-Spinello
15 14405

Leann Adams Miller
15 5902

Recent Retirees

John Ayala
41 10262

John Campbell
27 10263

Martin Armijo
26 10627

Stan Benavides
23 10267

Schneeberger, Gallegos recognized for work with small, minority, and women-owned businesses

Cynthia Schneeberger, Manager of Supplier Relations Dept. 10205, has won two awards from the US Small Business Administration, and Corina Gallegos (10205) will receive an award from the National Association of Purchasing Management for their work with small businesses.

Cynthia will receive the national Small Business Administration (SBA) Frances Perkins Vanguard Award during ceremonies in May at the National SBA Small Business Week celebration in Washington, D.C. This award honors government and industry for excellence in the use of women-owned small businesses as prime contractors and subcontractors. The evaluated areas include leadership, advocacy, innovation, and implementation. Frances Perkins served as secretary of labor from 1933 to 1945 under President Franklin D. Roosevelt. The first woman to hold a cabinet-level position, Perkins was a social reformer who brought to her post a commitment to women's issues.

Cynthia was also selected as the 2001 New Mexico Minority Small Business Advocate of the Year by the SBA. She will receive the award May 1 at the New Mexico Small Business Week Celebration.

Corina Gallegos, also of the Supplier Relations Department, has been selected to receive the National Association of Purchasing Management's 2001 Charles J. McDonald Minority Business Advocate Award. Corina was selected as the sole recipient of the award for her outstanding contributions to small, minority, and women-owned business. The award will be presented formally at NAPM's 86th Annual International Purchasing Conference in Orlando, Fla., April 30.

Founded in 1915, the National Association of Purchasing Management, Inc. (NAPM) is a communication link with more than 47,000 purchasing and supply management professionals. NAPM provides national and international leadership in purchasing and materials management, particularly in the areas of education, research, and standards of excellence. It is a not-for-profit association.

Retirement report a bit premature (wrong)

In contrast to what you may have been led to believe by our publishing his photo in the March 23 *Lab News* under "Recent Retirees," Robert "Bob" Fisher of Materials and Process Sciences Center 1800 is still very much here at Sandia, not retired at all. In fact, he tells us he's not planning on any immediate retirement or retirement date. We should have published his picture on the Milepost page rather than in the Recent Retirees section.

BOB FISHER

The problem all started when Bob came in for his 35-year Milepost photo a year after his 35th service anniversary. We got the photo marked 36 years and in the format of retiree photos, so assumed. . . . But we're happy to now correct the record. *— Editor*

Recent Patents

Perry Robertson (1751) and Edward Witzke (9336): General Purpose Programmable Accelerator Board.

Marcelino Essien, Henry Peebles, Philip Sackinger (9141), and M. Erick Schlienger (1843): Apparatus for Jet Application of Molten Metal Droplets for Manufacture of Metal Parts.

Retirement open house

Sandia is hosting an open house in honor of retiree **Lola Stude** (7112) in the Thunderbird Café on Wednesday, May 2, 10-11 a.m. Friends and acquaintances are invited.

Sandia Classified Ads Sandia Classified Ads Sandia Classified Ads Sandia Classified

MISCELLANEOUS

GENERAL GRABBER AW TIRES, P255/70R16, almost new, white raised letters, $30/tire. Jackson, 281-8927.

WOODEN EXECUTIVE DESK, solid mahogany, 46" x 74", excellent condition, 6 lockable drawers, $250 OBO. Heard, 877 3839.

FOUR HILLS GARAGE SALE, 1600 La Tuna Place, April 20-21, Fri. 9 a.m.-5 p.m., Sat. 8 a.m.-5 p.m. Strader, 296-0209.

PICKUP TRUCK SHELLS, for 8-ft. bed, 1 red fiberglass, $150 & 1 white aluminum insulated, $100; carpet kit free, w/shell. Muirhead, 281-2925.

HALF ARABIAN MARE, 19 years old, $1,000; '74 Miley 2-horse trailer, $350. Krivitzky, 897-9104.

CUSTOM THREE-PIECE SECTIONAL, Krause, SW design, 12 pillow backs, muted mauves, grays, & browns, like new. Harrison, 821-9099.

DOG DOOR, patio insert, flap for large dog, $40; molded 2-pc. dog house, medium, $15. Manginell, 298-6188.

REEL-TO-REEL TAPE RECORDER, Norelco collector's item, from the 50's, excellent condition, $55. Bridges, 298-6188.

"JEWEL" TEA DISHES, over 200, & serving pieces, will sell single or multiple pieces; pot belly stove, Rex model 771, $700 OBO. Owens, 877-0901.

SADDLE, double rigged western, good condition, includes saddle rack/stand, moving must sell, $175 OBO. Schaub, 865-8807.

BMX BIKE, Giant Mosh, polished aluminum, teenager paid $350, view at KAFB Thrift Shop, $200 OBO. Dubicka, 296-6557.

WATERBED, super-single, $100; Nordictrack, $100. Hott, 865-1859.

QUEEN-SIZE MATTRESS, box spring, 2-1/2 yrs. old, very good condition, $200. Williams, 831-6427.

TWO BOSE 501 STEREO SPEAKERS, $60 for pair; bicycle, girl's, 18-in., $20; IBM Quietwriter printer, $50. Bickel, 822-0951.

BED, full-size, includes frame, wicker headboard & sets of sheets. Harrison, 821-9099.

CRAFTMATIC ADJUSTABLE BED, cost $3,500, asking $1,800; above-ground pool, 4' x 24', w/high-end equipment, deck. Campbell, 294-6000.

SURROUND RECEIVER, Sony STR-D1011 Dolby Pro Logic, $120; Trek 930 mountain bike, w/Avocet cycle computer, $250. Schoch, 822-8479.

SURGICAL LIGHTS, from operating room, great for precision work area, fully adjustable, including 9-ft. track. Sena, 873-1665.

MOVING SALE, 6236 Rio Hondo NE, April 20 & 21, 9 a.m. to 4 p.m., sofa, La-Z Boy, tables, kitchenware, clothing, etc. Benham, 856-2739.

HEAT-N-GLOW GAS FIREPLACE, w/exhaust pipes & artificial logs, $100. Fuentes, 821-3324.

TWO ROUND TRIP AIRLINE TICKETS, to either the Bahamas or Hawaii, $300, requires stay at specific hotels. Schroen, 286-1428.

WOOD SHAPER, Craftsman vertical spindle, solid cast iron table, w/2 cutters, $90.Bentz, 857-0728.

LP BBQ GRILL, $30; 100% wool rug, 8' x 9', $99 OBO; 55 sets Legos, $300 OBO; complete homebrewing setup, $55 OBO. Mooney, 294-5161.

DINING ROOM SET, 8-piece, light blonde, very good condition. Yanalavage , 884-1292.

WHIRLPOOL GAS STOVE, white, good condition, reasonable. Sedillo, 298-2527, evenings.

KING-SIZE WATERBED, 4-post frame, w/six-drawer pedestal, $250. Chavez, 836-6061.

TWO CUSTOM WOOD BOOKCASES, 7' x 32", $75 each; 2 tower speakers, $40 each; 2 colonial style lamps, 36-in., $50 each. Record, 243-5103.

KITCHEN TABLE, 40-in. round, expands to 70-in. long, corner bench unit, 2 chairs, $200 OBO. Peters, 293-6356.

SCHACHDT LOOM, convertible table & floor model, w/8 harnesses & many accessories, valued at $900, asking $500. Larsen, 292-7896.

SOLID OAK CAPTAIN'S BED, full-size, $350; large house speakers, $150 for set. Sherwood, 342-1161.

SW AIRLINES ROUNDTRIP TICKET, expires 11/22/01, good anywhere SW flies, $310. Smith, 256-0562.

AIRLINE TICKET VOUCHER, anywhere Southwest flies, expires on Nov. 30, 2001, $300. Sikora, 296-1762.

ANTIQUE FAINTING COUCH, burgundy, w/walnut frame, good condition, $600. Young, 867-3794.

REFRIGERATOR-FREEZER, GE, 25.2 cu. ft., like new; lawnmower, Craftsman, 20- in., 4-hp, excellent condition. Hanson, 298-2120.

QUEEN-SIZE WATERBED FRAME, w/6-drawer pedestal,$75; computer desk,$50; custom end tables, $75; 4-drawer dresser, $15. Suderman, 265-1786.

SCOTT PUSH REEL LAWN MOWER, $50; man's & woman's golf clubs, w/bags, $45 each. Gluvna, 884-5251.

CONSOLE COLOR TV, Zenith 25-in., $60; bassinet, w/liner, $50; "Country Bear" dishes, service for 8,$50. Burstein, 899-8971.

YARD SALE, 3907-A Ivy Place, KAFB, Saturday, April 21, 8:30 a.m. to 4:30 p.m., boy's clothes, up to 2T - 4T, baby clothes, children's toys & games, bedroom & dining room furniture. Roth, 856-2925.

GERMAN SHEPHERD, female, 4-5 mos. old loving, playful, needs big yard to play in. Kristek, 877-1254.

SECTIONAL COUCH, recliner/sleeper, matching chair, light peach & browns on cream, 4 yrs. old. Sandoval, 866-6991.

EXTENSIVE WOOD DOLL HOUSE KIT, large, assembly required, free to interested modeler. Sinton, 828-9672.

COCKER SPANIEL, purebreed, 9-mo.-old male, current shots, housebroken, buff-colored, groomed, $150. Graham, 896-2231.

JOINTER, Craftsman, 6-in., excellent condition, very precise, carbide knives, extra steel knives, 3/4-hp, on stand, $275. Bennett, 298-1142.

ANTIQUE CHANDELIER, excellent condition, 100 OBO; Lobo stadium seats, $5; miscellaneous ceramic molds. Rodacy, 293-2668.

GAS FIREPLACE, attractive design, 3-sides glass, zero clearance installation, very low price. Errett, 858-1013.

HEALTHRIDER, total-body aerobic/cardiovascular fitness machine, like new, paid over $500, sell for $250. Bear, 881-7128.

SCHWINN AIRDYNE EXERCISE BICYCLE, w/book rack, new $690, good as new, $299 OBO. Von Loh, 323-7533.

CLOTHES DRYER, Maytag, heavy duty, electric, $150. Reilly, 857-9908.

MAYTAG LARGE-CAPACITY WASHER, Whirlpool large-capacity electric dryer, relatively new, great condition, $550 OBO/set; wood microwave table, $75 OBO. Siegal, 323-1992.

MOVING SALE: 4/21/01, 7:30 a.m., good stuff, low prices, 1720 Algodones, follow signs from Indian School/Juan Tabo. Lindsey, 291-5485.

CAMPER SHELL, highback, w/Yakima upright bicycle racks, fits shortbed Ford Ranger pickup trucks, $500 OBO. Arquitola, 796-0430.

MINIATURE SCHNAUZERS, 2 for the price of 1, male & female, w/papers, 14 mos. old, would like to keep together, $375. Morales, 249-8800.

FOUR NOVAN SOLAR COLLECTORS, 4' x 8', water circulators, 4 pumps, controllers, McQuay circulating heaters, 300 gal. water tank, supports, & 126-ft.+ copper pipe, $1,500 OBO. Newman, 265-0274.

FLOWERED CHAIR/LOVESEAT, $125; single chair, green, high-back, $35; coffee table, six-sided, smoke glass, $100, all great condition. Ristorto, 899-7125, ask for Joan or Nicole.

BBQ Grill, butane, $35; 6-1/2 ft. picnic table, $50; dunebuggy, $2,500, all excellent condition. Gabaldon, 831-9012.

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.**

ANIMAL KENNELS: medium size, 32"L x 22"W x 23"H, $50; small size, 20"L x 13"W x 12"H, $30; small, 16"L x 11"W x 8"H, $25. Stang, 256-7793.

TRANSPORTATION

'90 CHEVY SUBURBAN, Silverado, 4WD, loaded, 160K highway miles, great condition, runs great, $7,750. Jackson, 281-8927.

'96 FORD TAURUS, 52K miles, mint condition, clean in & out, $7,000 OBO. Sanchez, 540-3529.

'93 MERCURY SABLE, teal, 89K miles, power everything, AM/FM/cassette, loaded, excellent condition, $5000 OBO. Gilliland, 271-1767.

'98 CHEVY 4X4, original owner, 1/2-ton, extended cab, short bed, 5.7-liter, AT, Z-71, CD/cassette, locking rear differential, towing package, 3-dr., bedliner, alumium cast rims, rear slider, tinted glass, white/pewter, matching white camper shell, 17,500 miles, looks like new, $21,700. Dwyer, 271-1328.

'98 CHEVY SUBURBAN LT, 1/2-ton, 4WD, leather, CD, like new, $27,000. Salazar, 275-9991.

'91 MERCURY CAPRI CONVERTIBLE, fun & sporty, 56K miles, clean, runs great, new top, $3,500. Whinery, 271-1653.

'89 VOLVO 240DL, manual transmission, dark gray, 170K miles, original owner, great condition, $6,000. Moore, 344-1982.

'88 RANGER XLT, SC, new TA's, Koss CD, 5-spd., chrome wheels. Hanson, 299-6421.

'84 FORD 4X4 F-150, LWB, extended cab, w/ fiberglass shell, excellent condition, $3,400 OBO. Schaub, 865-8807.

'96 Ford Taurus, beautiful car, 52K miles, fully loaded, clean in & out. Sanchez, 315-8799.

'95 JEEP CHEROKEE, I/O, new tires, brakes, shocks, battery, hoses, tow package, show package, PL, PW, PD, AM/FM/cassette, tilt, cruise, bucket seats, red/gray color, 79K miles, $12,500. Griego, 873-4480.

'72 CHEVROLET SUBURBAN, 1/2-ton, 2WD, 400 engine, towing package, lots of new parts, must see, $1,999. Smith, 869-4318.

'89 HONDA ACCORD LX, 170K miles, runs well, loaded, alarm, 5-spd., one owner, $2,000. Tharp, 792-0790.

'71 240Z ORIGINAL CLASSIC, body restored, w/rebuilt suspensions & driveline, fast & nimble sportster, $7,200. Gwinn, 281-9897.

'92 DODGE SPIRIT LE, silver, power windows, seat, & mirrors, $1,800 OBO. Rogers, 286-2143.

'98 GMC SONOMA, extended cab, 2WD, 4.3-V6, 5-spd., all accessories, 21K miles, like new, $13,500. Jones, 471-3149.

'98 MITSUBUSHI MONTERO SPORT LS, white/tan, V6, 4WD, 60K miles, lots of extras, $15,000 OBO. Lopez, 831-0777.

'00 CHEVY Z71 TRUCK, 4x4, AT, AC, PS, PB, AM/FM/CD/cassette, leather seats, beautiful white step-side custom wheels, tires. Baca, 899-9063.

'93 FORD RANGER, styleside, blue, 120K miles, AC, new tires, well maintained, 30-day guarantee, 5-spd., 24-mpg, $3,500. Pasco, 890-1434.

'99 MAZDA MIATA, 2-dr. convertible, approximately 21,384 miles, manual 5-spd., AC, red exterior, w/black interior, AM/FM/CD, 4-cyl., PW, bids accepted through 04/24/01, right to refuse bids, sold as is. Sandia Labs FCU, 237-7254, -7384 or -7386.

'98 GRAND PRIX SE, low miles, fully loaded, new tires, excellent condition, must see, $10,995. Veres, 797-4714.

'96 DODGE GRAND CARAVAN, 50K miles, excellent condition, new tires, radio/tape, AC, tinted windows, $13,000. Visor, 265-7288.

'95 MAZDA MIATA, 1.8-liter, AC, AM/FM/cassette, only 13,700 miles, show room condition, $11,500. Lanes, 856-7738 or 888-605-7968 pgr.

'85 MAZDA RX-7 GSL-SE, immaculate condition, 5-spd., both tops, 125K miles, full records, garaged,$3,100. Smith, 281-9666.

'97 FORD F-350, white, powerstroke, 4x4/dually, 20-in. centurion stretch, automatic/power everything, leather, rear seat/bed, $35,900. Talbert, 271-0607, ask for Mark.

'89 CHEVROLET TRUCK, 1/2-ton 305, FI, 5-spd., AC, PS, PB, AM/FM/cassette, 65K miles, $4,000. Eilers, 286-4013.

'78 VW BUS, new engine, $2,000 OBO. Martin, 247-0604.

'95 GRAND AM SE, 2-dr., 6-cyl., AM/FM/CD, AT, tilt/cruise, new tires, great condition, 102K miles, $5,900. Howell, 883-0568.

'96 TOYOTA 4RUNNER SR-5, V6, 4x4, excellent condition, AM/FM/CD/cassette, 48K miles, dash/cargo covers, alloy wheels, new tires, $18,500 OBO. Basil, 822-9544.

'98 CHEVY SUBURBAN, 4WD, loaded, leather, CD & more, excellent condition, 54K miles, $27,000. Salazar, 275-9991.

'98 HYUNDAI ELANTRA, 44K miles, blue, AT, 10-yr. factory warranty, gas efficient, excellent condition, $7,000. Barela, 877-9535.

'81 JEEP WAGONNER, good body, runs well, 100,700 miles, recent carburetor rebuild, V8, $1,800. Hardin, 828-1502.

RECREATIONAL

WOMAN'S MOUNTAIN BICYCLE, Trek 850, smooth road tires, excellent condition, $150 OBO. Kjeldgaard, 268-8835.

'76 DODGE JAMBOREE MOTORHOME, 22-ft., AT, roof AC, PS, PB, CC, stereo, 93K miles, $4,500. Lenberg, 238-0362.

'97 MOUNTAIN BIKE, Diamond Back Outlook, 18-spd., 19-in., chromoly main frame, virtually unused, excellent condition, $120. Helfrich, 255-9580.

BMX FREESTYLE BIKE, Silver X-games, w/4 pegs, good condition, $70 OBO. Poulter, 291-0607.

WIND SURFING BOARD, Hi-Tec 9'6", Race Slalom (carbon layup 118L), great condition, new $1,195, asking $585 OBO. Holmes, 292-0898.

'84 YAMAHA VIRAGO, 1000 cc, 18K miles, garage kept, look/runs great, $2,000 OBO. Gourley, 869-6273.

'00 HONDA CBR 929, low mileage, includes extended warranty, centerstand, TLC, yellow, like new, sacrifice, $8,000. Yip, 294-8124.

YOUTH GOLF SET, 1, 3 woods, 3-9 irons, $100; boy's, 24-in. mountain bike, 18 spd., $120. Biringer, 821-8741.

'98 SUZUKI MARAUDER 800, custom paint/pipes, C/A red, w/inlay, saddle bags, 4,700 miles, $7,200 firm. Lippert, 299-6594.

'92 DUTCHMAN ROYAL FIFTH-WHEEL, 30-ft., slide-out, fiberglass front/back, full-size bath, AC/central heat, great condition, $8,500. Cox, 865-0123.

ROAD BIKE, 54 cm Eddy Merckx, full Dura-Ace, unique older model, call for specs., make offer. Laiche, 798-1986.

BICYCLES, girl's 21-spd., 20-in., mountain bike, new $130, asking $65; man's Cannondale touring bike, all aluminum frame, new condition, model T700, new $900, asking $550. Roberts, 275-2941.

'71 FORD MOTORHOME, "Class C," sleeps 6, AC, PS, AM/FM, excellent interior, runs great, good exterior, ready for camping, perfect for hunting, $4,500 OBO. Herrera, 884-4925 or 881-1600.

'97 WANDERER TRAVEL TRAILER, 19-ft., sleeps 6, mint condition, used very little, see at KAFB-RV Lot, $9,500. Mares, 884-4843.

REAL ESTATE

HALF-ACRE, investment lot, in middle of developing area, $3,500. Shaffer, 256-7601.

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

WANTED

MOTORCYCLE JACKETS, man's & woman's. Sleeter, 299-3347.

VOLUNTEERS, Albuquerque Folk Festival, June 16, to help w/stage, workshops, tickets, dozens of possibilities, www.abqfolkfest.org. Esherick, 299-8393.

NANNY, for 1 & 3 yr. old, 35 hours/week, East Mountains. Mader, 250-4401.

COLLECTOR, seeking old microphones and/or equipment from radio/TV broadcasting stations. Dawson, 828-0873.

CROSS COUNTRY SKI BOOTS, poles, and/or skis, for size 1,2, or 3 shoe; kid's snowboard. Ling, 281-5328.

OLDER WOMAN, trustworthy, to transport & golf w/grandmother in Rio Rancho, 2-3 half-days/wk, $12+/hr. Hanselmann, 254-1782.

RED BRICK PAVERS. Lucero, 292-1955.

SINGERS, community service chorale (sing for hospice, Alzheimer's patients, children in crisis, etc.), Monday night rehearsals. McKenna, 293-0287, ask for Christine.

SUBURBAN THIRD SEAT, need for a '93, but '92 to recent may fit. Shields, 286-5917.

SLIDE CUBE PROJECTOR, Bell & Howell 35 mm, might consider non-working unit for parts. Cuderman, 884-8627.

BABY BACK PACK, Kelty brand, w/sun shade. Kuszmaul, 291-0933.

HANDYMAN, for household repairs. Hertz, 265-4729.

WORK WANTED

RESPONSIBLE COLLEGE STUDENT, will provide child care in your home full-time this summer. Kelly, 293-2475.

Engineer-artisan Kevin Fleming to exhibit wood art at prestigious Smithsonian Craft Show next week

By John German

Kevin Fleming the optical engineer seeks perfection.

But imperfections are what give "Kevin Fleming the wood turner" a thrill when he's roughing out a wooden vessel in the studio behind his kitchen or selecting that extraordinary chunk of stump in a New Mexico forest.

"Imperfections make wood more interesting, just like people," he says. "Who wants to hang out with a perfect person? Forget it."

A few years ago Kevin (2554) got special permission to remove a felled juniper in the Cibola National Forest. The 200-year-old tree was twice struck by lightning — once in the 1930s and again more recently — according to its grain pattern.

KEVIN with one of his finished pieces, a vase made of alligator juniper.

"I won't cut down a healthy tree for woodturning," says Kevin. "Instead I use wood from dead trees or trees being removed for landscaping. To me there's a certain satisfaction in capturing the beauty in a piece of wood destined for the landfill or fireplace."

The lightning-scarred tree is now a vase on Kevin's living-room bookcase.

Next week Kevin exhibits 30 of his wood vessels at the Smithsonian Craft Show, the nation's most prestigious artisan show, in Washington, D.C., April 25-29. He joins 119 other creators in 12 categories, including nine top-notch wood artists, selected by an expert jury from thousands of applicants.

"I applied for the show with the same sense of hope and pessimism that you might buy a lottery ticket with," he says. "Thousands of good artisans try year after year and never get in. I thought maybe with a computer malfunction or something I might get lucky."

A PLATE made of douglas fir burl shows how Kevin emphasizes flaws that enhance the beauty of wood.

To Kevin's surprised delight, the jury liked his work.

"The best works evidence a growth of ideas beyond the mere technical handling of materials," wrote one of the show's jurors about the selections. "There is an exceptional understanding of the principles of composition, color, design, line, texture, pattern, and form . . . an understanding of materials and their inherent possibilities and limitations . . . as well as a sense of feeling and caring that the maker has for the creations."

HANDS OF A MASTER — Artist/engineer Kevin Fleming at work in his wood studio. (Photos by Randy Montoya)

Influenced by New Mexico

Some of Kevin's pieces take months to complete.

The process starts when he finds an interesting piece of wood. He immediately seals the cut ends with wax and encloses the wood in a plastic bag to prevent splitting from sudden dry-out in the arid New Mexico climate.

He hollows the vessel and roughs out the shape on a lathe, then lets the piece dry slowly, sometimes for months, which results in subtle shape changes. When most of the moisture is out of the wood, he turns the vessel into its finished shape and seals it with a durable finish. He accents and enhances the wood with inlays of varying wood species, stain colors, and contrasting woods with interesting grain patterns.

He's also created unique cooperative pieces with renowned New Mexico gourd artist Robert Rivera, a friend.

"I try to base my work on shapes and forms found in nature and mathematics, blended with an intuitive feel for what, I hope, looks and feels pleasing," he says. "Being born and raised in New Mexico has exposed me to Indian vessel designs and shapes that have had a definite impact on my work."

Kevin began turning wood in his 7th grade shop class, beginning with small, simple pieces such as candlesticks. In 1994, after creating the latest in a series of vases, "My wife said, 'That's nice, but where are we going to put it?' " he says. "She was right. There were too many pieces to keep."

A friend sold her work at a gallery near Albuquerque's Old Town Plaza, so Kevin began taking his pieces there, and they began to sell. Soon other galleries sought his work. Now he exhibits at three galleries: the Southwest Mercado in Old Town, the Torres Gallery in Santa Fe, and the Adagio Gallery in Palm Springs, Calif.

Today he struggles to keep up with demand. His larger pieces sell for $2,000 to $5,000. Small pieces such as ornaments start at $65. The smaller vases are $100 and up.

But, he says, he does it not for the money but for the love of wood.

"When I look at a twisted branch on a tree, a discarded piece on a woodpile, the fork in a tree, I can't wait to see what's inside the wood," he says. "It's almost like archaeology. Preserving and displaying the infinite variety and beauty in wood is a very rewarding part of my hobby."

Retirees' vision discount plan

Retirees should have recently received a mailing about a vision discount plan through Superior Vision Services. Sandia's Benefits office says to be aware that to obtain a discount, you must go to a provider on the list designated with a "DP" for "Discount Plan." Providers without this designation do not participate in the discount plan.

In order to verify a provider's current participation in the discount plan, please contact Superior Vision's Customer Service Department at (800) 507-3800 or Sandia Benefits Customer Service Center at (505) 845-2363.

Coronado Club

Sign up now for summer fun — Pool passes, swimming lessons, water exercise, tennis lessons, junior tennis team, and more. This summer at the Coronado Club. Call 265-6791 or stop by the C-Club office for more information.

Sympathy

To Ken Condreva (8416) on the death of his mother, Dolores Condreva, in Dolton, Ill., on Jan. 7, and on the death of his father, Willard Condreva, also in Dolton, Ill., on Feb. 6.

To Daniel A. Lucero (9117) on the death of his father, Abel Lucero, in Albuquerque, on Feb. 13.

To Mae Lambert (2500) on the death of her mother, Audrey Scheinberg, in Albuquerque, on April 7.

Reader Service information

Retirees (only):
To notify the Labs of changes in address, call or write Diana Mares, Benefits Dept. 3341, at 505-845-9705, Mail Stop 1021, SNL, Albuquerque, NM 87185-1021.

Others:
To receive the *Lab News* or to change the address (except retirees), contact Iris Aboytes, Media Relations and Communications Dept. 12640, at telephone 505-844-2282, e-mail ioaboyt@sandia.gov, or Mail Stop 0165, SNL, Albuquerque, NM 87185-0165.

'Your Thoughts, Please' offers new question to answer, responses to read

The "Your Thoughts, Please" page on the internal web is offering a new question for employees to answer and displaying a new set of responses to an earlier question.

Recently posted employee input came in response to a question aimed at learning what Sandians believe is the Labs' most significant accomplishment of the past year or so.

The new question — which employees can respond to through the middle of next month — focuses on Sandia's future. It is:

"Throughout the Labs, Sandians are learning more about our revised corporate vision and values and our highest goal. Posters displayed around the site spell them out. Badge-size versions of the posters are being handed our (or are already handed out) by managers. What personally excites you about these words and principles? What projects, programs, or efforts would you recommend that Sandia pursue in order to make itself the lab the nation turns to first or to help the nation secure a peaceful and free world through technology?"

"Your Thoughts, Please" is reachable on the internal web's NewsCenter, http://www-irn.sandia.gov/newscenter/news-frames.html. Responses — no more than 300 words please — can be submitted through the web site or by e-mailing thoughts@sandia.gov.