

## Bizarre Electrorheological Fluids Transform at Blink of an Eye

In its normal state, the futuristic fluid has the hue and consistency of milk. But when an electrode is dipped into a cupful of the stuff, the milky white substance solidifies, allowing the cup to be lifted into the air. Turn the power off, and the cup and its liquid contents fall.

A recent *Scientific American* article, co-authored by Jim Martin of Advanced Materials Physics and Devices Dept. 1153, expounds the mysterious properties of a unique family of substances — called electrorheological fluids — whose form changes in the presence of an electric field.

"Depending on the strength of the field to which it is subjected," says the article, the fluids "can run freely like water, ooze like honey, or solidify like gelatin. Indeed, the substance can switch from one state to another within a few milliseconds." (The article appeared in the October 1993 *Scientific*

*American*. The other co-author is Thomas Halsey of the University of Chicago.)

Several Sandians — Jim, Judy Odinek (1153),

Doug Adolf, Bob Anderson (both 1812), Terry Garino (1841), and Brad Hance (1823) — began studying the unusual fluids nearly three years

ago under the Laboratory Directed Research and Development (LDRD) program.

"We're intrinsically interested in how things work," says Jim. "Plus, we thought the stuff might have some interesting, lucrative applications." (See "Shock Absorbers, Clutches, and Robotic Joints: Some Modern-Day Uses for Electrorheological Fluids" on page four.)

The result of their research was a better understanding of electrorheological fluids — how they change, why they solidify, and what might make them better.

### North to South

The "electrorheological effect," as it's called, was discovered in the late 1930s by inventor Willis Winslow. He found that a substance as simple as corn starch mixed in corn



JUDY ODINEK (1153) adjusts laser equipment as part of an experiment to study a unique family of substances called electrorheological fluids that transform from liquid to solid in the presence of an electric field. In the experiment, laser light scatters as it passes through a transparent fluid. The resulting pattern of light appearing on the screen behind Judy tells researchers how the fluids' structures flow and break up under stress. (Photo by Randy Montoya)



# LAB NEWS

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AT A STOP in the Robotics and Intelligent Machines Center, Arati Prabhakar (center), Director of the National Institute of Standards and Technology (NIST), puts a robotic simulation through its paces as Labs Deputy Director Jim Tegnalia (left) watches and Robert Anderson of Intelligent Systems Dept. 2161 explains its function. During a recent visit to Sandia, Prabhakar praised the Labs' work and said she expects much future cooperation between NIST and Sandia. See story on page five.

(Photo by Mark Poulsen)

### Announcement Delayed

## Changes to Retirement Plan Still in the Works

An announcement of changes to the Sandia Retirement Income Plan — which covers non-union-represented employees — won't happen until perhaps late this month or early April, according to Charlie Emery, Vice President for Human Resources 3000.

"We've prepared a set of recommended changes to the plan," he says, "but unforeseen delays prevented getting the necessary approvals and announcing changes in February as we had hoped."

The recommendations will be considered by the Sandia Board of Directors during its March 9 meeting at Sandia/California. Approval by the board is expected at that time.

Proposed changes to the plan must then be formally submitted to DOE for final review. "We hope to receive DOE's approval by late March or early April," says Charlie.

Recommended changes were developed as a result of employee concerns expressed during management and operating (M&O) contractor transition meetings last August and September. The Pension Security Plan for union-represented employees was adjusted during contract negotiations last fall.

Sandia and Martin Marietta management reviewed the Retirement Income Plan for appropriate

(Continued on Page Two)

**New Ethics Office  
Gears Up at Sandia  
— See Page Six**

# This & That

Squiggles from above - You can actually distinguish every letter in his signature, so I'm not sure how my director, Jerry Langheim (12600), got to his lofty position. In my semi-prestigious job, I get to see lots of signatures from Sandia directors and vice presidents (for example, on the unending stream of memos they send heaping lavish praise on me for the outstanding job I do), and I'm beginning to believe having an illegible signature is almost required for being a director or above. One signature I saw recently looks like a pigeon with dirty feet landed on the signature block.

\* \* \*

Please, friends, talk me out of it! - Looking ahead, I see we're scheduled to publish an issue on April 1, and I don't need to tell you jokers what day that is. I've got a great idea for the April 1 issue, but I hope one of my many friends - either one of them, actually - talks me out of it. My creditors hope I remain employed for the next 50 years or so, and what I have in mind could put that in serious jeopardy.

\* \* \*

Good idea, "butt ugly" - I've kept my big mouth shut about this as long as I can because I know some very-well-meaning Sandians were responsible for getting many of a new style of safer butt cans distributed at various outdoor spots around the Labs. They may work great, but those butt cans are also "butt ugly" - bright yellow with bold, black lettering on them informing people they should deposit their ashes and butts in the cans, and then even giving instructions for emptying the cans. There's even one of these lemon beauties in front of Building 800, and I have to wonder what kind of impression it makes on our visitors. If we really need these cans at such locations, maybe we could at least paint them something besides "screaming yellow."

And, as a former President used to say way too often, "let me make this perfectly clear": I don't want to get in the middle of any smokers vs. non-smokers flap. This isn't about smoking. It's about ugly.

\* \* \*

No more busy signals - Neither Sandians calling Sandians nor outsiders calling Sandians should get busy signals today, except in unusual situations. Employees who already have ISDN phones (ISDN stands for something, but I can never remember what) automatically have several incoming lines.

The rest of us at Sandia/New Mexico can very quickly program our voicemail boxes to receive incoming messages whenever we're talking to someone else. Here's how: Pick up your phone and dial \*2 after you hear the dial tone; after you hear the dial tone again, dial 5-7900. If it worked, you'll hear two quick beeps and another dial tone. Hang up. Mission success!

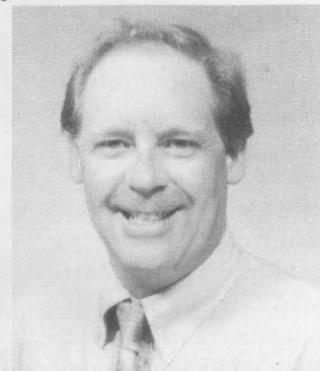
\* \* \*

Phrustrated phoner - Speaking about voicemail, a Sandian didn't hang up quite soon enough last week after calling LAB NEWS photographer Mark Poulsen and leaving a message. After requesting some photos of a VIP visitor (maybe for one of her several bosses), the caller sighed and commented either to herself or to a nearby sympathizer, "I have such an important job!"

•LP

## Meet Ken Frazier, New Managing Editor

New Managing Editor of the LAB NEWS is Kendrick (Ken) Frazier, who moves to Employee Communications Dept. 12660 from Media Relations Dept. 12630, where he has worked as a public information specialist since joining Sandia in 1983.



KEN FRAZIER

Ken replaces former Managing Editor Charles Shirley, now a senior writer in Laboratory Communications Dept. 12610. Ken will keep Charles' former Sandia phone number, 505-844-6210.

Ken is a well-known science writer and editor with long-standing interests in astronomy, space exploration, the geophysical sciences, archaeology, technology, the history of science, and public issues of science.

"We're delighted to get such an outstanding journalist as Ken as our managing editor," says Employee Communications Department Manager and LAB NEWS Editor Larry Perrine. "The LAB NEWS has a long tradition of covering what's happening technically at Sandia, and Ken has a long history of science writing achievements. He's a perfect match for our needs, and I know Sandians will soon come to appreciate his considerable talents."

### Science Writer Since '66

Before coming to Sandia, Ken had 20 years of writing and editing experience. He has specialized in science journalism since 1966 when he began editing the *News Report* of the National Academy of Sciences and National Research Council. In 1969, he joined *Science News* magazine in Washington, D.C., and became editor of that internationally distributed weekly publication in 1971.

Ken left *Science News* in 1977 and moved to Albuquerque to write books and become a freelance science writer. His articles have appeared in *Smithsonian*, *Air & Space*, *Omni*, *New Scientist*, *Reader's Digest*, *Physics Today*, the *Encyclopedia Britannica Yearbook of Science and the Future*, and many other publications.

He is author of four books: *People of Chaco*, *Solar System*, *Our Turbulent Sun*, and *The Violent Face of Nature*.

When he isn't on the job at Sandia, Ken edits *The Skeptical Inquirer*, an international quarterly that publishes critical investigations and scientific evaluations of fringe-science and paranormal claims. It is published by the Committee for the Scientific Investigation of the Claims of the Paranormal, a group of scientists, scholars, philosophers, and writers who try to educate the public about differences between science and pseudoscience.

Ken has a BA degree in journalism from the University of Colorado, which presented him an award for outstanding achievement by an alumnus in 1985, and an MS in journalism from Columbia University.

His memberships include the National Association of Science Writers and Sigma Xi research society. In 1990 the New Mexico chapter of Sigma Xi gave Ken its "Outstanding Science Resource Person" award for his work as a science writer and communicator of scientific news and information to the public.

Ken and his wife Ruth have two grown children, Chris and Michele. Ruth is president of Futures for Children, an organization that works with American Indians in the Southwest.

### Sympathy

To J. D. Williams (5861) on the death of his mother in Pratt, Kans., Feb. 23.

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MARTIN MARIETTA

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## Retirement Plan

adjustments when Martin Marietta became the M&O contractor. Possible changes were on the agenda at the Sandia Board of Directors' meeting in December.

In a Jan. 21 LAB NEWS article, Charlie was quoted as saying, "Although we cannot be more specific now, we believe these changes, when approved, will solve many of the concerns that Sandians expressed during the transition meetings." •

## Recent Patents To Sandians

Brian Dodson (1153): Method of Producing Strained-Layer Semiconductor Devices Via Sub-surface-Patterning.

Stephen Martin and Antonio Ricco (both 1315): Multiple-Frequency Acoustic Wave Devices for Chemical Sensing and Materials Characterization in Both Gas and Liquid Phase.

Lloyd Bonzon, O. B. Crump, Jr. (both 2514), Phillip Stanton (1433), and William Sweatt (9225): Apparatus and Method for Laser Velocity Interferometry.

## A Hot Solution to a Hot Problem

# New System 'Starts the Ball Rolling' in Toxic Waste Cleanup

Sandia researchers, working cooperatively with Lawrence Livermore National Lab and private industry, have improved upon steam reforming as a tool to clean up radioactive toxic waste.

"As part of DOE's effort to clean up mixed toxic waste at the Hanford site in Washington, several labs have been developing new systems that separate radioactive from organic components and then destroy the organic materials," says Larry Bustard of Hanford Environmental Technology Dept. 6624 at Sandia/New Mexico. "Our approach involves designing a circulating bed of ceramic balls — a moving bed evaporator — integrated with a high-temperature treatment process known as steam reforming."

Already used commercially to destroy wastes that include paint and hospital wastes, steam reforming breaks down heavy organic materials into more basic components.

Following a technology review last spring, Larry determined that the program required

### Needed: A high-temperature method to destroy organic materials mixed with radioactive waste.

mechanical engineering support to address issues in the design of the moving bed evaporator. He turned to Engineering for Transportation and Environment Dept. 8412 at Sandia/California, which then enlisted other centers in California and Lawrence Livermore in a partnership with Synthetica Technologies, Inc. of Richmond, Calif., the company that invented the steam reforming process.

"The support evolved into design help from Sandia/California, which formed a coalition with Lawrence Livermore to incorporate expertise in hot recycled solid processes," Larry says.

### Oil-Shale Facility Becomes Cleanup Lab

"Working together," says Larry, "we converted an idle oil-shale pyrolysis facility at Lawrence Livermore into a waste-processing test bed, creating a pilot organic destruction plant that can process 0.03 gallons of sodium nitrate waste per minute. By combining this lab technology with Synthetica's commercial steam reforming detoxification sys-

tem, we hope to help provide a solution to Hanford's waste disposal problem."

Hanford currently maintains 177 underground tanks — 149 single shell and 28 double shell vessels — used to store radioactive waste materials. A three-party agreement among the State of Washington, the Environmental Protection Agency (EPA), and DOE has set schedules to clean up the Hanford waste.

Hanford will begin retrieving complex waste from the tanks by the late 1990s. Under the tri-party agreement, the DOE site has committed to bring on-line by 2004 a fully integrated system that features a glass vitrification plant that will convert the radioactive material to a solid form for storage at a site such as the proposed Yucca Mountain repository in Nevada.

For the clean-up operation to be effective, however, the DOE site must first conduct extensive separations of the radioactive agents cesium and strontium from the mixed waste, which includes high levels of sodium nitrate.

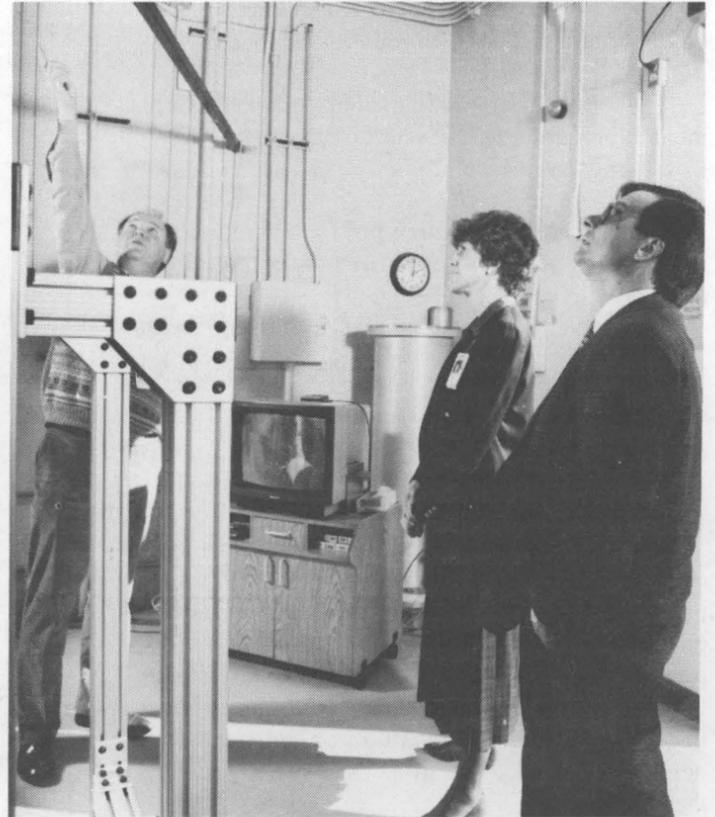
"Historically, thermal treatment processes used to destroy organic wastes have run into problems, particularly when the material includes nitrates that agglomerate at high temperatures and ruin the process," Larry says. "Therefore, we needed to develop a versatile, high-temperature method capable of destroying a wide variety of organics in the waste stream."

### Heating, Steaming, Filtering the Waste

The pilot facility, which consists of a central loop of ceramic balls, heat exchangers, filters to catch solid radioactive material, and the Synthetica detoxifier, works through a three-step process.

First, a thin layer of mixed waste is coated uniformly onto the hot-ceramic-ball surface, in the moving bed evaporator. At approximately 500 degrees C, heat and steam break down the organic waste, producing an organic vapor. During this phase, the different components are separated, with the sodium nitrate and radioactive materials captured in special filters.

The second step consists of filtering any residual volatile radionuclides and conditioning the



LINN DERICKSON (8412, left) shows part of the 0.5 gallon per minute moving bed evaporator designed and fabricated at Sandia/California to Joan Woodard (6600) and Larry Bustard (6624).

waste stream for further treatment in the detoxifier. Upon entering the detoxifier, or step three, the temperature of the waste stream is boosted to 1,000 degrees C, which converts the vapor to carbon dioxide, hydrogen, methane gas, and other compounds.

"The primary goal for the Hanford tank waste is to decompose the sodium nitrate into more easily handled sodium carbonate, a process that occurs at high temperatures in the presence of carbon dioxide," says Bob Cena, project manager at Lawrence Livermore. "These solids are collected in the filters along with the radioactive components, and will be further processed in the glass vitrification system."

Terry Galloway, Vice President of Technology at Synthetica and a former Lawrence Livermore employee, sees steam reforming as a key solution to safely handling toxic waste disposal. "This new system offers a much more environmentally friendly alternative to incineration as an effective means of hazardous waste destruction," he says. "The system will destroy a variety of wastes, and it can be put into use at many different DOE and Department of Defense facilities across the country."

In addition to the steam reforming design, several competing technologies, including supercritical water oxidation (hydrothermal) and plasma torch (calcination) processes, are currently being developed by DOE labs to help solve the Hanford waste treatment problem. A review near the end of March will narrow the search to two top competitors. Due to the efforts of the moving bed evaporator design team, steam reforming is expected to be a strong contender.

"We plan to have a 0.5 gallon per minute unit ready for Hanford by 1995 that can be used as a pilot test system," Larry says. "Thanks to the cooperative efforts of Sandia, Lawrence Livermore, and Synthetica, we hope to help solve this national waste disposal problem and thus contribute to a safer environment for everyone."

Sandians involved with the moving bed evaporator system project include Linn Derickson, Davina Kim, and Dave Zanini (all 8412); Bill Wall (8281); Pat Gildea (8411); Larry Hoffa (8415); Jamie Morris (8534); Brad Meyer and John Wirdzek (both 8746); Steve Goods (8714); Bob Bradshaw (8716); Jim Miller, Jeremy Sprung, and Paul Kuehne (all 6624).  
 ●MSheehan



## SANDIA CALIFORNIA NEWS

## Combustion Publications Win Awards

The Sandia/California publication *Combustion Research Facility News* has received an Award for Merit in the 1993 Northern California Technical Publications Competition "Visions of the Scribe," sponsored by the Society for Technical Communication. In another category, the Combustion Research Facility won an Award for Excellence for its 1992 *Sandia Combustion Research Technical Review*.

Now in its 16th year of publication, the *CRF News* reports on all phases of research going on at the Combustion Research Facility in Livermore. It is widely distributed to the combustion community, with recipients in government, universities, and industries both foreign and national. Articles highlight basic

and applied research, including cooperative efforts with industry and recent advances in environmental studies.

The *Technical Review* is a compilation of work done over a two-year span at the CRF. It is a comprehensive review of research accomplishments.

Both publications received judges' compliments on their style, content, and typography, especially the clarity of the writing.

"This is the first time we've entered the competition," says Publications Coordinator Lizbette Cox, "and I never dreamed we'd win for both of them. These are cooperative efforts of the entire staff of the CRF. I'm proud to be part of the team that put these publications together."

*(Continued from Page One)*

## Bizarre Fluids

oil, when placed between two charged metal plates, quickly hardened, then reliquified when the electric field was removed.

The effect is similar to the one demonstrated in the familiar grade school science experiment where iron filings are placed on a flat surface and subjected to a magnetic field — each filing becomes a magnetic dipole, its north pole attracted to the south poles of the other filings and repelled by other north poles.

The net effect is a “chain” of iron filings, with all north poles facing one direction and south poles facing the other.

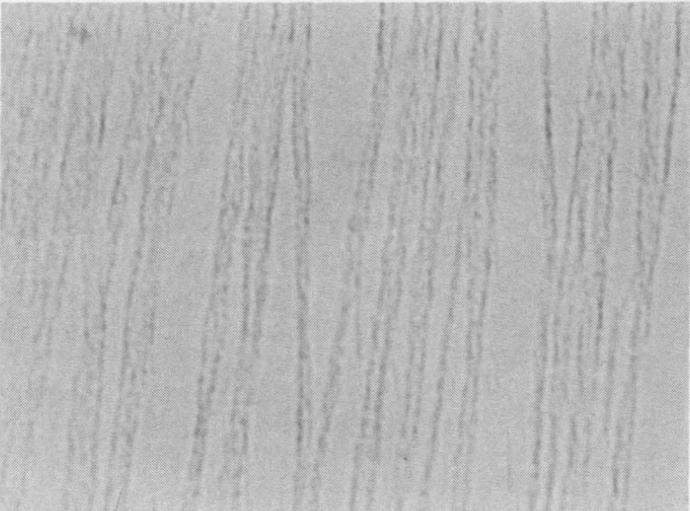
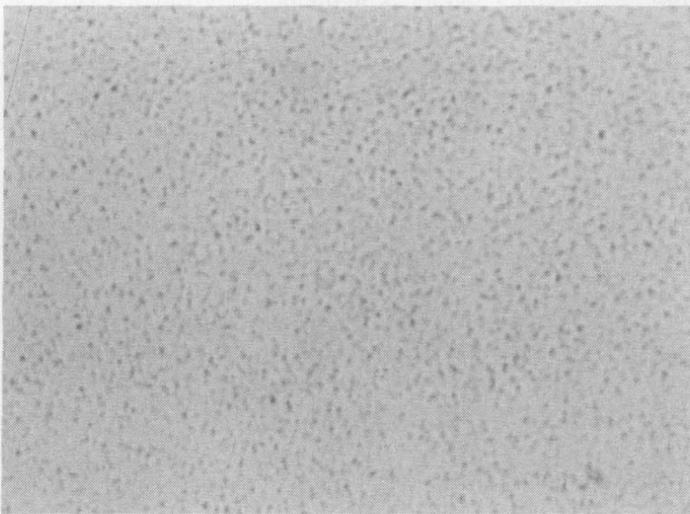
Individual particles in electrorheological fluids also exhibit attractive and repulsive forces when subjected to an electric field, a phenomenon called “electrical polarizability.”

In greatly simplified terms, an electrorheological fluid consists of microscopic particles suspended in an insulating liquid. In the absence of an electric field, a fluid’s particles move about independently of one another. But when an electric field is applied, positively charged protons inside a particle shift slightly toward one electrode while negatively charged electrons shift slightly toward the other.

Soon, individual particles begin to align with one another to form chains of particles connected end to end. Chains unite to become columns, columns unite to become larger columns, and so on. The strength of the effect varies according to the electrical polarizability of the particles.

The result is a liquid substance made “solid” by the attractive forces of particles to other particles within it.

Soon after discovery of the electrorheological effect, various shortcomings of electrorheological fluids for practical applications were realized. As solids the fluids are structurally weak, as liquids they are typically abrasive, and at high



NORMALLY, individual particles in an electrorheological fluid move about independently (top photo), but when an electric field is applied, the particles align end-to-end, forming columns of particles (bottom photo). The result is a liquid substance made “solid” by the attractive forces of particles to other particles within it.

## Shock Absorbers, Clutches, and Robotic Joints: Modern-Day Uses for Electrorheological Fluids

While useful electrorheological fluids are just over the scientific horizon, researchers are imagining a variety of modern-day applications for the substances.

Because the fluids can go from liquid to solid and back again in thousandths of a second, they could be used in devices that require quick mechanical changes.

Automobile manufacturers might someday produce an electrorheological clutch that couples a car’s engine to its drive shaft — the fluid inside solidifying when the car is in “drive” and liquefying when in neutral. Such a clutch would have no moving parts to wear or fail.

This feature — mechanical action sans moving parts — makes electrorheological devices promising replacements for a variety of conventional mechanical actuators as well.

Some of the most promising applications for electrorheological fluids take advantage of the fluids’ continuously variable viscosity. Smart electrorheological shock absorbers, for instance, might damp the impact when a car runs over a pothole.

“A pothole happens mighty fast,” says Jim

Martin (1153), “so you want to be able to adjust the damping instantaneously and in midstroke.”

A conventional shock absorber comprises a cylinder with a piston inside that pushes thick oil through an orifice when the device is compressed, the oil absorbing the force of the impact.

Adaptable shock absorbers filled with electrorheological fluids instead of oil, and equipped with motion-detecting sensors and electrodes, could sense the sudden displacement of the piston and immediately apply an electric field to the fluid inside. By varying the strength of the field, the fluid’s viscosity could be instantaneously adjusted to the severity of the pothole. (Similar shock absorbers may also damp the stopping and starting of magnetically levitated trains.)

Other proposed applications include fiber spinning clutches that exert a constant force on a spinning spool (used in the manufacture of certain fibers), and valveless hydraulics that allow robotic devices to move with human-like fluidity.

“The potential for applications is endless,” says Jim.

temperatures their chemical structures tend to break down quickly.

With no near-term, practical applications for the fluids, it was almost 40 years before scientists resumed serious study of the bizarre substances, says Jim. “There was virtually no progress in understanding electrorheological fluids until the past three years or so,” he says.

### Fluids Still Weak When Solidified

“We set out to understand how these substances work so we could make practical improvements and find the best fluid possible,” says Doug Adolf of Properties of Organic Materials Dept. 1812. “For the proposed applications, we wanted longer-life, more active fluids that are relatively stiff.”

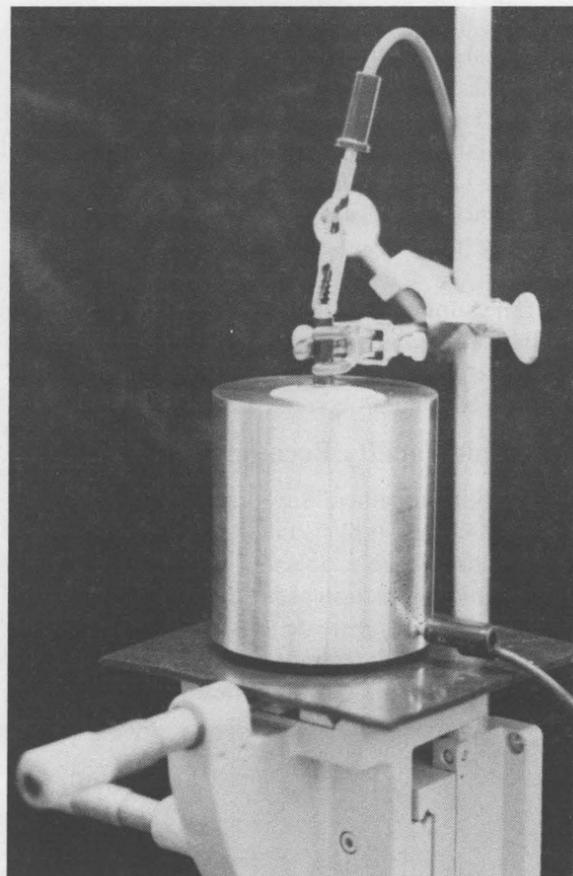
The Sandians first experimented with different mixtures for the fluids, hoping to create less abrasive fluids with longer shelf lives and resistances to chemical breakdown from friction and high temperature.

They also tested the viscosities and yield strengths of various mixtures, questioning how the fluids react under stress and what properties make the “solidified fluids” stronger or weaker. And they studied details of electrical interactions that take place within the liquids, as well as how the fluids respond to different electric fields.

In one set of experiments, they created a transparent fluid using micron-diameter glass balls as particles (typical electrorheological fluids are opaque). By shining a laser beam through the fluid, applying an electric field, and observing how the laser light scattered on a screen behind the sample, the researchers studied how the fluid’s solid structure develops.

In a variation of this “light scattering” experiment, the electrodes were shifted in opposite directions, causing columns in the solidified fluid to tilt and shear. The experiment led to an understanding of how the fluids flow and break up under stress.

Doug and Terry Garino developed fluids made with ceramic particles that are less abrasive and have greater strength and operating life. And Bob Anderson developed an understanding of the detailed



A SIX-POUND weight is suspended in air, held there by an electrorheological fluid solidified by the application of an electric field. The fluid was previously poured into a depression in the weight’s top surface.

mechanisms of particle polarization.

The result of the Sandia research, says Jim, is a better understanding of what causes fluids to “chain up” in the first place; how to make stronger, longer-life fluids without using additives; and a detailed understanding of the properties of electrorheological fluids under flow.

“Basically, we’ve been able to produce fluids with longer shelf lives and with less abrasive ingredients, but structural weakness remains a problem,” says Jim.

Research is now continuing under an LDRD, but researchers soon must make some connection with industry, he says. “Sandia has conducted some of the most thorough studies yet in understanding electrorheological fluids,” he says, “but we must try to go beyond basic research now and find some practical applications for them.” ●JG

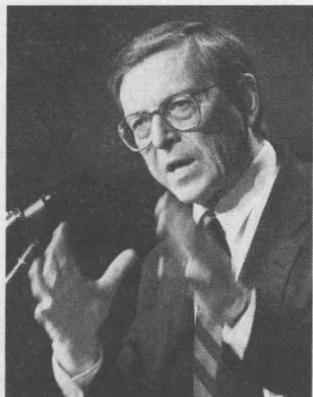
**Relationship with NIST Touted****Domenici Optimistic about Sandia's Near Future, Concerned about National R&D Funding**

Sandia's immediate future appears stable and secure, but the ability to change is key to the longer term future, said US Senator Pete Domenici, and there's little doubt change will come to the Labs during the next few years — change in kinds of work, share of the national research and development budget, and work force size.

They are the kinds of institutional changes reshaping businesses across the country, he told an overflow audience at the Technology Transfer Center auditorium Feb. 16. They include downsizing, reorganization, and exploration of new pursuits, among others.

"You are a great institution and you have not finished your job," he said. "We want to change with the times, but we don't want America to lose what you give it, and what you are able to give it in the future," he added later.

He praised President Clinton's public support of science, technology, and research as basic to keeping the national economy growing and producing the standard of living Americans seek and expect.



PETE DOMENICI

"But I believe the DOE national labs have a bit of a struggle when it comes to where the President currently is allocating new money," he said. "Everyone in Washington uses wonderful words, but it seems that between the lip and the pen, money goes elsewhere or falls off the table."



LABS DIRECTOR AL NARATH (center) discusses cooperative work involving Sandia and the National Institute of Standards and Technology (NIST) with (from left) US Senator Jeff Bingaman, NIST Director Arati Prabhakar, US Senator Pete Domenici, and US Representative Steve Schiff. All five answered reporters' questions at a news conference following Domenici's colloquium.

Domenici said that while the National Science Foundation, Department of Defense, and National Institute of Standards and Technology (NIST) received increases in the R&D budgets the President proposed to Congress for next year, DOE is the "only major science and technology player to see its R&D spending decrease."

**DOE's R&D Budget Declining**

He said that while Sandia's total budget is expected to increase by two percent in the fiscal year 1995 budget, he sees "troubling trends" that budget writers might begin to consider funding for the Labs' new manufacturing role in the reconfigured nuclear weapons complex as part of its R&D base.

"I think to do that would be a mistake," he said.

He praised Labs Director Al Narath as "the only lab director who's established a good working

relationship with NIST," and welcomed NIST Director Arati Prabhakar, who joined him, Al, and US Senator Jeff Bingaman on a tour of Sandia later in the day. (See "NIST Director Praises Labs' Work, Expects Much Cooperation" below.)

He said he and Al had toured NIST facilities together and discussed with Prabhakar ways of bettering the relationship between NIST and Sandia "and how they can use us to make their resources go further."

"In a nutshell, I remain optimistic about your future," he said. "I just want to make sure that those in government who sing the praises of our laboratories and talk about how great they are understand what can happen to this scientific capability if we don't nurture the base, keep it an exciting place for young scientists, and give those who work here sufficient challenge to make them feel they are really part of something important." ●HK

**Expertise Mutually Complementary****NIST Director Praises Labs' Work, Expects Much Cooperation**

The director of the National Institute of Standards and Technology (NIST) got a whirlwind tour of Sandia during a Feb. 16 visit that also included a news conference with Labs Director Al Narath and three members of New Mexico's congressional delegation.

Arati Prabhakar said she was familiar with some of the Labs' work from her former position with the Defense Advanced Research Projects Agency (DARPA, now ARPA), but was enjoying "seeing Sandia up front in person, after all the years of sort of seeing its work from outside."

She hosted Al and US Senator Pete Domenici recently on a tour of NIST headquarters in Gaithersburg, Md.

Al referred to that visit in welcoming her to Sandia, saying, "We spent the better part of a day, learned a lot, had a wonderful tour and good discussions, and today it's our turn."

Domenici, who had spoken earlier at a colloquium in the Technology Transfer Center auditorium (see "Domenici Optimistic about Sandia's Near Future, Concerned about National R&D Funding" above), said he was optimistic about the relationship that could be developed between NIST and the DOE labs "because she [Prabhakar] understands what we do. She was part of DARPA for a long time, and she knows the tremendous technological and scientific work that goes on in the labs."

**'Good Relationship' with NIST**

US Senator Jeff Bingaman, who with US Representative Steve Schiff joined the other three for the news conference, agreed. "I think this is a sig-

nal of the fact that Sandia's not just a DOE laboratory, it's a national laboratory, and it has a very good relationship now with the Department of Commerce and its NIST facilities."

Sandia and NIST have had a formal agreement in effect for the past year to cooperate in research on microelectronics, advanced manufacturing, materials, and standards (LAB NEWS, April 2, 1993).

Prabhakar characterized recent changes in funding allocations among various government research and development efforts as simply new directions in pursuit of new objectives.

"As we step up to some of the new challenges, in terms of economic competitiveness, I'm very heartened by what we've accomplished over the last few decades, and Sandia has been an important part of that," she said.

Part of the pleasure of her job, she said, is finding ways to combine national R&D resources into symbiotic relationships that yield greater results.

Al reinforced that concept in answer to a reporter's later questioning whether such combined work is in the nature of the Labs' current Work-for-Others programs.

No, he said, "It's simply that our skills and interests are complementary, and we felt it was time to achieve a higher degree of coordination. The idea is to make one plus one yield three, and I think we've started being quite successful in that."

Schiff praised that approach, saying, "I think it's not a matter of federal agencies competing with each other, but rather complementing each other. I think the strengths of the DOE labs like Sandia and

Los Alamos should be combined with the strengths of labs like NIST's."

Al used microelectronics as an example of important complementary work, saying that as microelectronics dimensions are shrinking to sub-microscopic levels, the dimensions of integrated circuits become critical. "While our interests lie in areas such as contamination-free manufacturing and proving fabrication equipment, the value of coupling those interests with the metrology expertise of NIST becomes, I think, obvious," he added.

**Relationships Are Key**

Prabhakar agreed that such relationships are key to increasing US industrial competitiveness. She said NIST also is involved in two programs outside its government facilities:

- The Advanced Technology Program, which funds high-risk projects on a shared-cost basis to help companies with opportunities that have long-term economic potential, but which those companies could not accomplish with their own resources.

- A program to channel to small and medium-size manufacturers around the country the expertise and assistance they need to upgrade their manufacturing efficiency.

"So, how do we really serve the needs of our industry and make our country much more economically competitive?" she asked rhetorically. "The vast resources in the DOE labs — Sandia being just a superb example, I think — are going to be an essential part of how we step up to the national challenge." ●HK

**Dan Hartley Is Acting Director****Sandia Ethics Office Gearing Up for Business**

Sandia VP Dan Hartley (6000) is now wearing a second Sandia hat as Acting Director of Ethics. A permanent Director should be appointed within a few months.

Establishment of the new Sandia Ethics program fulfills a commitment that Martin Marietta made when it took over management of the Labs last October. Martin Marietta has ethics officers high in the organizational structure at all of its facilities.

Dan was asked by Sandia President Al Narath and Executive VP Jim Tegnalia to get the new office going and get basic operating procedures established. The Ethics Director reports to the Sandia Executive Office (Al and Jim), with strong ties to the Martin Marietta Corporate Ethics Office.

The permanent position of Ethics Director will be posted soon, and a committee of 12 employees representing various Labs organizations will help make the selection. Jack Wirth (5090) is chairing the committee.

**Corporate Ethics Official Visits**

Robert (Bud) Reid, Martin Marietta's Director of Corporate Ethics, visited the Labs Monday to meet with Dan and the selection committee to discuss qualifications and responsibilities for the position and how the position operates at other Martin Marietta facilities.

The intention, he says, is to promote ethical work behavior and the use of good values such as honesty, fairness, and respect for the law and for other people. Employees are encouraged to report any wrongdoing and concerns early to someone who can resolve the problem.

Bud says employees will be encouraged first to work with the existing processes and people for

dealing with the issue, but the new position offers "a safety net — so that employees know they have a place to go if they can't get the problem solved anywhere else."

Dan emphasizes two points: (1) the Ethics Director will deal in complete confidence with employees, and (2) the Director will not simply talk with employees and refer them to someone else, but will follow up on each case to ensure that their concerns and problems get addressed properly.

"The Director of Ethics will deal directly with employees to ensure that their concerns get addressed as quickly as possible," says Dan. "No one will have to go through an intermediate person — the Director will be a person who will talk directly to employees and help them determine which of several Sandia support groups and people can best address their concerns."

"For example," Dan continues, "the Director might arrange for an employee to see one of the Sandia Ombuds, an Equal Employment Opportunity counselor, an Employee Assistance Program official, or an Audit Center manager if waste, fraud, or abuse is suspected."

**Follow-up Part of Job**

"The Director will also be responsible for assessing the 'health' of employee morale, for determining any root-cause issues that are

contributing to morale problems, and for reporting these things to the Sandia Executive Office," says Dan.

Bud says he considers Sandia employees to be good citizens and to have good character and high values. "But we need to have an ethics program established. If it's needed, it's then in place."

"We want to emphasize that this is not a cosmetic program," says Bud. "We take this seriously. We want Sandians to feel it's their program. We want people to feel they can report things they see that they feel are wrong. We want them to be rewarded for doing so. We want them to be treated fairly. The program is intended to be a shield not a hammer."

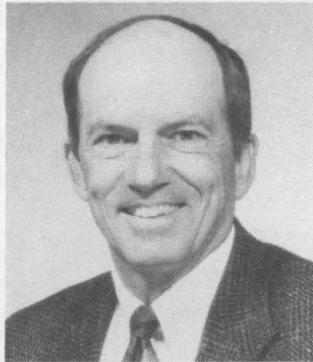
Until a special telephone for the Sandia Ethics Director can be hooked up and the number published, Sandians who have ethics-related issues are encouraged to call one of the following numbers:

- Code of Conduct and Corporate Personal Integrity Program (CPIP) concerns — CPIP Administrator Hot Line, 844-1744; or Sandia Ombuds: Mike Birnbaum (California), 294-2065, or Wendell Jones (New Mexico), 845-8301.

- Equal Employment Opportunity or Affirmative Action concerns — California, 294-2598; New Mexico, any of several applicable numbers listed under EEO/AA Dept. 3611 on page D54 of the current *Sandia Directory*.

- Fraud, waste, or mismanagement concerns — CPIP Administrator Hot Line, 844-1744; or DOE Office of Inspector General Hot Line, 1-800-541-1625 or 202-586-4073.

Bud says if the need arises, Sandians can even call Martin Marietta's Corporate Ethics office at 1-800-3ETHICS (1-800-338-4427). ●LP



DAN HARTLEY

**'Filling the Void'****Sculpture Honors Pulsed Power Researchers, Achievements**

Science and art have merged in the form of a new metal sculpture honoring the accomplishments of Sandia's pulsed power research community. The sculpture, titled "Filling the Void," was dedicated to Sandia's pulsed power researchers in organizations 1200 and 9300 in a brief outdoor ceremony in Area 4 on a bright Monday morning in February.

There just north of the entrance to Bldg. 960, the 14-by-10-by-9-foot multiringed sculpture will loom as a highly symbolic, if very visible and tangible, testimonial to Sandia's innovative achievements in light-ion-beam fusion and other applications of pulsed power.

How it came to be is a remarkable story. It goes back to a day in 1992 when Pace VanDevender, now Director of National Industrial Alliances 4700 but then in his eighth year as Director of Sandia's Pulsed Power Sciences Center, received an unexpected call from Will Happer of DOE Headquarters. Happer informed Pace he had just been named recipient of DOE's E.O. Lawrence award, one of the highest scientific honors DOE accords anyone. The award recognizes outstanding contributions in science and engineering fields related to atomic energy and was given to Pace "for his outstanding contributions to the generation of pulsed power" (LAB NEWS, May 15, 1992).

"I was surprised and shocked," Pace recalls now, "but I also felt a little awkward. I felt like an athlete who receives an honor in a team sport, because pulsed power is a team effort, and no one person is responsible for its accomplishments."

**Everyone's Accomplishment**

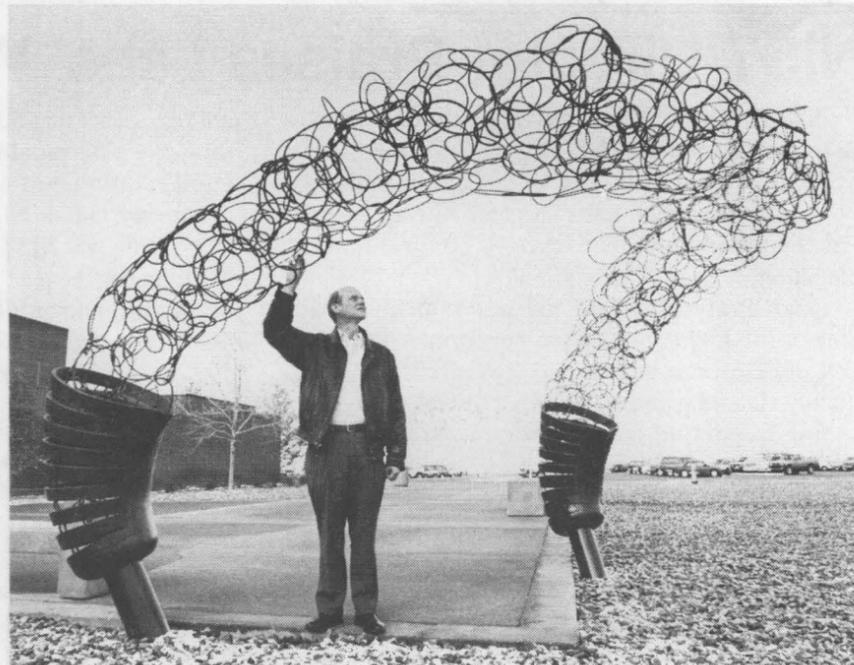
So Pace decided the award really belonged to everyone in pulsed power at Sandia. He put out bids to commission a sculpture with the award

money (\$10,000) to honor not just all the individuals involved but to recognize what he calls the superb "horizontal and vertical integration" of teams and capabilities at Sandia and elsewhere that helped bring the award to Sandia.

The idea of Albuquerque artist Walter Hoel "rose to the top," says Pace, and in lengthy discussions, Walter and Pace refined it to create the concept that 15 months of hard effort has since brought to fruition.

Month after month, Pace, who after he first came to Sandia had taught himself welding, spent weekends and evenings welding the metal parts at an improvised outdoor workshop at the side of his home. Some 545 iron rings had to be linked and welded together to make the arch of interlinked rings whose outreach, he says, represents the searching for new discovery. The rings rise out of two heavy crucibles, one representing Sandia, the other, all the organizations (government agencies, industries, universities, and other labs) Sandia works with, "working together synergistically to make more than any one organization could achieve alone."

Each crucible is sectioned into nine vertically connected rings and labeled to represent the "nine types of information processing we do in the



**RINGS OF DISCOVERY** — Pace VanDevender is framed by an arch of 545 interlocking metal rings that symbolize the searching for new discovery in the sculpture "Filling the Void." The rings rise from two crucibles that represent Sandia and the organizations it works with synergistically. The sculpture has been erected north of Bldg. 960.

horizontally and vertically integrated teams at Sandia — all supporting the accountable person for his customer," Pace says.

Friends and neighbors wondered what was going on. Pace himself wondered when he might ever finish. The work went on and on. "It was a lot of fun," Pace says now. "It was good therapy."

Another Albuquerque artist, Karen Yank, was brought on to apply the beautifying surface patinas and a heavy-duty antioxidant coating that will  
(Continued on Next Page)

**Black History Month at Sandia****Local Consultant Speaks Out about Civil Rights for the '90s**

Although 1960s-style civil rights protests have diminished in the last three decades, black employees in the 1990s can continue to "march" for significant political and organizational change in much more subtle ways.

That's what local business consultant Patricia Parham told nearly 200 employees recently during a Black History Month luncheon, sponsored by Sandia's Black Leadership and Outreach Committee and Black Heritage Club. Parham, a PhD in community psychology, is proprietor of Parham Enterprises, an Albuquerque-based organizational consulting firm.

The Feb. 16 luncheon was part of Sandia's celebration of Black History Month last month. On Feb. 2, many Labs employees also attended a live videoconference on the growing power of blacks in politics, featuring national political figures, business leaders, and educators.

Mary Ann Mitchell-Carr (7141), Mistress of Ceremonies, said the luncheon was "one event where we can share our culture with others and take a step in the way of learning to accept and appreciate other cultures."

The event featured traditional African American dishes, gospel music, a tribute to black history by local storyteller Jackie Niles, and unveiling of a new Heritage Club logo. In addition, eight employees were named at the

luncheon who received recognition for achievements and contributions to Black Leadership and Outreach initiatives during 1993. (See "Eight Sandians Recognized at Black History Luncheon" below.)

"I think it's time we start looking at our diversity not as a weakness but as a strength, not only as a moral or social issue but as a business issue," said Mike Robles, Director of Diversity Leadership Center 3600.

Albuquerque Mayor Martin Chavez and Governor's Chief of Staff James Lewis attended the event, along with several Labs Vice Presidents and Directors.

**'Marching on Corporate America'**

In her keynote address, Parham said civil rights today is no longer a black and white issue, and that people need to get beyond their social identity groups in order to achieve change.

"It's hard for us to know who we're fighting," she said. "Bigots exist in every camp: Hispanics, Asians, whites, women, blacks — all of us have bigots in our ranks. We are fighting an invisible enemy, and I think that invisible monster is called institutional bias, or institutional 'isms,' as in racism, sexism, agism, or any other kind of 'ism.'"

She said "isms" exist in corporate America because most organizations perpetuate unwritten policies of assimilation rather than acculturation. To achieve change, she said, individuals must join together to fight "isms" in the workplace and at home.

"Every time we confront our own racism or the racism of others, we are marching on corporate America," she said. "You're not wasting your time when you hear an ethnic joke or a blonde joke and you tell that person 'I don't think that's funny or appropriate.'"

Because the jobs of the future are going to require higher levels of skill and education, one of the most important things an individual can do to bring about

social change is help a child. "Every time we take the time to teach a child to write, to teach a child to read, to teach a child to do arithmetic, we are marching on corporate America," she said.

She added that blacks can make the world a better place for their children with what she called "The Three C's": commitment, cooperation, and compassion. She added that compassion includes discipline and high expectations for young people.

Parham emphasized that diversity is not an exclusive term but an inclusive one. "We all have a contribution to make," she said. "It's time for us to make those contributions, and to feel good about those contributions, and to not let others tell us that those contributions would be better if we did it their way."

"Let's put the self-fulfilling prophesy to work [on corporate America] as it's worked on us," she said. "Let's treat corporate America as we expect it to behave, as if it needs to change, as if it wants to change, as if it is trying to change, and eventually, it will change." ●JG



PATRICIA PARHAM, a local business consultant, told employees attending Sandia's Black History Month luncheon recently that blacks must continue to advocate change in the workplace through "The Three C's": commitment, cooperation, and compassion.

(Continued from Preceding Page)

**New Sculpture**

protect the sculpture from the weather.

Finally, after 15 months, the work was completed, and early Saturday morning, Feb. 12, Pace and his wife and children used their van to tow the sculpture, temporarily fitted with heavy casters, from his home to its Sandia Area 4 site. "You should have seen the look on the guard's face as we went through the Kirtland gate," Pace laughs.

**'Really Your Sculpture'**

Facilities had prepared a shallow trench for the sculpture's underground support structure. This was covered over with gravel, and on Feb. 14 the sculpture was dedicated.

The plaque will read: 'Filling the Void' by Walter Hoel and Karen Yank. Presented to the people of Sandia National Laboratories' Pulsed Power Community upon recognition of their work by the Department of Energy's 1991 Lawrence Award for Physics."

"This is really your sculpture, and it's in recognition of what you've done," Pace told the attendees. The artists were there, and so were a variety of volunteers within and outside of Sandia who played key roles in making the sculpture happen. All the symbolism was explained. Finally, Don Cook, now the Director of Pulsed Power Sciences 1200, and Jim Plimpton, acting for Jim Powell, Director of Applied Physics, Engineering, and Testing 9300, formally accepted the sculpture on behalf of Sandia. Just a short distance to the northwest, another pulsed power sculpture, "Starburst," made from the power flow section of the old Particle Beam Fusion Accelerator I (PBFA I), likewise glistened in the sunlight.

"Maybe this is the start of a trend to bring together at Sandia the two cultures that C.P. Snow talked about, and also to begin to beautify the Sandia surroundings," says Sandia VP Paul Robinson (4000).

Even more important, says Paul, is what Pace's action and sacrifice means. "Pace could have spent the award money on himself. For him to have invested it in a work of art for Sandia — that's something we all deeply appreciate." ●KF

**Eight Sandians Recognized at Black History Luncheon**

During the Black History Month luncheon Feb. 16, eight Sandians were named who received recognition during 1993 for achievements and contributions to Black Leadership and Outreach initiatives.

**Neil Hartwigen**, Director of Facilities Development Center 7900, for exceptional support of Black Outreach initiatives.

**William Patterson**, Manager of B61 Projects/EPW Development Dept. 5111, nominated by two of his employees for exceptional support of Black Outreach initiatives.

**Anthony Thornton**, recently promoted to a managerial position within Education Outreach Dept. 3020.

**Cynthia Harvey** of Facilities Engineering Dept. 7905. She is the first black female to achieve Distinguished Member of Technical Staff (DMTS) status. She is currently completing her master's degree in science and civil engineering.

**Elizabeth Schexnayder** of Facilities Engineering Dept. 7906. Elizabeth became a full-time employee in 1993 after two years in Sandia's Historically Black Colleges and Universities (HBCU) program and two years in the National Consortium for Graduate Degrees for Minorities in Engineering program.

**John Berry** of System Surety Engineering Dept. 12324. John became a full-time employee in 1993 after participating in Sandia's Outstanding Student Summer Program and the National Consortium for Graduate Degrees for Minorities in Engineering.

**Caleb Crump** of Energy and Environment Sector and Management Support Dept. 10403. Caleb became a full-time employee in 1993 after three years in Sandia's HBCU program.

**Patricia Salisbury** of Education Outreach Dept. 3020, for helping develop and sustain Sandia's Black Outreach program since 1986. She chaired the Black Leadership and Outreach Committee from 1986 through 1992.



LINKED BELT of NATO-type 7.62-mm ammunition feeds an automatic weapon.



FACE-FORWARD RAPPELLING — Making what's called an Australian descent, Lt. Ray Page (7436, left) and Pablo Montoya (7435) come down a vertical wall ready to face trouble.



SETTING UP to begin a hostage-rescue maneuver, Phil Gonzales (7435) holds weapon and attached flashlight at the ready.

# Sandia Spotlight



BEATING THE SENSORS? Special Response Team members Lt. Grant Aguirre (7435, left) and Lt. Ray Page (7436) use their skills to help Sandia evaluate intrusion sensors.

## Special Response Team Trains for the Unexpected

Photography by Randy Montoya

Black-hooded commandos hurry in the subfreezing darkness to obey the commands of their lieutenant: "Weapons at the low ready — commence firing!" The stillness of a winter night in Coyote Canyon is shattered by machine-gun fire.

By the time most Sandians have faced the challenge of leaving the comfort of a morning bed, Sandia's Special Response Team (SRT) members have had several hours of anti-terrorist training. They're charged with protecting people, facilities, and

weapon convoys in the event of a crisis.

The team undergoes training in anti-terrorist techniques at DOE's Central Training Academy in Coyote Canyon. Here, troops from around the DOE complex are schooled in paramilitary and special-weapons-and-tactics skills for handling hostage situations.

"Day-to-day vigilance keeps things at their best, but we prepare to handle things at their worst," says Lt. Willie Johns of Resource Management and

(Continued on Page Twelve)



COVER FIRE laid down by Terence Chang (7435) lets unidentified teammates move into position. These Special Response Team members are wearing headgear that detects "hits" from a laser simulating a weapon.



"VICTIM" Garry Bryant (7435), suffering from a simulated broken leg and gunshot wound, gets the help of (from left) Central Training Academy paramedic Reed Harry, Ray Page (7536), and Pete Irwin (7435).

**First CRADA That Brings Software Royalties****Sandia, Hewlett Packard Make It Easier to Test Integrated Circuits**

Software developed by Sandia to assess integrated circuits (ICs) for DOE components is now part of a Hewlett Packard product and is in the hands of major commercial firms that need to test the reliability of ICs and the processes used to manufacture them.

"This software is used to gauge reliability-related concerns in manufacturing processes," says project manager Eric Snyder, a member of Reliability Physics Dept. 2276. "For instance, at an IC manufacturing facility, it may turn out that one batch is better or worse than another — but why? This software lets process engineers carry out

**Why does one batch of chips turn out better or worse than another?**

highly accelerated tests for the reliability of metalization, oxides, and transistors on an IC. Those are major concerns of IC manufacturers."

Accelerated tests such as this can assess the quality of a lot of ICs faster than doing a more extended "burn-in." The tests are applied to what Eric describes as a simple version of the actual chip, often produced on a wafer along with the functional chips that become part of a hardware device.

IC manufacturers can use test results in developing new fabrication processes, such as those needed for advanced microelectronics that use multilayered circuits and small-size features. Accelerated tests can also benchmark processes for the reliability of products they're used to create, a major use that Sandia made of the software before the commercial version was developed.

Being able to rapidly assess the reliability of wafers is important to manufacturers in a competitive market, says Eric. "Maybe a company has developed a fast process for making ICs," he says, "but the company also has to know how reliable the chips manufactured with that process will be. There are often tradeoffs between economics and reliability, and the manufacturer has to know how much margin it has on the reliability side."

The collaboration between Sandia and Hewlett Packard was through the Labs' Electronics Quality/Reliability Center (EQRC), which works in electronics reliability and failure analysis and involves Sandians in Electronic Component Center 2200 and Microelectronics and Photonics Core Competency Center 1300.

Among the Sandians who did the primary work on the project, along with Eric, are four other members of Department 2276: Don Pierce, Bill Miller, Norm Smith, and Scot Swanson.

The commercialized software — dubbed SWORD for "Sandia Wafer-level Software for Reliable Devices" — moved to market quickly. The



**SWORD AT SEMICON** — Eric Snyder (left, 2276) and Greg Miller of Hewlett Packard demonstrate SWORD (Sandia Wafer-level Software for Reliable Devices) software developed by Sandia and Hewlett Packard. They're seen at last year's Semicon-West, the largest semiconductor equipment trade show, where Hewlett Packard's display featured SWORD.

project resulted in a commercial product in just six months. So far, SWORD has been purchased by Intel, AT&T, AMD (Advanced Micro Devices), AlliedSignal, Zilog, and Lattice Semiconductor.

This is the first cooperative R&D agreement (CRADA) that gives Sandia royalties from software sales. Vic Chavez of Technology Applications Dept. 4212 negotiated the license agreement.

**Useful to Sandia, Too**

Besides royalties, Sandia gets the benefit of feedback from users who are developing new generations of technology. "It keeps us current, and it helps Sandia provide high-reliability hardware for DOE and other customers," says Eric.

Reports from users will help Sandia and Hewlett Packard improve future versions of the software, says Eric. And because Sandia's concerns about reliability are in many respects similar to industry's, the result will be an improvement in Sandia's reliability-related work for DOE.

For example, Sandia uses SWORD to examine the product reliability of manufacturers that provide components for DOE systems, says Eric, helping identify reliability concerns early in the procurement cycle. The software is also used to compare possible suppliers.

It's also being used at Sandia, through five of the EQRC's eight CRADAs, to benchmark and improve the reliability of US manufacturers of ICs. That's a unique service the Labs can provide, Eric points out, because Sandia is a neutral site in the competition among companies.

The SWORD software merges Sandia's expertise in wafer-level testing with Hewlett Packard's experience in instrumentation and its Integrated Circuit Measurement System (IC-MS), a software "shell" that lets users run particular test routines in a consistent format. While Sandia converted its test software to operate in the IC-MS environment, Hewlett Packard added graphical software to increase ease of use.

The resulting product includes a SWORD user manual that features both the Sandia logo and the Hewlett Packard logo on the title sheet, with a note that the software is a cooperative effort of the two organizations.

The software runs on Hewlett Packard test equipment, and Hewlett Packard is licensed to distribute the SWORD software with that equipment. ●CShirley(12610)

**Program Brings UNM Grad Students To Sandia for Year of Research**

Sandia Vice President Roger Hagengruber's long-time teaching and other contacts with the University of New Mexico's Department of Political Science have led to establishment of a program that will send UNM graduate students (and seniors taking graduate courses) to work at Sandia.

The Student Externship Program was formalized in November, although its first participant, Mark O'Grady, had begun work at the Labs three months earlier, in August. He is doing research for Garry Brown, Manager of Strategic Studies Dept. 4111.

Garry says Roger, VP of Defense Programs

Div. 5000, has taught graduate political science courses at UNM for nearly two decades. He says the extern program is an outgrowth of that contact and DOE's recent initiative to foster closer ties between the DOE labs and all levels of public education.

"My own experience in working to finance college gave me a deep appreciation of the value to students of having a job, especially one with work that complements their educational experiences," says Roger.

"And students with political science  
(Continued on Page Thirteen)



A NEW PROGRAM that will bring outstanding University of New Mexico students to Sandia for "externships" is the talking point among some of those who worked out details of the program. Discussing the program are (left to right) William Gordon, Dean of UNM's College of Arts and Sciences; Neil Mitchell, Chairman of the Political Science Department; Mark O'Grady, the first student selected for the program; and Roger Hagengruber, VP of Defense Programs Div. 5000. Roger's long-time association with UNM as an adjunct political science lecturer was the catalyst for creation of the program.

**Calls from Industry Increasing****Sandians Celebrate Machine Tool Partnership Anniversary**

Sandians and fellow DOE labs researchers trying to reverse a decade-long decline in the US machine tool industry have taken on some unusual jobs along the way, ranging from cleaning the grit out of a used sander belt to speeding the flautist's breath into a new flute.

And although they can't claim a change in the industry's international ranking yet, Sandians involved in the National Machine Tool Partnership (NMTP) recently celebrated its anniversary in observance of a successful first year and determination to continue the trend.

Bob Reuter, Manager of Manufacturing Technology Program Development Dept. 2401, says the NMTP grew out of a December 1991 letter from Brent Scowcroft, national security advisor to then-President George Bush.

"The letter, addressed to all cabinet secretaries, expressed great concern that the US machine tool industry was in trouble in the global competitive market," says Bob, "and he wanted everybody to consider how to deal with the problem."

Scowcroft specifically asked the Energy and Commerce departments to assess the role the national laboratories could play. A committee was formed early in 1992, with a full-time dedicated staff member from Sandia, Los Alamos, and Lawrence Livermore national labs, and the Oak Ridge Y-12 Plant. Sandia's contribution was Don Plymale (2401), who was immediately elected chairman of the committee.

**Strategy, Plan Developed**

"Don pretty much led the committee through the next 10 months," says Bob, "surveying the industry, formulating a strategy built around help from the four labs, and developing a six-year plan that included budget, a lot of detail, and a lot of input from industry."

That brought the effort to December 1992, and the first phase began Feb. 15, 1993, he says. That phase makes each of the four labs and the National Institute of Standards and Technology (from the Department of Commerce) available for up to 80 hours of no-cost consultation and service to machine tool industry callers via a hotline.

Another Sandian, Jim Voytko of Technology Transfer and Commercialization Center Staff 4200, was assigned full-time in Washington as manager of the Machine Tool Partnership during its first year of operation.

In just over a year of operation, says Don, the NMTP hotline has rung up more than 800 projects in calls from industry. Sandia has handled 177 of those, Los Alamos 102, Livermore 187, Y-12 255, and AlliedSignal's Kansas City Plant, which has joined the consortium since its formation, has 72. A few have not yet been assigned, he says.

**Not Large, but Important**

Don says the international machine tool industry is not a large industry — despite its \$45 billion in annual sales — but it is an important industry. And, it is an industry in which the United States led until 1981.

"We know the Japanese and Germans have put a lot of money into this area, and that's how they took over the first and second [respectively] positions," says Don. "We've now dropped to fourth, behind Italy. It's important to national and economic security that we have a strong machine tool industry, because they're the machines that make the machines — that manufacture the parts."

Japanese machine tool industry sales in 1990 — the latest year for which Don has figures — amounted to \$11 billion. Germany was next with \$9 billion, followed by Italy with \$3.7 billion, and the United States with \$3.3 billion.

Reaction to the NMTP has been positive, with much favorable feedback from industry, says Bob,



ANDREW MILLUNZI (center), DOE's manager of the National Machine Tool Partnership, examines a ball screw, an example of work done in the US machine tool industry Sandia and other DOE and Department of Commerce facilities are trying to revive. Don Plymale (right) and Bob Reuter (both 2401) invited Millunzi to participate in Sandia's celebration of the partnership's first anniversary, which includes a technology display in the Bldg. 802 lobby.

particularly because of the rapid response on the hotline. Callers are promised a return call within a few days, and the lab assigned the inquiry makes sure that happens.

The answer is not always positive, he says, but that also can be a welcome answer to a company. An example was a company that manufactures punch presses and wanted to evaluate the feasibility of a new electric-motor-driven mechanical punch press. NMTP got a call from a company representative.

**Project Wasn't Feasible**

"We developed a dynamics model of the system they were interested in, sized the motor, and even did some calculations," he says, "and we came up with negative results. They wanted a certain number of punches per minute, but given their physical and financial constraints, it wasn't feasible."

The result, says Bob, was that the company dropped the project, but was happy to have had the help, because if they had carried it forward to, perhaps, some prototype models, it would have cost them a lot of time and money. As it turned out, with NMTP's help, they realized they couldn't develop the machine, and it cost them no more than their time in interaction.

Don says 73 percent of the hotline calls received during the first year were from small businesses (fewer than 500 employees), 20 percent were from larger ones (more than 500 employees), and seven percent were from nonprofit organizations, such as universities or state-run manufacturing technology centers.

"We're finding that about 16 percent of the projects we're called about are not truly machine tool problems," says Don. "Consequently, we've met with representatives of Sandia's Small Business Initiative and they're interested in helping, so in the future, when one of these non-machine-tool projects comes to us, we're going to use our resources to find an appropriate investigator to look into their concern."

**Variety of Problems Addressed**

Among the problems the NMTP has helped with to date:

- Helped a company redesign a machine that cleans grit from sanding belts, resulting in saving the company 15 percent in manufacturing costs.
- Employed a Sandia-developed acoustic emission sensor in screening bearings to determine which ones were skidding.
- Analyzed a process for recycling spent lithium batteries, which led to the British Columbia (Canada) Ministry of Environment clearing the way for a demonstration project at a US-built facility in British Columbia.

- On-going work with several companies to develop plasma-source ion implantation as a means of hardening tool surfaces.

These and other success stories are the good news, says Bob. The bad news is that — like research and development work nearly everywhere — there is growing concern about funding.

"We aren't experiencing as much financial support, at this point in the program, as we had hoped for a year ago," he says. "Funding is pretty flat, even though the enthusiasm of industry and the number of calls has increased considerably and continues to increase."

"We're concerned that demand is going to outrun our ability to meet it unless significant budget adjustments are made," he continues, "and that concern is focused only on sustaining the first phase of the program. To move beyond that, into the long-term phase, will take significant funding in addition to what is now being planned."

**Noteworthy Project**

And then there was the job for people who whistle while they work.

"A company that makes flutes for professional flautists called us," says Don. "The hole in a flute mouthpiece is a very complex shape, so they would machine-drill a round hole and then someone would file it by hand. Then they'd have the flautist come in and try it, file some more, try it again, file it again, and so on — a process that would take something like two weeks to finish."

"So we analyzed three of them [finished mouthpieces] and came up with an ideal hole shape, generated a tool path from the digital data we got by measuring the trough, and sent that to them," he says. "Now, they can mill the ideal shape by machine and do the custom filing by hand in a much shorter time period." ●HK

**Take Note**

The Albuquerque Gem and Mineral Club will hold its 25th Annual Gem and Mineral Show the weekend of March 5 and 6 at UNM's Continuing Education Center (1634 University Blvd. NE). With a silver and gold theme this year, the show features competitive and non-competitive displays, demonstrations, silent auction, lectures, dealers, and a raffle. The non-profit organization is celebrating its 50th anniversary as a club. Show proceeds help support the club's scholarship fund. Admission is \$2 for adults; children under 12 get in free. Hours are 10 a.m.-6 p.m. Saturday and 10 a.m.-5 p.m. Sunday. For more information, call 265-4178.

**What Do You Think?**

# Employees Offer Some of Their Words to Work By

"What Do You Think?" features employee responses to questions posed by the LAB NEWS. The idea is to give Sandians an opportunity to voice their opinions and thoughts about various issues — some serious and some not so serious. Some responses have been lightly edited and condensed to meet our maximum word limit.

The current question: "What is your favorite quotation or saying that influences the way you do your job? How does it influence your work?"

"Minds are like parachutes. They only function when they are open." This quotation not only influences the way I do my job, but how I live my life. A closed mind limits a person in what they are able to achieve, by restricting their understanding and appreciation of the world around them. By listening to ideas and opinions of other people, even when I disagree, I am able to gain wisdom and experience I might not have otherwise.

Tammie Muniz (10505)

"You think change is easy? Go talk to the caterpillar!" I find that my job satisfaction is directly proportional to my adaptability to change and the ability to be flexible. There's a book on the market called *Each Day a New Beginning*. Some days that's the good news; some days that's the bad.

Cecelia Grayson (9823)

"Plan like you're going to live forever; live like you may die tomorrow." This reminds me to spend part of my day doing things that provide more options for a brighter future if I'm around to enjoy one. However, it also helps me keep perspective of what the really important things are to accomplish today. Did I do my best work? Did I care for others today? Did I care for myself today? Paying attention to these questions makes me a more responsible worker and helps ensure that I'd have little regret, if indeed, this was my last day.

Betty Caponera (3335)

The first quote that came to my mind was: "We make a difference," used by Division 2000. If one thinks about it, we make a difference in our work. I believe if individuals put forth the extra effort in their work, each can make a difference, and the

**The Next Question**

## What Do You Think?

Here's the next question:

Quality is something Sandians talk about a lot today, but mostly as it applies to the work of the Labs or to specific groups or projects. **How have you applied quality principles to your work as an individual, and have your work habits improved as a result?**

We'll be calling some Sandians and asking you personally to respond to the question. If you agree, we'll fax you a one-page answer sheet (with guidelines) that you can complete and fax back to us. Other employees are also welcome to respond — not just the folks we call. If you'd like to respond, please call us for a form on 844-7841 or 844-7522.

sum of individuals will make a difference. With a "we make a difference" mind set, not one of arrogance, but of sincerity, we can improve our product and achieve personal satisfaction, in our department, our center, our division, Sandia, and at a national level.

Richard Graham (2882)

I like the saying "Just do it!" (borrowed from a national ad). To me it means conversation is closed; meeting is adjourned; no vacillating between "should I or shouldn't I?"; no more sitting on one's indecisions, it's time for creative action. When "Just do it!" is directed toward me, I am immediately reminded of my job responsibilities and that working at Sandia is a privilege not to be taken for granted.

Paul Eckles (7304)

"Working hard does not count for much if you are not also working smart." You must be working on the "right" product or service that will meet your customers' needs, or the value of your hard work may be questioned. We should

remember this when we nominate people for quality awards.

Melissa Murphy (10300)

"If it's worth doing, it's worth doing right." What this means is that I try my best to do it right the first time and every time. It also means that I go back over my work to see if I can do it better and to review my work for any mistakes. This attitude is used at home and at play, as well as at work.

John Souza (5151)

"The bitterness of poor quality remains long after the sweetness of a low price is forgotten." I saw this on a poster and have kept this saying in mind when I'm working on my specifications job at Sandia, and anything else I do.

Andy Oravec (2882)

●JC

## Take Note

"Sandia Singles" is growing and active. Sandia and DOE singles are encouraged to join club members in a variety of activities planned for March, including downhill and cross-country skiing, inner tubing, dancing, movies, dining out, bowling, roller skating, billiards, video nights, potlucks, attending an arts and crafts fair, and touring the Atomic Museum. Special event: Members and prospective members are invited to a get-acquainted party at the Coronado Club on Saturday, March 19, 6:30 p.m., with other area singles club members attending. RSVP is not required. Cost is \$5 per person to cover the disc jockey charge. In April, the club will offer some of the same activities, but has added some new events, including a night at the New Mexico Symphony, hot-air ballooning, and a trip to Carlsbad Caverns. Regular club meetings are held at 5 p.m. on the first Monday of every month at the Coronado Club; next meeting is March 7. For information about Sandia Singles, call Janice Bauer (12820) on 281-9754 or Rex LeGalley (9615) on 822-0676.

(Continued from Page Nine)

## Special Response

Development Dept. 7436, a team member and training coordinator. "We train in the prudent use of force. Having to shoot is a last resort."

The teams' responsibilities go beyond protecting Sandia's personnel and facilities. The training is standardized so they can interact with any protective force in the DOE complex. "We can call in a Special Response Team in a maximum of 45 minutes for deployment to any DOE facility where we're needed," says Willie.

Members of the SRT comprise one-third of Sandia's Security Police Officers. "To do this work, you must be self-motivated," says Lt. Ray Page (7436), training coordinator and 10-year team member. "We depend on each other. If you aren't motivated, your teammates will make sure you get motivated."

SRT training requires developing high levels of skill with numerous weapons and tactical techniques such as rappelling and night shooting. Training is run at full speed to simulate the pace of actual situations.

"If you're afraid of being hurt, you shouldn't be here," says Ray. "Sometimes being part of the team may require you to live with some pain in order for the mission to succeed. That's not to say that we are not careful. We take a lot of care to ensure everyone is safe. The nature of this business is just dangerous."

●RM



MEET THE BOARD — Sandia's new Board of Directors, seen here at Sandia/New Mexico during its first meeting in December, will hold its second meeting next week (March 9) at Sandia/California. The board consists of (from left) Jim Tegnalia, Sandia's Executive Vice President; Bobby Leonard, Martin Marietta Vice President of Human Resources; Tom Young, Board Chairman and Martin Marietta's Chief Operating Officer; Al Narath, Board Vice Chairman and Sandia's President; Lew Allen, former Air Force Chief of Staff, Vice President of the California Institute of Technology, and Director of the Jet Propulsion Laboratory; Diana Natalicio, President of the University of Texas at El Paso; Marcus Bennett, Martin Marietta Senior Vice President, Chief Financial Officer, and a member of Martin Marietta's Board; William Howard, Jr., independent engineering consultant and former Senior Vice President and Corporate Director of R&D at Motorola; Charles Carnahan, Martin Marietta Environmental Management Vice President; Richard Adamson, Martin Marietta Strategic Development Vice President; and Donna Fitzpatrick, President and Chief Executive Officer of Radiance Services Company.

**Efficiency, Environment Targeted**

## Sandia, 25 US-Owned 'Twin Plants' Collaborate to Improve Competitiveness

A consortium involving Sandia and a group of 25 US-owned "maquiladoras," or production-sharing plants, in El Paso and Juarez is under way with \$1 million in industrial funding.

Members of the Maquila-Sandia Technology Consortium (MSTC) signed a formal agreement Feb. 11 and opened discussions on projects to help make the companies and their "twin plant" operations more energy efficient, environmentally friendly, and ultimately more competitive.

Maquiladoras are companies with joint facilities that reach across the US-Mexican border. The US companies share production in arrangements that typically involve coordinated activities on the Mexican and US sides of the border.

*(Continued from Page Ten)*

### Grad Students

knowledge and related research and writing skills can give Sandia valuable assistance in expanding areas such as non-proliferation and environment," he adds. "Clearly, the extern program will be win-win for all involved."

Mark, who will complete his master's degree in May and begin working toward his doctorate in political science, says he first met Roger when Roger taught a UNM course in international conflict. "This is a unique program, and I'm overwhelmed at the opportunity to work at Sandia," he says.

He is currently on a leave of absence from a research position in the US Commerce Department's International Trade Administration, in Washington, to which he will return after finishing his year at Sandia.

Garry says the program is in the process of selecting three more UNM students now. He says plans call for three to six students to be enrolled in the program at one time, and they may be selected from disciplines other than political science.

Students will receive no college credit for their work, he says, but will be cleared at the "L" level to participate in the program, and will be part-time, paid employees. ●

### Welcome

*Albuquerque* — Karen Conley, Jenny Dubbs, Karen Findell, Angela Guerin, Mary Martinez, Diane Miller, Sheila Pounds, Janet Russo, Marylu Wilson, Sandra Woodward, and Rusty Wright (all 12111); John Ganter (6641), Michael Lopez (2566), Sharon Matier (10504), and Paul Resnick (1332).

*Elsewhere: Arizona* — Mark Spoonamore (7903); *New York* — Steffen Parratt (2861).

### Congratulations

To Stephanie (9421) and Albert (5821) Eras, a daughter, Amelia Rose, Feb. 11.

To Yolanda and Robert (7615-3) Goodloe, a daughter, Andrea, Feb. 15.

### Recent Retiree



Allen Church  
9332

38

The agreement calls for Sandia researchers to work with individual maquiladoras through the consortium on projects determined appropriate by the participants. The MSTC industrial members will pay in advance for all costs associated with these projects, says Gil Cano (6909), Sandia project manager. Potential areas for projects include waste management, environmentally conscious manufacturing techniques, energy utilization, and transportation issues.

### Environmental Technology Transfer

"We see the consortium as a way to provide members greater market access to the environmental technologies and sciences residing in the US Department of Energy's national laboratories and to direct these assets toward improving the overall environmental condition of the US-Mexico border," says Michael White, MSTC director. He said the consortium is formed as a not-for-profit corporation to broker projects between the maquila industry and Sandia.

The consortium will be guided by a board of advisors made up of industry representatives. MSTC plans to form alliances with universities in the US and Mexico for continued development and transfer of environmental technologies, White says. Agreements with municipalities may also be possible. "Our primary target city will be Juarez, which impacts both El Paso and southern New Mexico. We then hope to expand," says White.

The contract runs through 1995, but is subject to change as demand changes. "Discussions are now under way to include maquilas in all of the 14 twin cities along the US-Mexican border with common technology needs," says Gil. Border observers estimate there are more than 2,000 maquilas at present, employing more than 450,000 workers on both sides of the border.

"We are pleased to be setting the stage for technological development of US companies in the border region," says Sandia VP Dan Hartley (6000). "Given the priority of maintaining US jobs and economic development, we look forward to working with the consortium and other potential collaborators, including the University of Texas at El Paso and New Mexico State University." ●WKeener (12630)



**NO TWO-BIT SURPRISE** — Alma Van De Velde, who retired from Sandia in 1982 after 31 years and nine days — "don't forget the nine days" — runs her fingers through the source of a very pleasant surprise. While at her bank one day last year, she asked her banker to tally up the value of the 166 US Savings Bonds of various denominations she had been accumulating since 1966 — starting with an allocation of a quarter a week. When she went back a few days later, she was greeted with a cake, smiles and hugs all around, and the news that those nearly forgotten bonds were worth well over \$16,000. "I just couldn't believe that my poor quarter a week at that time gave me such a pleasant surprise savings in 1993," she wrote in a letter to Labs Director Al Narath. She wrote, she said, so perhaps "my experience could be in one of your messages" promoting savings bond purchases. This year's bond drive chairman, Jennie Negin (left), Manager of Information Systems Development and Training Dept. 10323, didn't hesitate a moment in taking Alma up on her offer. Sandia's 1994 bond drive will be conducted in April.

## Sandia News Briefs

### PLZT Thin-Film Decoupling Capacitors Developed

Sandia researchers have developed decoupling capacitors using thin films of lead lanthanum zirconate titanate (PLZT). The thin-film decoupling capacitors are intended for use in advanced electronic packages, such as multichip modules (MCMs), because they can be more fully integrated into packages than current ceramic capacitors. This increased integration should lead to decreased package volume and improved high-speed performance. It should also allow greater design flexibility. PLZT thin films are being used for decoupling capacitors because they have very high dielectric constants and excellent resistances. Sandia researcher Duane Dimos of Glass and Electronic Ceramics Dept. 1845 is preparing several scientific papers on the development.

### Art Department Wins Nine Awards

Several technical artists from Art Dept. 7155 recently won a total of nine awards, including four Awards of Excellence, from the Phoenix Chapter of the Society for Technical Communication (STC). The awards were presented for two publications, *Creative Solutions for Complex Developmental Testing* and *President's Quality Award 1993*, and two illustrations, *T558 LF7 Piston Locator* and *Container and Spectrum X-Gamma Spacecraft*. These four winners now enter the STC's international competition, winners of which will be announced in May. STC members include communicators and technical writers from research and development and scientific organizations.

### Metal Trades Council Recognizes John Garcia

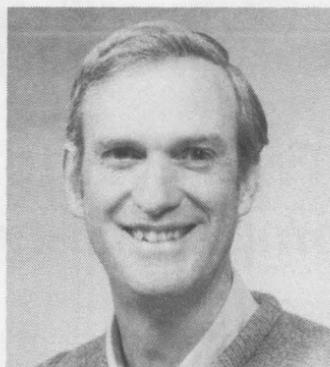
The Metal Trades Council (MTC) presented a Certificate of Appreciation to John Garcia, Supervisor of Metal Forming and Preparation Team 2482-4, in a brief ceremony at Sandia on Feb. 24. The certificate was given to John in appreciation for his leadership, teamwork, cooperation, and fairness toward all of his MTC employees.

Send potential Sandia News Briefs to LAB NEWS, Dept. 12660, MS 0413.

# MILEPOSTS

## LAB NEWS

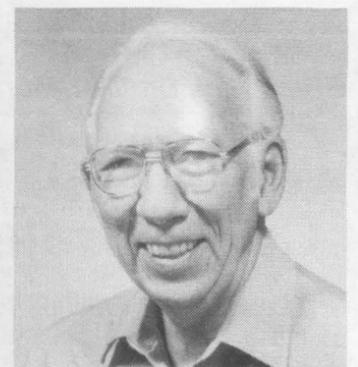
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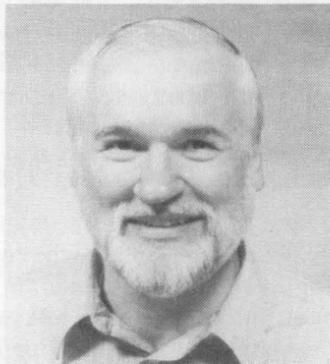
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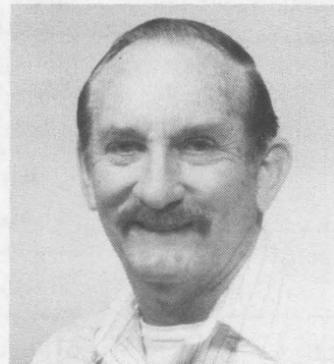
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Pat Childers  
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Jim Kwak  
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Lester Harris  
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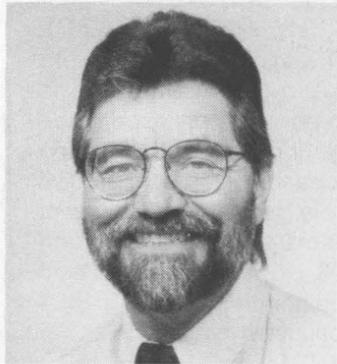
Gerald Stoker  
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Lisa Polito  
7601 15



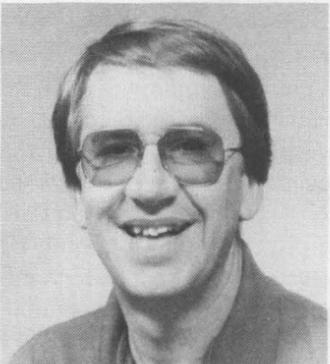
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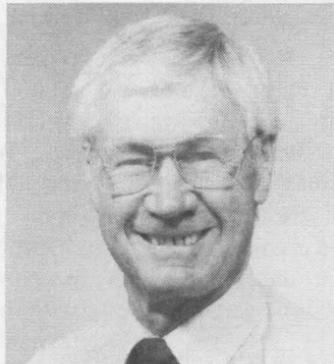
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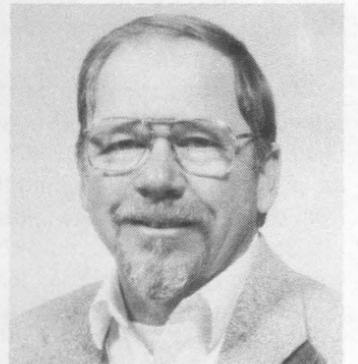
Lola Stude  
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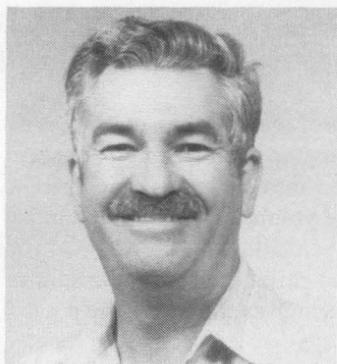
Stephen Babicz  
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Don Hanson  
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John Claassen  
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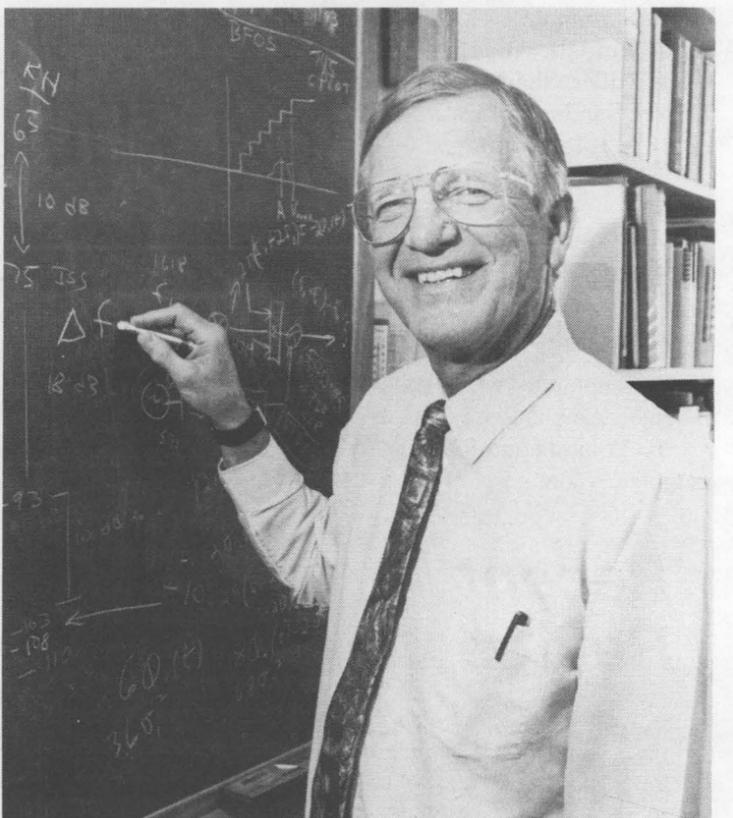
Donald Tipping  
9819 25



Charlene Rodgers  
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Frank Gallegos  
7400 20



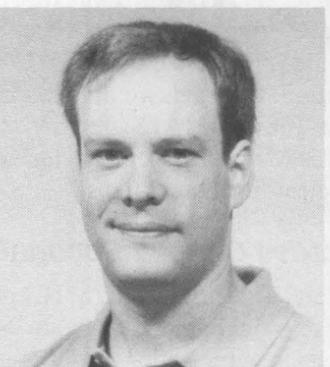
Donald Jelinek  
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Mel Mefford  
10328 30



Bob Sheldahl  
9816 25



Paul Johnson  
2171 15

## Take Note

An upcoming New Mexico Volunteers for the Outdoors project is:

**Mason Rancho Project** on Saturday and Sunday, March 12 and 13, needs volunteers for a project to stabilize a historic Butterfield Stage station on the Southern Overland Trail west of Las Cruces. NMVFO will provide lunch and dinner on Saturday. Contact project leader Glen Kepler (1704) on 296-0402 in Albuquerque by March 8.

NMVFO projects are open to all. You don't have to be a member to work on a project, but membership dues help support NMVFO activities on New Mexico's public lands. Please call the project leaders or the NMVFO Office on 884-1991 to sign up or for more information.

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Retiring and not shown in LAB NEWS photos: Duane Hughes (7311).

## Farewell Reception

The Labs is holding a farewell reception in honor of Lee Bray (former Executive Vice President) and his wife Twila at the Sandia Cafeteria (Bldg. 861) on Tuesday, March 29, 2-4 p.m. Refreshments will be served. Friends and acquaintances are invited.



### UNCLASSIFIED ADVERTISEMENTS • UNCLASSIFIED ADVERTISEMENTS • UNCLASSIFIED ADVERTISEMENTS

**Deadline: Friday noon before week of publication unless changed by holiday. Mail to Dept. 12660, MS 0413, or fax to 844-0645.**

#### Ad Rules

1. Limit 20 words, including last name and home phone (the LAB NEWS will edit longer ads).
2. Include organization and full name with each ad submission.
3. Submit each ad in writing. No phone-ins.
4. Use 8 1/2" by 11-inch paper.
5. Use separate sheet for each ad category.
6. Type or print ads legibly; use only accepted abbreviations.
7. One ad per category per issue.
8. No more than two insertions of same "for sale" or "wanted" item.
9. No "for rent" ads except for employees on temporary assignment.
10. No commercial ads.
11. For active and retired Sandians and DOE employees.
12. Housing listed for sale is available for occupancy without regard to race, creed, color, or national origin.
13. "Work wanted" ads limited to student-aged children of employees.

#### MISCELLANEOUS

COMPUTER, Macintosh Classic 2/40, loaded with software, w/Imagewriter printer, \$600 OBO. Maynard, 281-4523.

GIUITAR, SG copy, hardshell case, small practice amp, \$250 OBO. Schultz, 275-9349.

RADIAL TIRES, high-performance, two Pirelli P6 105/60R1482H, \$30; two Suimitromo P185/60R1482H M&S, \$60. Cropp, 296-1877.

COMPUTER, new Macintosh Performa 600, 160MB HD, 5MB RAM, w/multimedia kit, System 7.0, MacClariss Works, keyboard, mouse, \$1,200. Campos, 275-7830.

LABRADOR RETRIEVER PUPPIES, chocolate, AKC-registered, \$275. Fate, 293-2131.

CHINA, 97-piece, and matching 51-piece stemware, beautiful, both never been used, \$200. Cianciabella, 268-7150.

ROCKING CHAIR, solid maple, spring-type on base, back and bottom cushions, like new, \$50. Ré, 298-0290.

WEDDING GOWNS: dry-cleaned, size five, one cream, one white, \$150/ea.; twin-size bed, Sealy mattress & box spring, \$100; Coral dishware, 6-piece setting, \$35. Clavey, 292-7667.

VGA COLOR MONITOR, 14-in., excellent condition, \$165; space heater, 50,000 Btu, on wheels, w/thermostat, like new, \$180. Torres, 831-3539.

KEYBOARD, professional quality, Ensonic Mirage digital sampler, w/case and stand, \$375; black upright piano, good condition, \$200. Thornberg, 897-3785.

CAMERA, Nikon N2020, AF body, w/50mm f1.8 lens, some extras, like new, \$275. Garcia, 292-1603, leave message.

ENCYCLOPEDIA, '74 World Book, excellent condition, \$50 OBO; tires, two whitewall poly radials, P215/75R15, 1/2-tread, \$20. Cocain, 275-9505.

SOFA BED, queen-size, w/matching loveseat, beige background w/brown flecks, four loose accessory pillows, \$250. Seyfer, 292-0179.

BEDROOM SET, French provincial, antique, white, standard full-size bed, triple dresser, two chests, nightstand, perfect, \$695. Casper, 268-4464.

ROYAL ELECTRONIC ORGANIZER, 160KB memory w/eight functions, data link, case and manual, never used, list price \$399, sell for \$299. Lucero, 296-2473.

STEREO AMPLIFIERS: Quicksilver Monos, recent tubes, extra set, \$700; Perreux 2150B, 200-watt stereo MOSFET amp, \$500. Both excellent, all packing material. Damkroger, 897-7627.

UPRIGHT FREEZER, Frigidaire; drapes, foam-backed, blue jacquard, 100"W x 84"L; two bedspreads, pink foam-backed, jacquard. Porter, 884-4577.

SWIVEL STOOL, bucket seat, \$18; Prince tennis racquet, \$20; tub whirlpool, \$40; Dynastar GS skis, 195cm, Tyrolia 280 bindings, \$75. Horton, 883-7504.

SYNTHESIZER, Korg DW 8000, programmable digital waveform, also many programmed sounds, carrying case, manual, instructions, \$395. Schneider, 822-9273.

NORDICTRACK, Pro Model, good condition, \$375 firm. Romero, 867-6444.

CAT, mackerel-tabby, "Hurrshy," neutered, shots/tags, 11 months, loves people, litter box, carpeted play home, carrying case, bowl set, \$130. Gallegos, 899-9004.

SHOTGUN, Winchester Ranger Model 120, 12-gauge, ribbed barrel and chokes, \$150; Poole console piano, needs key work, \$200 OBO. Standing, 299-2031.

SOFA BED, beige color, wood trim, excellent condition, \$250; poker table, w/removable top, \$75. Creel, 294-8291.

IN-DASH CD PLAYER, Alpine, removable safety features, new, never used, still in box, paid \$600, best offer. Brown, 892-5939.

SKI/BIKE RACK, Yakima, 48-in., \$75 OBO; Stormguard car cover, for '91-'93 Honda Accord, \$75. Edwards, 899-8634.

'87 SUNLITE HAWK POP-UP CAMPER, 7-ft., \$2,000; oak bedroom set, light bar, bookcase headboard, dresser, \$500. Both excellent condition. Martin, 296-8154.

LARGE VOLUME OF SCHEMATICS, for pre-1946 radios and phonographs, thousands of models shown, for old radio buffs, \$50. Wyant, 298-0371.

SOLOFLEX, w/butterfly & leg extension attachments, \$600; "Fit One" ski exerciser, from Sharper Image, \$100. Both like new. Henry, 296-1781.

DOG, red heeler, 7 mos. old, female, spayed, has all shots, \$100. Sanchez, 292-1982 after 5 p.m.

BUILT-IN DISHWASHER, Kitchenaid, new, \$150; Maytag washer, connected for your testing, \$100. Pappas, 268-7020.

LOVESEAT, sofa, & chair, blue, \$350; dining table & chairs, wooden, \$350; cement bird bath, \$45; metal desk, \$50. Bouchard, 262-0007.

ALL-TERRAIN TIRES, four, Uniroyal Laredo, 10.50x15x31, \$100 or trade for 235/75x15; four 8.75x16.5 Cooper tires, mounted on 8-lug rims, \$100 OBO. Fine, 281-2116.

MOVING BOXES: wardrobe, dish pack, and a good assortment of other sizes, 90 total, \$2/ea. or \$150 for all. Konkel, 866-0304.

SOFA BED, brown plaid, \$125; coffee and end tables, dark wood, \$125; kitchen captain's table, four chairs, \$50. Catanach, 265-2290.

DOGS, collie/golden retriever-cross, 2 yrs. old, one spayed female, one neutered male, free to good home. Miller, 823-1070.

SLATE DINING TABLE, and four chairs, \$50; two round glass table tops, 24-in., \$5; bathroom sink, counter, and faucet, free. Castillo, 344-5112.

RCBS PROGRESSIVE RELOADER, w/powder measure, 9mm & 45 ACP shellplates, single-stage 9mm shellholder, \$275. Madole, 298-6081.

FLEX 110 HOME GYM, \$65; couch, 85-in., plaid, white, beige, & brown, \$75. Benton, 877-2473.

WOMEN'S HIKING BOOTS, Vasque, leather, w/Goretex lining, size 8-1/2, only worn twice, excellent condition, \$80 OBO. Rivers, 836-6304.

GARAGE SALE, Sat., March 5, 5504 Territorial Rd., Taylor Ranch, stroller, car seats, highchair, small kitchen appliances, electronics, more. Green, 899-1109.

CUSTOM RECEIVER, heavy-duty, and drop hitch, w/tow hooks, fits Ford step-side pickups, \$75. Desantis, 896-1092.

COLOR TV, 9-in., w/remote, AC/DC, cable, '89 Sylvania, \$150. Lorence, 275-3586.

SPA EQUIPMENT: gas heater, 60-sq-ft. filter, air blower, 1-hp 220-volt pump, four-function controller, underwater light, \$300 for all. Biffle, 293-7043.

'89 PROWLER TRAVEL TRAILER, 26-ft., microwave, awning, refrigerator/freezer, full bath, more, excellent condition, \$10,500; engine hoist, 1,000-lb. capacity, \$150. Trollinger, 268-3414.

WASHER & DRYER, Hotpoint, heavy-duty, white, new heating elements installed in dryer, \$300 OBO. Bronkema, 291-1323.

SOFA SLEEPER, tan, corduroy, \$150; matching La-Z-Boy recliner/rocker, \$80; navy blue sofa, w/pillows, \$100; baby changing table, \$60. Dobranich, 298-4547.

PRECOR ROWING MACHINE, \$140; Scotts spreader, 18-in., \$30. Leeman, 281-7949.

MAHOGANY DESK, large, old, \$100; computers, Commodore 128 and 64, disk drive, tape drive, printer, software, \$100 for both. Parson, 291-8394.

GOLF PULL-CART, Browning, \$20; leather chair and ottoman, brown, Scandinavian design, \$325; gold-plated crystal chandelier, \$375. Hanson, 298-2120.

WIND LOAD TRAINER BIKE, All American Product Model 45, direct drive, fits full-sized bicycles, new, \$100 OBO. Desko, 883-2662.

CAMERA, Olympus OM-4T SLR, w/2-yr. + extended warranty, almost new, \$550; flash, F280, \$100. Schneider, 293-6612.

COUCH & LOVESEAT, tan/earthtone, \$200; kitchen table w/leaf and four chairs, \$150; sewing machine, \$150. Rimkus, 281-2048.

#### TRANSPORTATION

'74 VW BUG, good gas mileage, good condition, asking \$1,800 but will entertain offers. Ask for Gene. Ward, 265-8377.

'87 SUZUKI SAMARAI, hardtop, AC, AM/FM stereo/cassette, low mileage, good condition, \$4,000. Rice, 266-4210, leave message.

'93 PONTIAC GRAND AM, 4-dr. AT, AC, cruise, stereo, PL, tilt, 17K miles, teal w/gray interior, \$11,200. Shaw, 856-1141.

'85 CADILLAC SEDAN DE VILLE, 4-dr., AT, brown, good condition, \$1,750. Cibicki, 877-7098.

'90 OLDS DELTA 88 ROYALE, 4-dr., loaded, low mileage, \$9,500. Hackard, 299-4333.

'92 FORD TEMPO GL, 35K miles, fully loaded, \$7,800. Boatman, 291-1241.

'88 TOYOTA SUPRA TURBO, Targa, 5-spd., red/gray, new tires, 76K miles, all maintenance performed, excellent condition, \$9,800. Baca, 271-2962.

'63 CORVAIR MONZA, 53K miles, blue, one-owner, excellent condition, \$3,700. LaGree, 293-2734.

MOUNTAIN BIKE, Motiv, quick-release wheels and seat, all Shimano drive and brakes, very low use, \$150. Bentz, 299-3448.

'89 FORD AEROSTAR, extended, EFI, 6-cyl., AT, Bivouac Conversion, loaded, 60K miles, \$11,500 OBO. Everett, 296-8786.

'73 DATSUN STATION WAGON, for parts, engine and running gear good, front end shot, \$175. Smith, 384-5182.

'84 BUICK REGAL LTD, 55K miles, original owner, 4-dr., AT, power everything, new paint, excellent condition, \$3,350. Jenkins, 293-9714.

'82 MAZDA RX7 GSL, 5-spd., moon roof, hardtop, louvers, extras, all records, excellent condition, \$2,500. Schlimme, 293-0304.

'65 IMPALA SS, 283, AT, console, PS, PB, no rust, good body, interior worn, all original, red, runs but has worn cam, \$1,500. Pantuso, 892-3641.

'82 HONDA GOLDWING INTERSTATE, 34K miles, excellent condition, \$3,000. Gilbert, 892-1963.

'80 PRINDLE 16 CATAMARAN, two sets of sails, double trapeze, 7-part mainsheet, cover, excellent condition, \$1,200. Murata, 881-8459.

'85 FORD ESCORT, AT, FWD, 100K miles, runs well, good condition, \$800. Perk, 291-1685.

'91 FORD F250 XLT, 4x4, supercab, 5-spd., 57K miles, many extras, very clean, excellent condition, \$16,000 OBO. Maestas, 869-1803.

'74 SUPERIOR MOTORHOME, 22-ft., 67K miles, Dodge 440, recent AT, 5kw Onan, AC, awning, dual tanks, new interior, \$7,800. Perkins, 899-8766.

'81 DATSUN 280ZX 2+2, T-tops, 5-spd., cranberry, clean interior, runs very well, \$2,500 OBO. Burgett, 275-0229.

'89 FORD TAURUS LX, 4-dr., one owner, fully loaded, low mileage, excellent condition, \$8,000. Martin, 296-8154.

'92 GEO METRO LSI, 2-dr., 5-spd., AC, stereo, great gas mileage, cloth seats, \$5,995. Konkel, 866-0304.

'77 GRAND PRIX LJ, all power options, AC, stereo cassette, maintenance records, runs and looks great, \$2,000. Cocain, 275-9505.

'85 LINCOLN TOWNCAR, trailering package, clear-coat platinum paint, always garaged, beautiful condition, \$5,100 OBO. Hall, 299-0009.

'92 FORD RANGER SUPERCAB, V6, 4.0L, PS, PB, cruise, AC, AM/FM cassette, bedliner shell, \$12,500. Crutcher, 298-7161.

'85 LARSON OPENBOW BOAT, 15.5-ft., 90-hp Mercury OB, EZ loader trailer, low hours, garage-kept, many extras. Van Ornum, 294-6498 after 5 p.m.

MAN'S BICYCLE, 26-in., Huff, 12-spd., \$35. Parson, 291-8394.

'87 FORD RANGER, supercab, 4x4, camper shell, loaded, \$5,275. Williams, 856-5722.

'89 MALLARD SPRINT MOTORHOME, 190DD, recently serviced, sleeps four, very good condition, must sell, \$13,000 OBO. Zarick, 898-8840.

'84 EL CAMINO, V8, fully loaded, good condition, \$4,000 OBO. Sinowitz, 224-0772.

NISHIKI STREET BIKE, 18-spd., generator set, thornproof tires, \$75. Leeman, 281-7949.

'91 MITSUBISHI ECLIPSE, white, 2-dr., AT, PS, AC, AM/FM stereo, \$8,450. Stude, 897-4352.

'92 MAZDA MIATA, red, "A" package, alloy wheels, cassette, PS, AC, bra, 26K miles, perfect condition, \$12,600. Damkroger, 897-7627.

BICYCLES: Peugeot PX-10, Imron paint, 56cm, \$225 OBO; Peugeot, 19-in., \$110 OBO; Fuji Team bike frame, 56cm, \$75. Healer, 298-6967.

'90 ISUZU TROOPER, V6, standard transmission, 59K miles, excellent condition. Evans, 897-4782.

'90 JEEP WRANGLER, PB, PS, 4x4, two tops, looks great, runs great, \$8,500 firm. Tedro, 256-9780.

#### REAL ESTATE

3-BDR. HOME, 2-1/2 baths, 2-story, 1,550 sq. ft., solar, sprinklers, 2-car garage, needs some fix-up, near Indian School/Chelwood, \$105,000. Barnette, 292-5186.

3-BDR. TOWNHOUSE, 6 yrs. old, in Las Cruces, quiet neighborhood, ideal for family or students, \$59,900. Cropp, 296-1877.

MOTEL & HOME, 8 units plus RV hook-ups, Eagle Nest, hunting, fishing, good net profit, \$90,000 OBO. Trace, 292-3118.

3-BDR. HOME, Moriarty, 1,100 sq. ft., 1-1/2 baths, single-car garage, 6'x10' shed, extra lot, \$55,000. Green, 829-3235.

3-BDR. HOME, Westgate, on cul-de-sac, lots of cabinet and closet space, solar & central heating, \$65,000. Maldonado, 836-6923.

20 ACRES, northeast of Edgewood, frontage on SR472 (east Frost road), 2.4 miles east of SR344. Kureczko, 281-8206.

3-BDR. HOME, Ridgecrest area, 1,670 sq. ft., 2-car garage, 2-1/2 baths, wood floor, large modern kitchen, two fireplaces, wood deck. Romero, 255-3782.

#### WANTED

ACCOMMODATIONS, for World Cup, Bay area, June 20-July 7, for family of five, will consider house-sitting, house swapping, renting, etc. Kelly, (505) 299-3527.

RECORDS, Wickham Brothers. Roeschke, 266-8988.

CAROUSEL SLIDE PROJECTOR. Carrick, 266-0191.

LIFE VEST, inflatable, similar to type used on aircraft, prefer small or medium size. Adams, 256-7265.

WEAVER STAINLESS STEEL SCOPE, 4x or 6x power, in good condition. McDonald, 899-8578.

TOY COLLECTOR, for trading, selling, and buying, action figures, and related toys. Boatman, 291-1241.

ACCOMMODATIONS, condo, apartment, house, or timeshare, in South Padre Island, Texas, for use March 16-21. Romero, 865-6155.

PIANO TUNING & REPAIRING TOOLS, equipment, and manuals. Meister, 268-9159 leave message.

METAL STORAGE LOCKERS; bass guitar, for beginner; ride-on mower. Kureczko, 281-8206.

HOUSE OR APARTMENT TO RENT, furnished, for visiting scholar, June 18-Aug. 27. Heinsteinst, 291-1525.

'91-'93 PICKUP, 2WD, extended cab, jump seats, 40K miles maximum, 3.9-4.3L V6, AT, AC, light interior. Leeman, 281-7949.

MOVING BOXES, all sizes. Fellows, 821-7664.

#### LOST & FOUND

LOST: Wooden mechanical pencil, by Hallmark, in parking lot east of Bldg. 823. Green, 844-4261.

**Coronado Club Activities****Bring the Kids and Let 'Em Bingo**

**BINGO FOR YOUNGSTERS** — It's Kids' Bingo Night (12 years and under) at the C-Club tonight, March 4, and the prizes are lined up waiting to be taken home by lucky winners. Every kid playing bingo gets a free hot dog and soft drink. The buffet line opens at 5 p.m., and the cartoon-watching starts at the same time. Bingo begins at 7 p.m.

**OLD FAVORITES** are hard to beat. We're talking about the Isleta Poorboys, of course, and they bring their foot-stompin' brand of country and western music back to the club next Friday, March 11. The 'Boys will be on stage from 7 to 11 p.m. for your listening and dancing delight. The kitchen crew offers your choice of filet mignon (\$11.95) or grilled halibut (\$10.95), or a trip to the all-you-can-eat buffet (\$6.95). Dinner is served 6-9 p.m. Reservations recommended — call 265-6791.

**PRE-ST. PADDY'S BINGO** — Because of the St. Patrick's Day doin's on Thursday, March

17, there won't be bingo that evening. But on March 10, whichever bingo player has the most "luck o' the Irish" will have a chance to win a \$250 "pot o' gold." As usual, the early bird specials start at 6:45 p.m. and regular bingo around 7.

**ST. PATRICK'S DAY** is coming up Thursday, March 17, and the C-Club is turning green. Enjoy the celebration, starting at 5 p.m. with a buffet that features corned beef and cabbage, Irish potatoes, and genuine Irish green chile stew. The buffet line will be open until 8 p.m., and the cost is only \$3 per person. Wanna dance a jig? The Bob Banks Trio will play the music for it, from 7 to 10 p.m. Come on out — everyone's Irish for an evening.

**NO DINNER EVENT** on Friday, March 18 (what? you wanted a big dinner just one day after the St. Patrick's celebration?). Come to the club anyway and enjoy the sociability of the Cantina.

**Feed Back**

*Q: Sandia says it keeps up with industry standards when it comes to salaries. I disagree with this. Industry recognizes its college graduates and starts them off with better salaries than they give their high school graduate employees, and also rewards those who continue their education to a higher level.*

*The college graduates who came into the Labs in the middle '70s were not given such recognition for their education if it was not job related. History, liberal arts, English, etc., were not regarded as acceptable degrees to allow entry into the management type jobs. Some of us were placed in clerk positions with the hope that a management trainee slot would open and we would then be able to rise in the ranks. Instead, only a few of these opportunities came about, and the competition was prohibitive. There were so many people who had their degrees that Sandia could not offer enough trainee jobs to meet the demand.*

*The Education and Training Department then came into the picture when we approached them as to how to get ahead in this company. They told us we would need a degree higher than a bachelor's. Some of us went and got masters' degrees thinking surely this was the answer. After we received our masters' degrees, we were told that this also was not enough, and that we should go out and get courses in purchasing or accounting, that these were the only organizations with any growth potential.*

*After 16 years with this company, I am making less money than my union counterparts. I understand that people who come into Sandia with degrees now are hired as MLS's.*

*What about the people who came in before this change? Don't we deserve some recognition for hard work and student loans? While others were taking vacations to go to exciting places, we were using our vacations to study for exams. Doesn't this count as something?*

*I have been to personnel representatives and they do not have an answer to these questions. I would appreciate your response.*

**A:** First, Sandia's salary practices are similar to industry's. In general, it is industry practice to pay for the job that is being done, not for the degree of the person doing the job. Specific jobs may require specific credentials in order to accomplish them, and in these cases, this requirement would be taken into account in the starting salary computation.

As to Sandia's change of policy to hire bachelor's-level graduates into MLS positions, and how this change impacts those on-roll, you should be

aware that there was an additional change in policy to allow a number of classifications of on-roll employees to bid on MLS jobs. Moreover, any full-time, regular employee with a bachelor's or master's degree may bid on MLS Level 2 and 3 postings.

When these openings occur, there are typically a great number of bidders, many of them qualified for the job. If it has been your experience that you have been turned down when you bid on these postings, we would advise you to keep trying. The competition is great, but each job posted is another opportunity, and each of the posting managers will have different requirements.

Ralph Bonner (3500)

this month in the past...

## Sandia LAB NEWS

A "space squeeze" in the February issues of the LAB NEWS kept us from publishing "This Month in the Past." But February is barely finished, so here's what was happening that month in past decades.

**40 years ago...**This one's for the whole year: In 1954, the drawing that appears at the top of this column was the LAB NEWS page-one "flag." It was used through the end of 1955, then replaced with another flag incorporating the thunderbird that had become the Labs' symbol.

**30 years ago...**The Atomic Energy Commission's budget allocated funds for an office and lab building, designated Bldg. 807, to be built next to existing Bldgs. 805 and 806.

Sandians took photos of satellites Echo 1 and Echo 2 — large aluminum-coated orbital balloons used for bouncing radio signals from one point to another — as their orbits crossed.

**20 years ago...**A Feedback published in the LAB NEWS objected to the Coronado Club's increase in the price of a Happy Hour drink, from 25 to 35 cents.

A bill creating the Energy Research and Development Administration (ERDA) passed the House of Representatives and was being considered by the Senate. ERDA succeeded the Atomic Energy Commission as Sandia's primary customer and was itself succeeded by DOE.



**OOPS!** — A combination of confused sequence and politeness led to the misidentification of these three Sandians not once, but twice. We apologize — with double sincerity — to (from left) Joel Darnold, John Wronosky, and Doug Jordan (all of Manufacturing Applications Dept. 2338). The photo was published first in the May 28, 1993, LAB NEWS, with a story about their work on a magnetically levitated positioner, and they were misidentified as (from left) Doug, Joel, and John. They noticed, of course, but decided that "what's done is done," and politely chose not to call the mistake to our attention. Admirable, but unfortunate, because when we put together the recently published Labs Accomplishments FY93 special issue (LAB NEWS, Feb. 18), we included their work as an accomplishment, pulled the old photo out of the files, and ran it again — with the same mistaken identities. Joel, John, and Doug (from left, above) decided they should let us know about our mistake this time, and did. Our apologies to them (and anyone else who noticed); hope this atones somewhat for our goof.