Three weapons labs, SRC developing semiconductor simulation models for 0.1 micron technology

CRADA seeks advanced modeling tools by end of century for manufacturing use by 2007

By Ace Etheridge
Media Relations Dept. 12621

It may be a small world after all, but when it comes to integrated circuits, things are getting too small.

That is, they are getting so small that models the semiconductor industry uses to simulate integrated circuit manufacturing processes are becoming inadequate. These models — developed from algorithms, converted to software programs, and transformed with powerful workstations into manufacturing recipes — reduce the cost and time required to develop each new generation of semiconductor manufacturing equipment and design the new integrated circuit chips they build.

The shrinking sizes and increasing complexity of the equipment and devices have created another opportunity for the national laboratories to work with industry and universities to develop better models to simulate semiconductor materials, devices, systems, and manufacturing processes. The vehicle for this work is a cooperative research and development agreement (CRADA) between Semiconductor Research Corporation (SRC), Sandia, and the other two DOE weapons labs — Los Alamos and Lawrence Livermore. Each of the three labs will conduct research in specific areas in collaboration with researchers at universities and SRC member companies.

Suite of models for 0.1 micron circuits

The five-year goal of the CRADA is to achieve a complete suite of models for the 0.1 micron technology generation of integrated circuits that the semiconductor industry hopes to be manufacturing by 2007. To meet that goal, the manufacturers need advanced modeling and simulation tools before the end of this century. Sandia and SRC recently signed a license agreement to commercialize tools developed under this program.

SRC, based in Research Triangle Park, N.C., is a consortium of more than 60 semiconductor companies and government agencies that plans and implements an integrated program of research by North American universities, national laboratories, and research institutions.

Sandia has many years' experience starting with fundamental equations and using technology computer-aided design (TCAD) tools to develop models that simulate physical and chemical processes.

Whether these processes occur during nuclear explosions or during ion implantation, the basic techniques for modeling are the same.

Whether these processes occur during nuclear explosions or during semiconductor ion implantation, the basic techniques for modeling are the same.

Tom Picraux, Manager of Semiconductor Nanostructure Physics Dept. 1112, and Gerry Hays, Manager of Laser, Optics, and Remote Sensing Dept. 1128, who have programmatic responsibilities in two of the research areas of the SRC CRADA, say past modeling of semiconductor processes has been mainly empirical.

"You basically made an assumption and stuck it in the model. It involves a lot of trial

(Continued on page 4)

Sandia National Laboratories

Sandia LabNews

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No layoffs at Sandia; all 'impacted' positions resolved as of Wednesday

Sandia's goal to reduce the number of "impacted employees" to zero without forced layoffs has been achieved, Sandia President C. Paul Robinson announced Wednesday, Feb. 14.

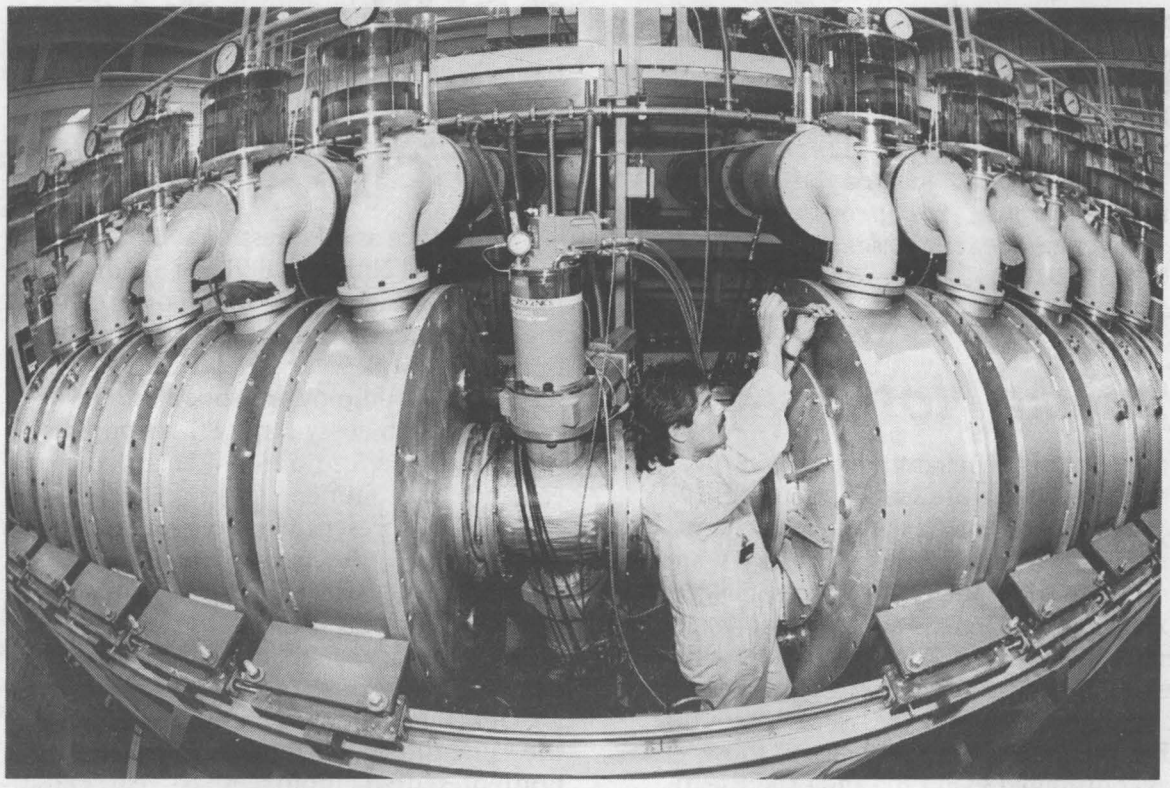
The Labs has been working since early January to eliminate 327 "impacted" positions in 182 employee peer groups across the Labs — groups that needed to be reduced by one or more persons. This effort to move employees out of positions in which there is insufficient work or funding, to reassign some employees to new jobs, and to downsize the Labs is a part of Sandia's Workforce Realignment Plan. Several years in the making, the plan was announced in the Sept. 29, 1995, *Lab News* and explained to employees in a series of meetings in early October.

VSIP eliminates 271 positions

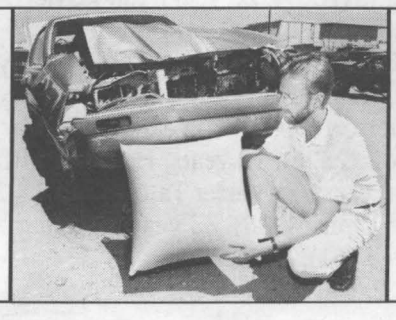
Of the 327 impacted-position reductions, 271 were accomplished through the Labs' Voluntary Separation Incentive Program (VSIP), which was announced Dec. 5. This DOE program provides monetary incentives (a minimum of $15,000 per employee), educational benefits, health insurance for a year, and other benefits to employees who volunteer to leave Sandia (*Lab News*, Dec. 15). The other 56 impacted positions were eliminated by internal transfers and other resolutions, including normal attrition.

Although Sandia management emphasized last fall that the realignment plan is not a "layoff plan," it includes a process for layoffs

(Continued on page 2)



JOE ARMIJO of Intense Beam Research Dept. 9531 adjusts the Sandia Accelerator and Beam Research Experiment (SABRE) particle beam accelerator in preparation for a test as part of Sandia's inertial confinement fusion program. To accelerate research on Sandia's large pulsed power accelerator, Particle Beam Fusion Accelerator II, experiments are first performed with SABRE, which is more easily modified, less expensive to run, and has quicker and higher shot rates than PBFA II. (Photo by Randy Montoya)



This & That

A most impressive array – Our special Labs Accomplishments insert in this issue lists Sandia's top 140 achievements during FY95. As Labs President and Director C. Paul Robinson says in his introduction to the section, "It is a most impressive array of important contributions." I think you'll agree.

Our thanks go to the many Sandians who submitted accomplishments (including those who didn't make the final cut), and to the managers, directors, and VPs who reviewed them all and selected the ones included. *Lab News* writer Bill Murphy coordinated the Labs Accomplishments project this year, with help from writer Howard Kercheval and others.

We normally encourage you to recycle the *Lab News*, but think about saving this special insert to help inform VIP visitors and customers. If you need an extra copy or two, call Nancy Campanozzi (12622) at 844-7522.

* * *

Still in style – Rosemary Springer, Staff Secretary for Public Relations and Communications Center 12600, retires at the end of this month. She's living proof that grace, a sense of humor, a warm smile, and competence are still a stylish combination. I speak for lots of folks who work with her when I say, "We'll miss you, Rosemary – a lot!"

* * *

A wrap on pet peeves – Here's the final installment of Sandians' pet peeves. Sorry that I couldn't use everyone's peeves, but I thank all peeved persons who submitted them. I tried to use a representative sample of issues and gave priority to things that peeve more than one person. Most peeves are excerpted or paraphrased, but exact quotes are enclosed.

• Sandians who don't support recycling. "How can we expect our children to make a better world for our grandchildren if we can't set the example?"

• Safety rules that "feel good" but have no practical impact on safety. "I have always worn a [biking] helmet when commuting to and from work. . . but I never wore a helmet when biking within the tech area until it was mandated. It can't be much more dangerous than driving the [golf-type] carts that have very poor brakes and NO SEAT BELTS."

• People who "have loud conversations in halls by open cubicles, even when they have offices to use! The din is incredible!"

• Symposium [colloquium] announcements that now routinely say: "Don't Miss This One!"

• People who send e-mail messages without including their full name somewhere in the message. "I don't like getting messages from 'hrclint@sandia.gov,' for example."

* * *

E-mailers Anonymous – Speaking of e-mail, I know I'm very late sharing this, but my New Year's resolution is to send, forward, and reply to fewer e-mail messages – sending only those that truly *need* to be sent. I hope other folks will join me in taking the pledge. I get so many e-mail messages some days that I wish we could establish a quota for senders. Maybe we could suspend employees' e-mailing privileges for a week if they exceed their allotment the previous one. And maybe we should start a new support group: E-mailers Anonymous, for people who feel compelled to fill our e-mail inboxes with unnecessary messages.

– Larry Perrine (845-8511, MS 0129, lgperri@sandia.gov)

No layoffs

(Continued from page 1)

if they become necessary.

"We're very pleased that we were able to eliminate our current workforce surplus without layoffs," says Sandia Human Resources VP Charlie Emery (3000). "But it wasn't easy. We couldn't have done this without a lot of help and cooperation from a lot of Sandians."

"Although we didn't have layoffs, that doesn't mean some people didn't suffer some pain," says Human Resources Center Director Don Blanton (3500). "Some employees who opted to take the voluntary-program benefits — especially some in impacted positions — may have preferred to stay at the Labs. And other employees who transferred into new jobs in order to stay with Sandia probably would have preferred to stay in their old jobs. All folks who made difficult personal decisions to help remold Sandia for the future deserve our gratitude."

Sandians approved for VSIP benefits will leave the Labs by April 15. As announced in the Feb. 2 *Lab News*, all of these employees may use a variety of outplacement services (career and financial counseling, job-search help, etc.) at recently established "career transition centers" at both Sandia/New Mexico (844-3030) and Sandia/California (294-1564). A total of 225 employees based at Sandia/New Mexico were approved for VSIP benefits and 46 employees at Sandia/California.

"All of us should feel grateful to those Sandians who have agreed to switch jobs and especially to those who have volunteered to leave the Labs," says Paul Robinson. "Many of these folks changed their professional and personal plans to help us as a Laboratory, and we thank them for their actions. They are the real heroes who have made this announcement possible."

— Larry Perrine

OPEIU members approve 9/80 work week option

The Office and Professional Employees International Union (OPEIU) at Sandia has ratified a side agreement to its contract with the Labs enabling its members to participate in the 9/80 work week schedule. The schedule, in which employees work 80 hours in nine days with every other Friday off, has been an option for nonrepresented employees since last summer.

OPEIU-represented employees may begin working the 9/80 schedule no sooner than March 1, 1996, with manager approval. OPEIU employees working the standard schedule are not affected by this side agreement. The agreement for the 9/80 schedule for OPEIU-represented employees follows the same rules as those implemented for nonrepresented employees last year. OPEIU-represented employees participating in the 9/80 schedule may not observe their 9/80 Friday off on any other day of the week.

Two other groups of represented employees do not participate in the 9/80 schedule. Security Police Association-represented employees are not eligible because of the requirements of their jobs, and the Metal Trades Council has not negotiated a 9/80 side agreement with the Labs.

Sympathy

To Virginia (12000) and Pro (7612) Padilla on the death of her mother and his mother-in-law, Sophia Chavez, in Albuquerque, Jan. 24.

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LOCKHEED MARTIN

Take Note

Cavalcade of Enchantment on KOB-TV, Channel 4, will feature Sandia on its Feb. 19 program, 7:30-8 p.m. Cavalcade of Enchantment is shown once a month on KOB-TV and focuses on various interesting places in New Mexico. Channel 4 news anchor Carla Aragon narrates the program. The Sandia show will feature robotics, micromachines, virtual reality, solar and renewable energies, supercomputing, and tech transfer. Many Sandians in those areas contributed their time and expertise to the show. Media Relations Dept. 12621 coordinated the interviews and videotaping, and Visual Communications Dept. 12614 provided file film footage.

* * *

Retiring and not seen in *Lab News* pictures: Phillip Lane (7809), 20 years; Juan Griego (3344), 26 years; Barry Granoff (4400), 26 years; Joseph Grant (6853), 27 years; Robert Meyer (6111), 23 years; Harry Morris (6114), 34 years; Edna Pederson (3331), 20 years; Rudolph Schindwolf (2526), 19 years; Harold Smith (9719), 20 years; Sylvester Tafoya (9711), 29 years; Joe Tapia (4913), 33 years; and James Tichenor (1561), 39 years.

Sandia success showcased at White House event

Programs and policies that assist women-owned businesses featured in report

By Nancy Garcia

California Reporter

Sandia's entrepreneurial leave program took a bow at the White House in January when Nina Bergan French was invited to the Oval Office to help present a report on the economic impact of women-owned businesses.

The report describes the growing economic importance of women entrepreneurs and the efforts by the Clinton Administration and Congress to foster their successes. It was prepared by the Interagency Committee on Women's Business Enterprise, an advisory panel created by the President a year ago, in coordination with the National Women's Business Council.

NINA FRENCH

"This event highlights our leadership in promoting innovative and effective ways to commercialize Sandia technologies," says Len Hiles, Director of California Site Development Center 8800, "as well as our support and encouragement of staff who have an entrepreneurial spirit."

Nina was one of 15 women to attend the Oval Office ceremony. She had been featured as a "success story" in the report, representing one of eight various federal programs that encourage women entrepreneurs. Nina attended a DOE workshop on the "Entrepreneurial Experience for Women" before going on entrepreneurial leave from Sandia/California in October 1995 to commercialize a metal emissions monitor. (*Lab News*, Oct. 27)

Sum greater than parts

Besides this DOE workshop, the case studies described such programs as loan guarantees by the Small Business Administration and assistance available from the Department of Commerce.

Nina found Clinton "very engaging and warm" as photos were taken that morning in his office. A luncheon speech to a group of about 100 women by Hilary Clinton was "really just powerful." Sitting with the successful business women (such as gift catalog founder Lillian Vernon, who chairs the National Women's Business Council) gave Nina the sense that "the sum was greater than the parts."

A former program manager in Technology Applications Dept. 8113, Nina is now running an environmental monitoring services business, Sky +, from Oakland and financing the operation one transaction at a time. Her business is commercializing a laser-based monitoring system developed at Sandia by a team led by Bill Flower of Exploratory Systems Dept. 8111.

As the only entrepreneur featured in a case study who was able to attend, "I represented small women business owners who really need a lot of help," Nina says, and "a link from a national laboratory."

Laura Tyson, who chairs both the National Economic Council and the interagency committee, emphasized at the event that the nation's only hope for future prosperity is a sustainable economy. Nina sees a link between that goal and her nascent environmental services business.

'Trade security for opportunity'

She anticipates that the report and a new Census Bureau report on the growth of women-owned firms will be widely referenced in the next year or so (initial accounts have appeared in the national business press).

Already, Tyson has provided Clinton with a statistic that he quotes frequently: There were 7.7 million women-owned firms in 1994 that employed more workers in the US than Fortune 500 companies employed worldwide.

"My Administration will continue to aggressively pursue forward-looking initiatives that will foster the success of these women-owned businesses," Clinton said, "which contribute well over $1 trillion in receipts to our nation's economy."

Added Vernon, "the Administration recognizes that women-owned businesses have contributed significantly to the economic recovery and that programs that advance women's business ownership advance our economy's health and prosperity."

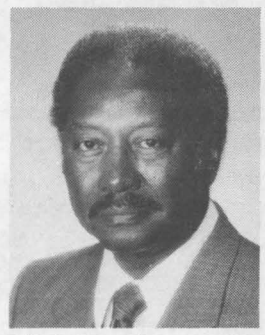
Nina, meanwhile, is encouraging women with professional and technical backgrounds to "trade a little bit of security for a lot of opportunity."

OVAL OFFICE VISIT — Nina Bergan French was included in the Interagency Committee on Women's Business Enterprise that presented a report to President Clinton at the White House Jan. 29. Posing for a group photo in the Oval Office, Nina is standing at the right of the President (President Clinton's left).

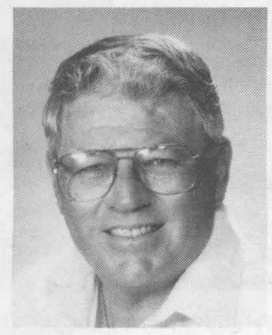
SANDIA IN LIVERMORE 40 YEARS — Sandia/California is commemorating 40 years at the Livermore site on March 7 with a special observance. This logo has been designed to be used for the occasion. Chairing the Anniversary Committee is Cindy English (11/8000).

Sandia CaliforniaNews

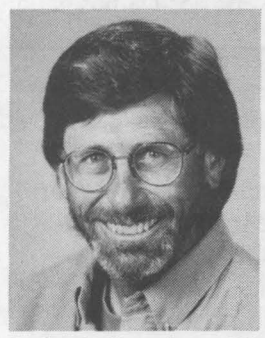
Recent Retirees



Bill Ormond 30
8403

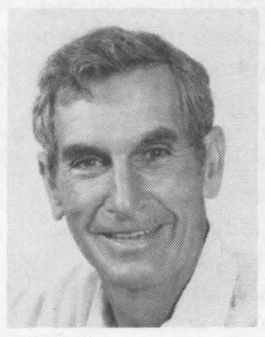


Jack Casey 35
8783

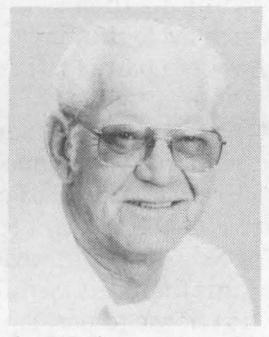


Stefan Folkendt 32
5361

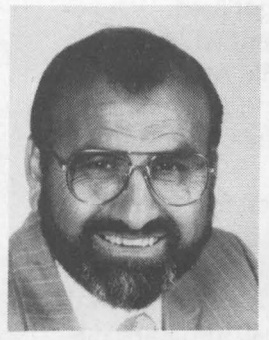
Betty Folkendt 22
8117



Bill Wall 36
8609



Jim Workman 20
8611



Andy Cardiel 30
8200

Wes Estill 38
8412

Semiconductors

(Continued from page 1)

and error," Tom says.

But, he says, if manufacturers are going to understand and control the manufacturing processes for integrated circuits with smaller feature sizes and additional levels of metal, they must move away from the empirical models of the past to fundamental new models based on solid state and atomic physics.

The problems of dopant diffusion is a good example of how submicron feature sizes have complicated the modeling process, Tom explains.

Dopants are minute quantities of impurities added to semiconductor material to change conductivity. Depending on the type of impurity, a positively conducting (P-type) or a negatively conducting (N-type) semiconductor can be obtained and the direction of the electron flow can be controlled. But the dopants must be kept separate. If they run together, the integrated circuit will be defective.

As feature sizes become more minute, it gets more difficult to separate the dopants. When they are added by implanting ions into the material, there is a "poof" effect called transient enhanced diffusion that spreads the material, often mixing it with the other type of material being added.

"To develop better models, we need to understand the processes that control impurity redistribution on the atomic level and apply new techniques for calculating the interactions of dopants and defects in silicon to the modeling of integrated circuit fabrication processes," Tom says.

Sandia's role in two areas

Sandia researchers are working with SRC companies, national lab collaborators, and university investigators in two major areas. One is the aforementioned ion implantation and dopant/diffusion modeling. This is an area known as bulk processes — processes that occur below the surface of the semiconductor material.

The other Sandia area of research is topography — the study and modeling of processes that occur on the surface of a semiconductor wafer when material is either deposited or removed. Gerry has the programmatic responsibilities for the topography work.

Like the bulk processes research, Sandia' s SRC work in topographical modeling fits well with other work that Sandia has done. Chuck Gwyn, Manager of External Silicon Programs Dept. 1302, says the topographic modeling work interfaces with Sandia's research with SEMATECH, the consortium of US semiconductor manufacturers.

"We have a six-year relationship with SEMATECH in which we have used modeling to solve real equipment design problems," says Chuck, who oversees Sandia's programs with SEMATECH.

"We started with fundamental equations and developed detailed models, describing exactly the physical operation of the processes. We have characterized how we produce plasma and how we transport energetic ions to the surface of the wafer and how they interact with the surface of the wafer," he explains.

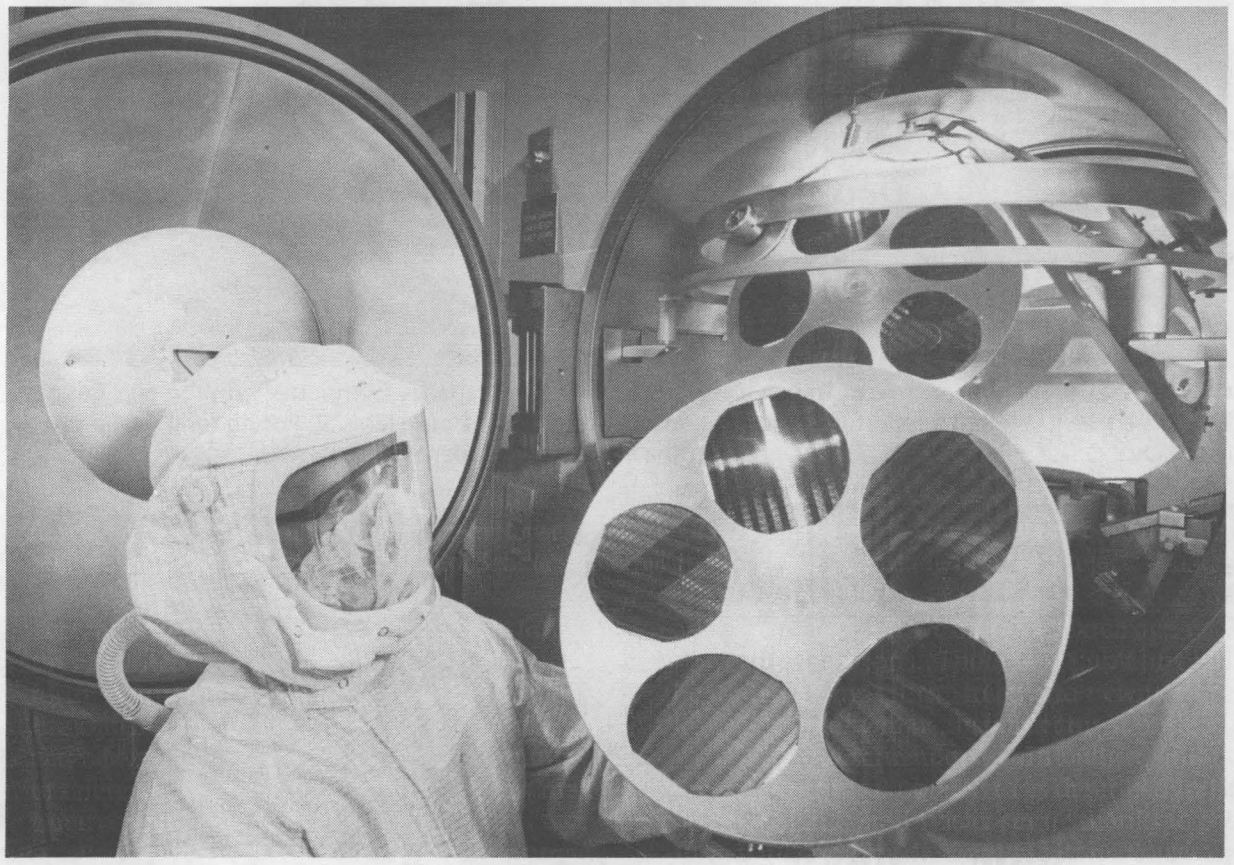
Chuck says the SRC CRADA is beneficial both to Sandia and its partners. "We bring a lot of expertise to the program with our state-of-the-art silicon fab [fabrication facility at the Microelectronics Development Laboratory] and actual fabrication experience. Meanwhile, the work we are doing in this CRADA is valuable to us in maintaining our capabilities and making sure that we stay at the state of the art by working with universities."

Gerry says the principal strengths that Sandia and the other national labs bring to semiconductor modeling is a wide inventory of skills and equipment. This is evident in the list of Sandians and varied departments working on the SRC CRADA. Besides Tom and Gerry, they include Jeff Nelson (1113), Alan Wright (1113), Peter Esherick (1126), Fred Yost (1831), Bob McGrath (6503), Carl Melius (8117), Ellen Meeks (8745), and Sudip Dosanjh (9221).

"The research by universities has been more focused in specific areas. They have developed several good commercial predictive simulators [models] that are being used by the microelectronics industry, but none deals with the whole process," Gerry says.

"The current simulators must be tuned to each specific process. What we hope to do in our research is to take these existing simulators and incorporate our science-based algorithms to extend them to the entire process, thus eliminating the need for this fine tuning," he says.

The universities, which are participating in the CRADA with their own research, also will benefit by having better data to develop improved software codes that the universities can make commercially available to industry.



THOUSANDS OF CIRCUITS — Bill Taylor (1323) inspects semiconductor wafers following their removal from a deposition chamber at Sandia's Microelectronics Development Laboratory. Deposition is one process Labs researchers will be looking to improve as part of a five-year CRADA with Semiconductor Research Corporation and Lawrence Livermore and Los Alamos national labs. (Photo by Randy Montoya)

Sandia Ski Day is Feb. 23 and March 1

All Sandians and their family members are invited to participate in the inaugural Sandia/DOE Ski Days at Santa Fe Ski Area Friday, Feb. 23, and Friday, March 1.

The "Ski Day" event, sponsored by the Coronado Ski Club, is scheduled for two consecutive Fridays so that employees can participate during their 9/80 Fridays off regardless of which cycle they are on. Other employees who choose to participate must schedule a day of vacation.

The event will include a "serious but recreational" race course and an "all-in-fun" race course, as well as other events, according to Ski Club President John Hancock (12304). The Ski Club will provide door prizes and awards for racers. Sandia and DOE employees who choose to participate are eligible for discounted lift tickets, equipment rentals, and ski lessons. (See lift ticket rates for Feb. 23 above; March 1 prices are being negotiated.)

Headquarters for the event will be the main lodge at the Santa Fe Ski Area base to accommodate both skiers and nonskiers. At the lodge, light snacks will be provided by the Ski Club.

Lift ticket vouchers, rental forms, and lesson forms are available at the Coronado Club office (checks only please). Sign-up lists for car pools (drivers and riders) also are available; car pools will leave the Coronado Club parking lot at 7 a.m. and leave the Santa Fe ski basin at about 4:30 p.m. both days.

Feb. 23 lift ticket prices

Adult all day, all lifts	$22.00
Child/senior all day, all lifts	$17.00
Beginner chair lift only, all day	$17.00

If the snow is unsatisfactory, the event will be canceled and money will be refunded to those who return their lift ticket vouchers and rental and lesson forms by the Monday following each Ski Day.

The event is expected to be held annually. Sandia Peak Ski Area is expected to be the site of next year's Ski Day.

If you have questions, contact the Coronado Club at 265-6791.

Retiree deaths

Warren Schaefer (72).....2510.....Jan. 13
Lasiter Spivey (73).....8133.....Jan. 15
Mary Van Brocklin (94).....8241.....Jan. 16
Donald Knapp (78).....1211.....Jan. 17
Mae Wood (75).....0120.....Jan. 18
Fred Sweet (86).....9134.....Jan. 23
Leonard Smoll (80).....1644.....Jan. 25

Organization numbers indicate retirees' positions at the time of retirement and may not correspond to present-day organizations.

Labs Accomplishments 1995

Sandia National Laboratories • Albuquerque, New Mexico • Livermore, California

To All Sandians:

Dear Sandian:

In spite of all the political and budget turmoil of the past year, the list of 1995 Technical Accomplishments is proof-positive that Sandians remained focused on their work. It is a most impressive array of important contributions.

The list of accomplishments is impressive from several viewpoints. First, the many "programmatic" achievements show that Sandia is serving customers by providing robust solutions to the problems they assign to us. This year's list of program accomplishments amply demonstrates that we are satisfying, indeed often delighting, our customers.

The breadth of Sandia's contributions in science and engineering amply displays the strength inherent in multidisciplinary problem solving. From enhanced security devices to new advances in knowledge preservation, the marriage of diverse technical skills is extraordinary.

Finally, the many fundamental scientific breakthroughs, in applied technology programs as well as in basic research efforts, testify that science is alive and well throughout the Labs.

I urge you to read carefully the full list — there is no better source for kindling pride in being a Sandian or for lighting further sparks that can lead to next year's achievements.

C. Paul Robinson
Labs Director and President

WATCHING THEM MOVE — Brian Swartzentruber (1114) at the scanning electron microscope he modified to track fast-moving atoms. His "atom tracker" is one of many accomplishments highlighted on this and the following pages. (Photo by Mark Poulsen)

Sandia National Laboratories

Sandia LabNews

Special Section February 16, 1996

Electronics, materials, & components

For several years, scientists have been able to observe atoms at rest on a crystalline lattice, important in examining the structure and reliability of materials. The newly developed **Atom Tracker now can observe an atom as it hops about its business.** By programming the needle-like sensor of a scanning tunneling microscope, we modified it to track the motion of individual atoms. This advanced ability to study the behavior of atoms is comparable to going from the days of snapshot cameras to video recordings. (1100)

A fully functioning 256-kbit static integrated circuit memory was fabricated in the Microelectronics Development Laboratory (MDL) as demonstration of a new, highly advanced technology. This integrated circuit has minimum features about the size of a large virus (0.5 micron) and nearly 2 million transistors. It operates at more than twice the speed of our previous memories, representing an advance of more than three generations in circuit technology when compared to earlier MDL deliveries for defense programs. The microchip demonstration was a milestone at about two years into a program that includes equipment installation, process development, and fabrication. (1300)

Using a newly developed selective oxidation technology along with our previously developed low resistance mirrors, we have demonstrated **vertical-cavity surface-emitting lasers that exhibit greater than 50 percent electrical-to-optical power conversion efficiency.** The new oxide-confinement layer in the device structure boosts optical as well as electrical efficiency, resulting in the highest performance light sources demonstrated to date at the less-than-10 mW power level (the level required for optical communications sources). This innovation should open the door to widespread applications for these lasers, which are much easier to mass manufacture than conventional diode lasers. (1300)

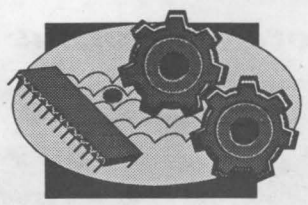
Extensive applications for micromachined components have been found in both industrial and military systems. In most applications, enormous advantages in size, cost, and performance would be achieved if the control electronics could be built on the same chip as the micromachines. Sandia has successfully developed **a new integrated technology that enables the monolithic fabrication of micromachines** with high performance microelectronics. This new integration capability is a critical enabling technology for future Defense Program systems,

Toward the beginning of each calendar year — a practice we began with the January 23, 1981, issue — the *Lab News* sums up Sandia National Laboratories' principal achievements during the previous fiscal year. This issue of *Labs Accomplishments* continues that tradition.

All Sandia divisions were invited to submit achievements, and the ones selected are summarized on the following pages. The work was accomplished during the fiscal year that ended Sept. 30, 1995. These brief summaries are not ranked in any way, but as in the past, we have grouped items that are obviously related. Organizations contributing to each accomplishment are shown in parentheses at the end of each item.

Requests for further information should be sent to Media Relations Dept. 12621, MS 0167, Sandia National Laboratories, Albuquerque, N.M. 87185-5800.

Electronics, materials, & components



including the self-aware weapon, the integrated nuclear materials monitoring program, and the Micromachined Guidance, Arming, Fuzing, and Firing program. (1300)

Materials and Process Sciences Center 1800 scientists developed an **electronic ceramic granule technology that enhances nuclear weapon safety of lightning arrestor connectors (LACs).** The new lead magnesium niobate/lead titanate (PMN/PT) granules were microstructurally engineered to safely shunt high voltages away from smart electronics for weapons at high temperatures and to meet B61 mechanical vibration and long-term insulation resistance requirements. Center 1800 has teamed with many organizations to War Reserve-qualify PMN/PT granules that will be used in B61 LACs starting in May 1996. (1800, 2400, 2200)

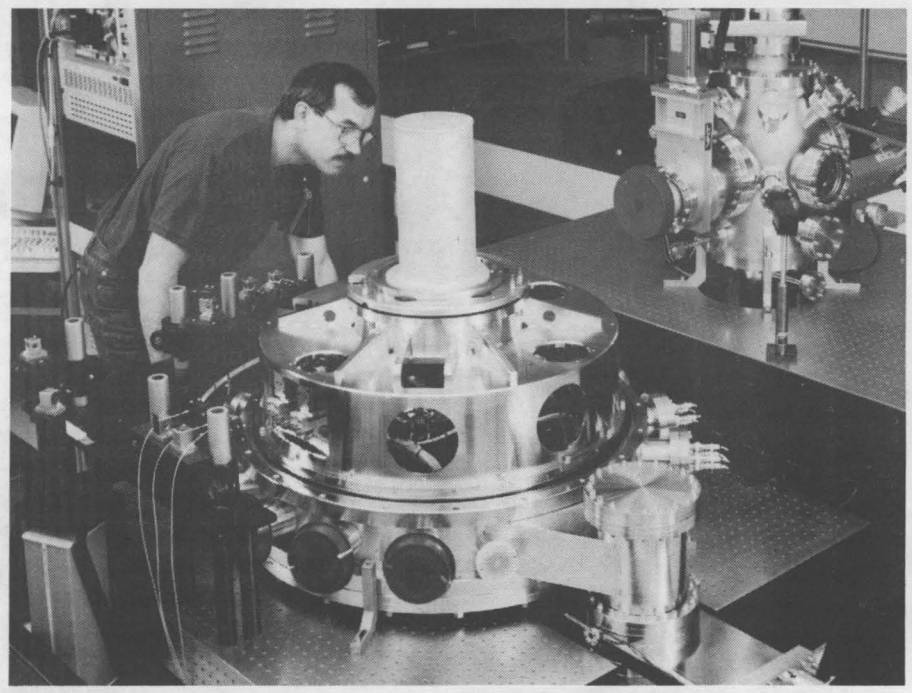
TIME IS OF THE ESSENCE — CIVA development team members examine data on the screen as their Charge Induced Voltage Alteration system goes through its paces.

The Electronics Quality/Reliability Center won its third consecutive R&D 100 Award in 1995. The winner was **Charge Induced Voltage Alteration (CIVA)**, a technique that reduces the time to find a crack in any one of the millions of microscopic wires on an integrated circuit from days or weeks to minutes. Originally developed to solve a Defense Programs problem, CIVA is now also licensed by major commercial companies including Intel and Motorola. (2200)

We delivered recertified MC2989A neutron generators to the Navy for the W76 weapon system Limited Life Component Exchange and packaging kits to the Air Force for W78 neutron generators. These deliveries represented the **first production deliveries for Sandia neutron generator manufacturing** under non-nuclear reconfiguration. We also separated neutron generator explosive timers from neutron generators returned from the stockpile, and shipped the timers to the Ensign Bickford company for reprocessing and recertification. (1500, 14300, 14400, 1400, 10200, 1800, 7600)

We have **greatly improved the reliability of ferroelectric thin films** used as nonvolatile microelectronic memories. Based on our Advanced Research Projects Agency-sponsored studies of defect chemistry and electrode interactions, we have changed the chemical composition of the films to resist the imprinting of memories held with one number for long times and the fatigue of memories cycled over a billion times. We have also changed the chemistry of film formation to lower the processing temperatures by nearly 100°C. (1400, 1800)

The **Modular Adaptable Controller (MAC)** project developed a set of electronic modules that perform the following presently known functions of weapon controllers: control, input, output, power, and use control. Each module has been optimized for size and packaging. New system designs can be accomplished by selecting one or more modules for the required functions and integrating them into a custom hardware package. The existence of these qualified modules will reduce development time and provide significant cost savings over traditional separate development for each system activity. (2300, 2200, 2400)



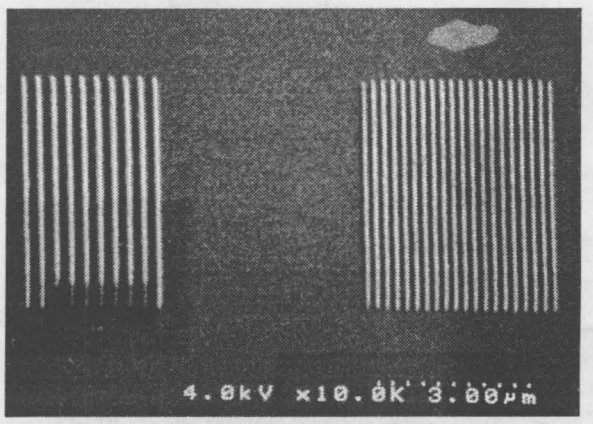
SANDIAN YON PERRAS (8414) inspects extreme ultraviolet lithography tool.

Sandia has teamed with Integrated Solutions Inc. and MIT to develop a **magnetically levitated (maglev) positioner** to meet the extreme accuracy and cleanliness requirements associated with the lithography of future generations of integrated circuits. A maglev positioner delivered to Sandia's Extreme UV Lithography Program in 1995 is the basis for a commercial version now under development. Maglev positioning work at Sandia has been supported by DOE through cooperative research and development agreements with SEMATECH, AT&T, and Integrated Solutions, and by DoD's Advanced Research Projects Agency. (1300, 2300, 2600, 8300, 9200, 9700)

Under NASA sponsorship, **Critical Dynamics in Microgravity (DYNAMX)** is a joint effort by Sandia, the Jet Propulsion Laboratory, and the University of New Mexico to develop a fundamental physics experiment for space shuttle launch in the year 2000. DYNAMX will measure the heat transport properties of helium as it becomes a superfluid (a superconductor of heat) at minus 271°C. Sandia has already developed new technology to support this mission, including a hermetic liquid helium actuated valve and ultrahigh resolution thermometers that can measure temperatures to within $10^{-10^{\circ}}$ Kelvin. (5700, 9100)

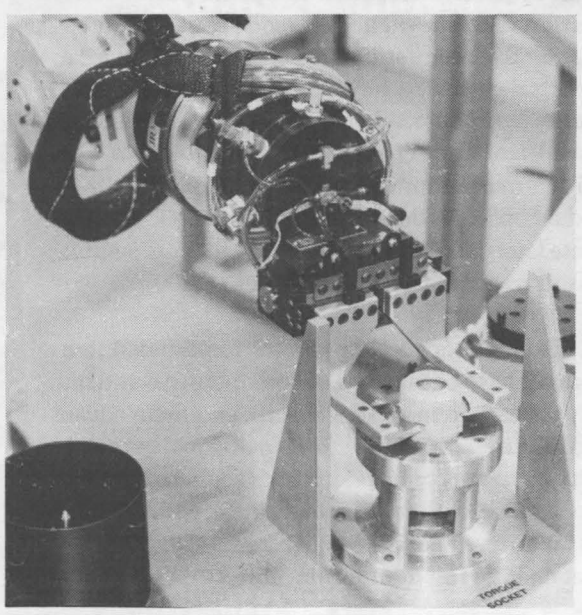
Sandia and AT&T constructed a third-generation **Extreme Ultraviolet Lithography** system with overlay capability for the fabrication of prototype semiconductor devices with features as small as 0.1 micron. The system's camera exhibits a total wave-front error (WFE) of <1 nm RMS (root mean square), the best ever achieved. Resulting patterns show cleanly resolved 0.1-micron patterns in all directions. Additionally, the world's most precise aspheric mirrors were produced this year, exhibiting WFEs of 0.6 nm RMS on each of three optical elements to be used in an advanced wide-field reduction camera. The project is supported by DOE Technology Transfer Initiative and ARPA funds. (1400, 1800, 2200, 2300, 2600, 6500, 8300, 8400, 8700, 9200)

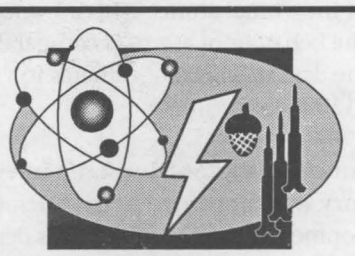
Detection and spectroscopy of ionizing radiation at room-temperature has been a critical technical problem for many years. In the last year, the Radiation Detector Group made major strides in solving this problem. Working with a number of industrial and academic partners, we **investigated several new types of room-temperature semiconductor detectors.** We recently demonstrated detection systems made from gallium arsenide and cadmium zinc telluride that are among the best ever reported. (8200)



GOING EXTREME — Imaging results from Sandia's new 10x reduction extreme ultraviolet lithography system, showing .15- and .10-micron test patterns.

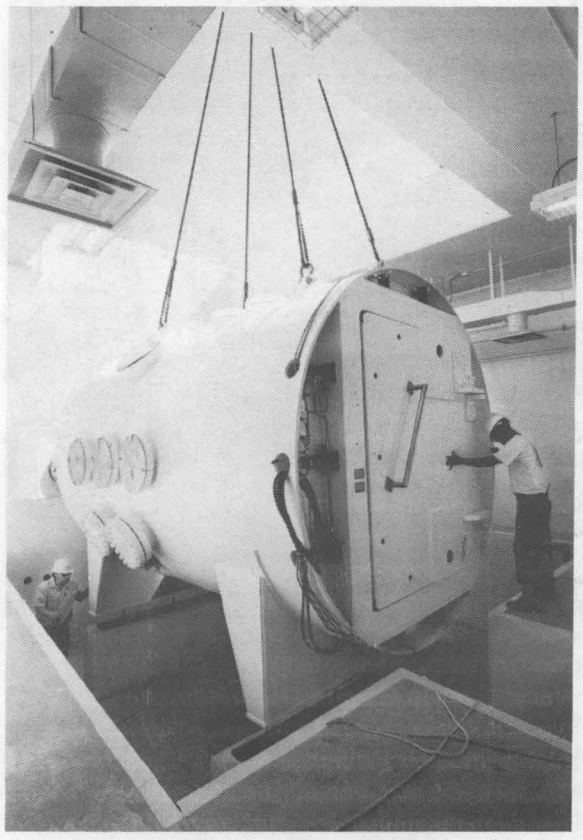
Nuclear weapons





We completed development of the **Automated Gas Generator Disassembly** (AGGDIS) robotic workcell. This system (see arm assembly at left) demilitarizes MC1362 and MC1835 gas generators by removing the propellant and igniters. These aged components from the dismantlement stream have become more sensitive to mechanical shock and electrostatic discharge. AGGDIS enhances operator safety by remotely performing disassembly operations. AGGDIS also separates the byproducts

Nuclear weapons



A BLAST — Blast chamber is lowered through the roof into the new ECF building prior to its July 1995 opening.

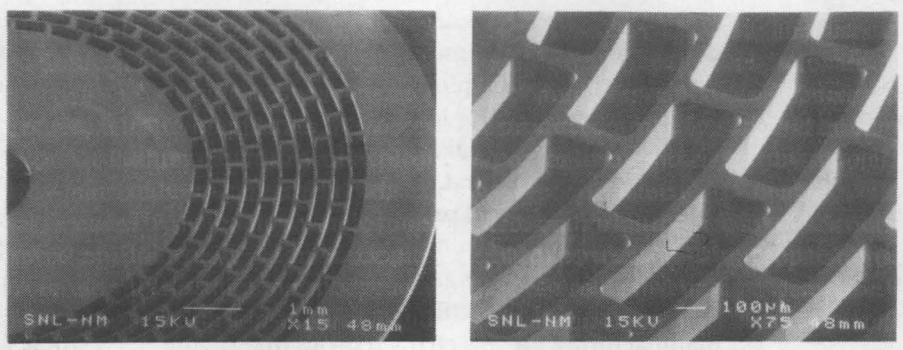
of disassembly into waste and recycle streams. The assembly was shipped to Pantex in December 1995 and becomes operational in the spring of 1996. (1500, 9600, Mason & Hanger)

The **Explosive Components Facility** (ECF), dedicated July 6, 1995, consolidates vital functions of the research, development, test, and evaluation of explosives, batteries, and neutron generators, as well as many weapon component surveillance activities. The ECF provides special facilities for the high consequence performance testing, materials evaluation, and (limited) manufacturing of energetic systems . . . up to the equivalent of 1 kilogram of explosive. Designated a "User Facility" by DOE, and with several User Facility agreements and cooperative research and development agreements already established, the ECF was designed with university and industry collaboration in mind. (1500)

The design and compliance testing of the **Russian Fissile Material Container** was completed and production was begun by a Defense Nuclear Agency production contractor. This container will be used for the storage and transport of dismantled Russian nuclear weapons components. The container was designed to meet the requirements of the International Atomic Energy Agency as well as Russian-specific requirements. Approximately 25,000 containers will be produced and delivered to Russia. A Protective Sample Container (PSC) was also developed, and eight containers were delivered to the US Army's Edgewood Research, Development, and Engineering Center. This package was developed to allow commercial air transport of previously prohibited chemical agent samples taken in support of the Chemical Weapons Convention. The PSC utilizes a modular concept that allows anything from sample collection in remote sites to field-ready, safe, and tamper-resistant air transport. This container reduces the cost of transporting a single chemical agent sample from approximately $50,000 to $600. (2100)

The **W87 Qualification Evaluation for Surveillance** (QES) was successfully conducted June 19-29, 1995, by Sandia and Lawrence Livermore national labs researchers at Mason and Hanger (M&H), Pantex. The QES addressed the safety, health, and quality of the disassembly and inspection process of surveillance units. No findings that were identified warranted suspension of operations. A conditional release allowing operations to continue was granted. The evaluation team recommended enhancements to the processes that will be considered by M&H. (2200, 12300)

We have developed a novel solution to a component need for neutron generators that uses **an advanced lithographic and electroplating process called LIGA.** This process is one of the key technologies useful for creating microelectromechanical systems (MEMS). The developed component is a grid with precisely controlled microscopic features. The process supports a rapid product-realization cycle of six to eight weeks from computer-aided design definition to first-part deliveries. The critical features have dimensions of a few milli-inches, with accuracies of a few microns. The parts are uniform and can be made repeatedly in a wide range of lot sizes. Thus, fabrication of this part geometry exemplifies the ability of the process to achieve readily what was difficult or impossible with conventional machining methods. (2600)



IMAGES from a scanning electron microscope show a relatively thin deep x-ray lithography and electroplating result.

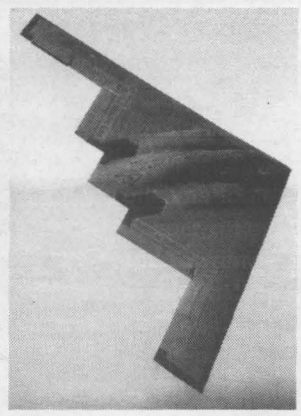
FISSILE MATERIAL CONTAINER — This container will be used for the storage and transport of Russian fissile materials. It was designed by a Sandia team.

Four major weapon systems were removed from the nuclear stockpile during FY95. The dismantlement effort at Pantex saw the B57, W68, W70, and W71 disassembled at rates exceeding 175 per month. This achievement was the culmination of four years of work by Mason & Hanger and design agency employees. Sandia participated in the qualification evaluation of each system that produced a stockpile database listing the materials and hazards associated with each of these weapons' parts, a first step in the proper disposition of material. Restart of W48 dismantlement allowed the complete removal of this system from DoD, thus eliminating the Army's nuclear weapon capability. (2100, 2200)

Engineering and Process Dept. 2165 redesigned and fabricated a **Hyster forklift outfitted with a radiation shielded cab** for use in the Stage Right program at Pantex. The shielding panels were made from a proprietary mix of polyethylene and tungsten powder. These panels are mounted to a support frame that in turn is mounted to the forklift. Clear, leaded-glass windows mounted in these panels allow the driver to see. This lift-truck was the second such vehicle delivered to Pantex and included many upgrades and modifications. We ran the project for Advanced Vehicle Development Dept. 9616 after the demise of the private company that delivered the original truck. Most of the fabrication and all of the final assembly were done at Sandia, and the truck was delivered to Pantex the last week in October 1995. (2100)

The MC4033 Common Radar Fuze, the first radar fuze with universal applicability to the B83 and B61, was released and put into production at AlliedSignal in June. The superior design is by all measures the most manufacturable radar ever developed at Sandia. It has achieved a better than 98-percent first-electrical-acceptance rate since the beginning of production and has reduced manufacturing flow times to 20 weeks, a factor of two better than previous radar designs. (2200, 2300)

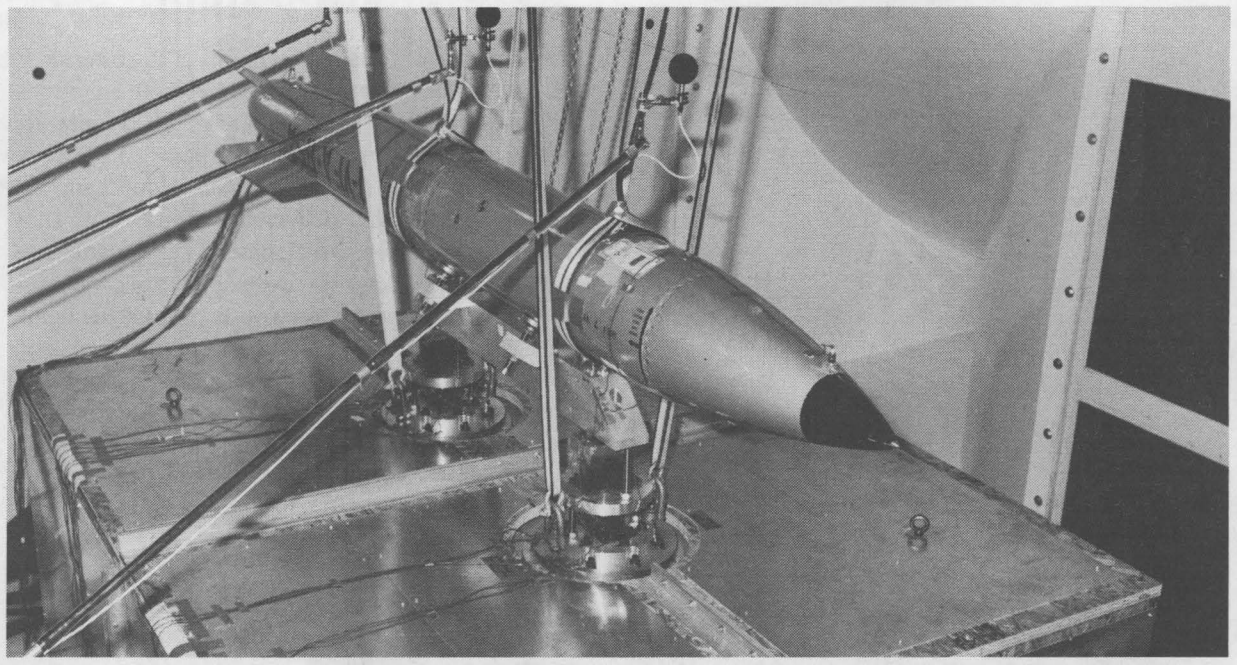
The work to **certify that the B-2A stealth bomber** is capable of carrying and delivering B61-7 and B83-0/1 nuclear gravity bombs was completed this year. The Sandia compatibility activity involved working with the Air Force and its contractors, Northrop and Boeing, to ensure that B-2A mechanical environments are within weapon design limits and that the aircraft electrical interface is properly designed to operate the bombs. Extensive testing and analysis was involved to verify compatibility. Sandians have been contributing to this program for the last 15 years. (2100)



A project to improve nuclear detonation safety of B61 tactical weapons has fielded retrofit kits. The project's purpose is to **replace existing Trajectory Sensing Signal Generators**. Secondarily, we were able to provide compatibility with a subsequent alteration adding encryption capability, eliminating the need for two thermal batteries, and simplifying weapon assembly. We accomplished these tasks while applying the most recent nuclear safety processes and maintaining current weapon reliability. (5100, 2200, 2300, 2600, 12300)

Nuclear weapons

Sandia conducted experiments in the Area 3 Vibroacoustic Test Facility (VTF) to **evaluate improved simulation capabilities for aircraft store environments.** Multiple input vibration shakers were combined with a reverberent acoustic field to more accurately simulate the actual field environments compared with the traditional use of single-axis vibration tests. Test environment tailoring techniques were developed to optimize shaker and acoustic inputs to match internal component responses with actual field measurements. Test results for a B61 show excellent agreement with measured field component responses. (9700, 2100)



ALL SHOOK UP — The Vibroacoustic Test Facility provided data to evaluate improved simulation capabilities for aircraft store environments. Tests of the B61 showed excellent agreement with measured field component responses.

In order to establish a consistent foundation for programs that will maintain the integrity of the US nuclear stockpile, DOE's assistant secretary for defense programs requested a study that would **coordinate and summarize stockpile support concerns** raised by each of the three Defense Programs national laboratories. The resulting report delineates a clear rationale for the future development of Science-Based Stockpile Stewardship, Enhanced Stockpile Surveillance, and other vital programs. (5400)

With the end of the Cold War and subsequent reductions in the US nuclear stockpile, the average age of weapons in the enduring stockpile is increasing, and aging degradation is a critical issue. A symposium titled **"Aging in the Enduring Stockpile"** was held at Sandia Aug. 15-16, 1995, to provide a forum for important discussions of aging in systems, components, and materials, with the intent of expanding our understanding of these concerns and coordinating our approach to addressing them. (5400, 1500, 2100, 9700, 2300, 1200, 2600, 1800, 12000, 8700)

Subsystem and component environmental and functional **testing and analysis of the new Safeguards Transporter** have been successfully completed, and a successful Prototype Design Review has resulted in DOE approval to fabricate a prototype of this high priority new vehicle. The project remains on schedule for the commencement of production in mid-1996. (2300, 2500, 5100, 5500)

The Nuclear Emergency Search Team (NEST) represents DOE's technical response capability for accidental and possibly dangerous nuclear events. During FY95, Sandia team members provided **training to more than 90 decision-makers** from seven government agencies and the three nuclear weapons laboratories. We also participated in three multiagency response exercises, planned and executed a one-week containment and effects drill, and led the planning of a major NEST exercise that was held in December 1995. (5500, 5800, 5900, 9300)

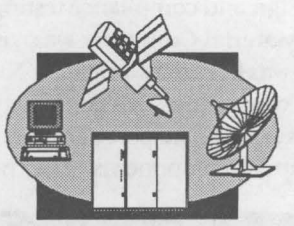
Sandia is a member of the Los Alamos National Laboratory-led **W76 Acorn Product Realization Team** as stipulated in a memorandum of understanding for future gas transfer system development. Sandia's input to the conceptual design selection resulted in a much improved design from the performance and manufacturing aspects. Sandia is completing a group of conceptual prototype units for long-term tritium storage at LANL and has also taken the lead role in the **development of a burst disk assembly.** This assembly is an integral part of the Acorn design, and its function is required for proper storage and delivery of the transfer gases. Although commercial burst disks are specified, specific design and manufacturing process characteristics that ensure long-term compatibility with the tritium environment must be developed and verified. (8400)

Significant advances were made in the **safety, function, and reliability of the Lightning Arrestor Connectors (LACs)** for the B61 safety upgrade program. These new LACs function properly at high temperature levels more than double those of previously fielded LACs, providing significantly greater margins of weapon safety and reliability. The design, development, and production process employed achieved high levels of internal and external recognition. It was selected as a Navy Best Manufacturing Practice and benchmarked by representatives of the nuclear power industry (1200, 12300)

Organization 12300's **Stockpile Surveillance Program evaluated 116 nuclear weapons** in FY95. All weapons were denuclearized and instrumented in test configurations at Pantex. Eighty-one were tested, at various environmental conditions, in Sandia's Weapons Evaluation Test Laboratory at Pantex. Thirty-five warheads were flight tested with operational delivery systems. Twenty-six significant finding investigations were opened to determine the reliability and safety impacts and appropriate corrective actions for anomalies detected during these tests. All results were reported to DOE's Weapons Quality Division, which requires that this activity be accomplished yearly to continuously demonstrate the reliability, safety, security, and readiness of the nation's nuclear stockpile. (12300)

Computation/information

SPEEDSTERS — Members of the Sandia/Intel team pose in front of one of the Paragon computers they used to shatter the world computational speed record, posting the new benchmark of 280 gigaflops in December 1994. The team is now aiming to shatter the teraflops barrier before the end of the calendar year.



As part of DOE's Accelerated Strategic Computing Initiative program, in FY95 Sandia and Intel Corp. entered into a research and development contract to develop the world's first supercomputer capable of more than **a trillion floating-point operations per second** (teraflops). When completed in late 1996, the new computer will have a peak performance of 1.8 teraflops and will be about 10 times more powerful than the fastest existing supercomputer. The teraflops computer is the first step in a 10-year program to advance the state of high-performance computing into the realm of more than 100 teraflops capability. Supercomputers of this enormous power are needed to simulate nuclear weapons tests and will make possible the conversion from test-based to simulation-based nuclear weapon design. They will also make possible a wide range of scientific applications such as computer design of new drugs and development of new materials, simulation of global climate change,

Computation/information

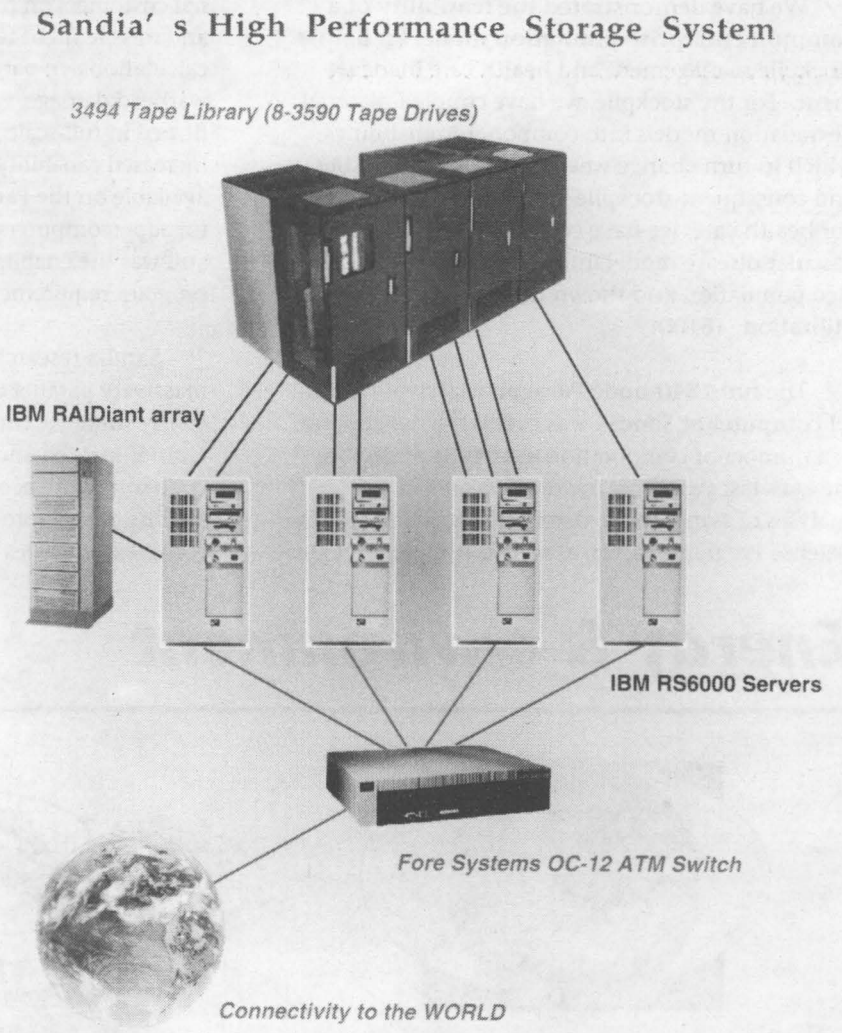
development of safer and more efficient automobiles, and simulation of natural disasters more quickly than real time. During FY95, a Sandia/Intel team set the current supercomputer speed record of 280 gigaflops. (9200)

The High Performance Storage System (HPSS) team has **deployed the first production HPSS**. This effort represents an important first step in several areas: scalable parallelinput/output, use of network-attached storage, and high performance tape drives. The team is part of a government-industry consortium to develop the next generation mass-storage system, necessary to support the ever increasing amounts of data being generated and accessed for programs such as the Accelerated Strategic Computing Initiative (ASCI). The goal is to improve storage performance and capacity by two orders of magnitude over what is available today. (4900, 4600, 8900)

The Chief Information Officer organization continued to implement enterprise communications capabilities in a balanced fashion. The cornerstone of these efforts was the **completion of a state-of-the-art building wiring effort in 14 major buildings**. The effort enabled the implementation and acceptance of a 20 Gbps core Asynchronous Transfer Mode switch, the extension of the Synchronous Optical Network backbone with capabilities at 155Mbps, 622Mbps, and 2.5 gigabytes per second, and the upgrade of the distributed router network. These efforts have strongly impacted the overall reliability and availability of networking services throughout Sandia. (4900)

Sandia led a multilaboratory team that developed the **National Counterproliferation Test Bed**, a unique test environment at the Nevada Test Site for studying signals that emanate from underground structures. The team, with participants from Lawrence Livermore National Laboratory and the Defense Nuclear Agency, then used that environment to develop sensor systems for characterizing such structures. This required the development of new procedures and capabilities at the test site and the leveraging of DOE infrastructure funds with the DoD customer's system development funds. (2500, 6100, 9200, 9300, 9400, 9700)

The use of Unattended Ground Sensors (UGS) in tactical battlefield operations is of increasing interest, and Sandia has developed a prototype software model, called the **Sensor Evaluation Model (SENSEM)**, to simulate the use of such UGS packages against various target arrays. This model enables the user to simulate the deployment of sensors on a specific battlefield and assess sensor performance under realistic battlefield conditions, complete with roads, terrain contours, and moving targets. These are unique simulation and modeling capabilities, and several DoD agencies are currently funding us to develop sensor architectures using the SENSEM model. (5400)



SPEEDIER DATA STORAGE AND RETRIEVAL — A key component of advanced computing requirements, high performance storage systems, is being effectively addressed by a Sandia/government/industry team.

To improve our ability to access and utilize weapons information, the **Knowledge Preservation Project** has developed the means to rapidly access specific information contained within videos, thereby moving video into the realm of information management. Through a process called Relevant Point of Access Video (RePAV), videotapes are digitized, compressed, and their audio tracks are converted into fully indexed text documents that are linked to the video. Specific information can then be located using ordinary keyword queries. Upon accessing a video, the keyword is spoken within one minute. (9700, 14700, 15100)

For the National Center for Advanced Information Component Manufacturing, funded by DoD's Advanced Research Projects Agency, we developed **models for the life cycle cost of ownership of equipment** used in flat panel display manufacturing, thus enabling the assessment of total factory cost and resources required to meet production demands. These tools were developed in close collaboration with industry and provide a basis for rational operations planning and the efficient allocation of production resources. The models were enthusiastically received by initial users. Several hundred copies have been distributed to industry. (5400, 1500)

Transportation Information Systems Dept. 5517 has developed a rapid modeling environment for transportation planning. The **Transportation Planning Model (TPM)** was developed to help DOE's Transportation Safeguards Division plan the future size, location, and operation of the Safe Secure Transport fleet over the next decade. Using the TPM, an analyst can rapidly project a shipment workload, schedule shipments into the most efficient trip sequence, and simulate trip execution in a model that includes vehicle maintenance and driver personnel management requirements. (5500)

Sandia, Lawrence Livermore, and Los Alamos national laboratories have established **SecureNet, an Asynchronous Transfer Mode (ATM) high-speed network** for classified and unclassified traffic among the laboratories. SecureNet will enable interactions and efficient data transfer for the Accelerated Strategic Computing Initiative, Advanced Design and Production Technology, and other Stockpile Stewardship activities among Defense Programs laboratories and facilities. The network uses ESnet, the DOE portion of the Internet, as the wide-area backbone, resulting in significant cost savings. (8900, 4600, 4900)

Nonnuclear weapons

We are actively teaming with industry and other government agencies to develop **state-of-the-art synthetic aperture radar (SAR) and automatic target recognition (ATR) systems.** We completed the SAR sensor assembly for the Open Skies treaty verification program. Multiple data gathering missions were flown on the Airborne Multisensor Pod System (AMPS), a DOE multilaboratory nonproliferation data collection and data fusion effort. We are applying template-matching and model-based vision algorithms and real-time computing hardware to demonstrate ATR aboard the E8-C Joint STARS aircraft. (2300, 2500, 2600, 5300, 5700)

Work performed as part of the memorandum of understanding between DOE and the Office of Munitions at DoD has resulted in several completed subsystems. The **Scannerless Range Imager** produces high rate reflectance and range images in real time. A unique, low cost global positioning system guidance scheme provides alternate precision guidance to inertial platforms. The Super Quick Thermal Battery project has demonstrated rise times of less than 0.2 milliseconds, enabling a redundant safing system to tube-launched munitions. (1200, 1400, 2200, 2300, 2500, 2700)

The Aerospace Systems Development Center provided and launched two missile systems from the Kauai Test Facility as a critical element of the US Navy's Extended Tracking & Control Experiment (ET&CE) conducted on June 27 and 29, 1995. This experiment demonstrated the capabilities of the Aegis combat system to detect and track theater ballistic missile targets following a cue from a national means sensor. Sandia's **Strypi IX missile systems were selected as targets** based on their ability to accurately fly a prescribed, long-range (400 nautical miles) flight profile to an impact within 25 nautical miles of an Aegis cruiser. According to Navy officials, the success of the ET&CE program has completed another step in fielding a sea-based missile defense system even faster than expected. (2100, 2300, 2400, 9100)

Using funding provided by the National Institute of Justice (NIJ), Sandia developed an **aqueous foam prison cell extraction system** for potential use in correctional institutions. This system is based on the use of a nontoxic, high-expansion-ratio, aqueous foam that incorporates an oleoresin capsicum inflammatory. The technology is intended to minimize the need for force in cell extraction and other prison disturbance situations. A prototype cell extraction foam machine has been demonstrated, and the large-scale use of the technology to isolate and control disturbances has been evaluated. A second phase of the project is being negotiated with the NIJ. (1800, 5500, 7700)

Computation/information

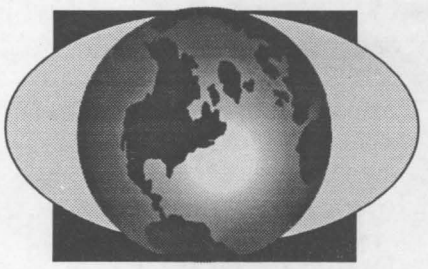
We have **demonstrated the feasibility of a common enterprise simulation model** for both stockpile management and health care management. For the stockpile, we have coupled material degradation models into component reliabilities, which in turn change weapon system reliabilities and consequent stockpile maintenance operations. For health care, we have coupled a detailed cardiovascular disease model into an individually modeled population and shown the effect on resource utilization. (8100)

The **full 1840-node Paragon massively parallel computer at Sandia was crucial** to our support of a number of computational analysis projects at the Labs last year. This included weapon safety analyses of sympathetic detonation scenarios for the Defense Programs sector, as well as projects for external customers on theater missile defense problems and missile flight test support. The missile defense calculations, in particular, gave predictions of target warhead damage, which were subsequently confirmed in full-scale ground-based experiments. The increased capability (memory and computing speed) available on the Paragon, relative to traditional vector supercomputers, was crucial for these projects and was the enabling factor in our ability to meet program requirements. (9000)

Sandia researchers have developed a code for massively parallel computers that could significantly **increase the known amounts of oil** in the Gulf of Mexico and the Rocky Mountains. This code solves the acoustic wave equation and uses seismic data to produce detailed 3-D images of complex geologies that may contain gas and oil. Large-scale simulations that previously took months can now be performed in hours on the Intel Paragon or Cray T3D. The project's industrial partners include two major oil companies, four oil industry service companies, three computer vendors, and a university. (9000)

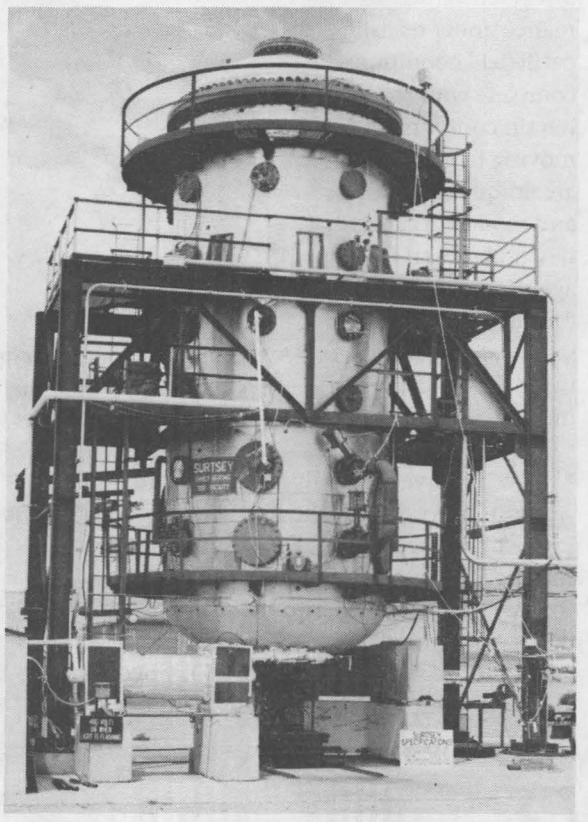
Sandia continued its support for **USSTRATCOM and USSPACECOM** in providing mobile, survivable command and control systems for the strategic nuclear deterrent. Sandia developed and installed Ground Nuclear Detonation Detection Terminal (GNT) equipment, upgraded Nuclear Planning & Execution System (NPES-II) hardware, integrated Military Satellite and Relay (MILSTAR) communications, and provided redundant/upgraded architecture for the processing of intelligence information into the system. (9400, 5700)

Energy & environment



We have successfully grown **nanometer-size semiconductor clusters**, deposited metals on their surfaces, and demonstrated strong electronic quantum confinement effects and broad tailorability of their bandgaps, features that are important for the potential use of these materials as photocatalysts for solar fuel production and detoxification. A key finding is that the functions of energy absorption and energy transfer can be separated: materials for the interior of the cluster can be chosen to optimize absorption of light energy while materials on the surface can be chosen to optimize transferring energy to reactant molecules. (1100)

Sandia recently completed a major legislated requirement of the Waste Isolation Pilot Plant Land Withdrawal Act (LWA) for a study of technologies for radioactive waste treatment. The three-year study schedule resulted in the report titled "The Radioactive Waste Treatment and Volume Reduction Technologies Study" **summarizing more than 200 individual processes for treating radioactive and mixed waste.** The report was submitted to DOE's Carlsbad Area Office (CAO) on schedule and on budget. As required by the LWA, the CAO submitted the report to Congress at the end of FY95. (6700, 6800)

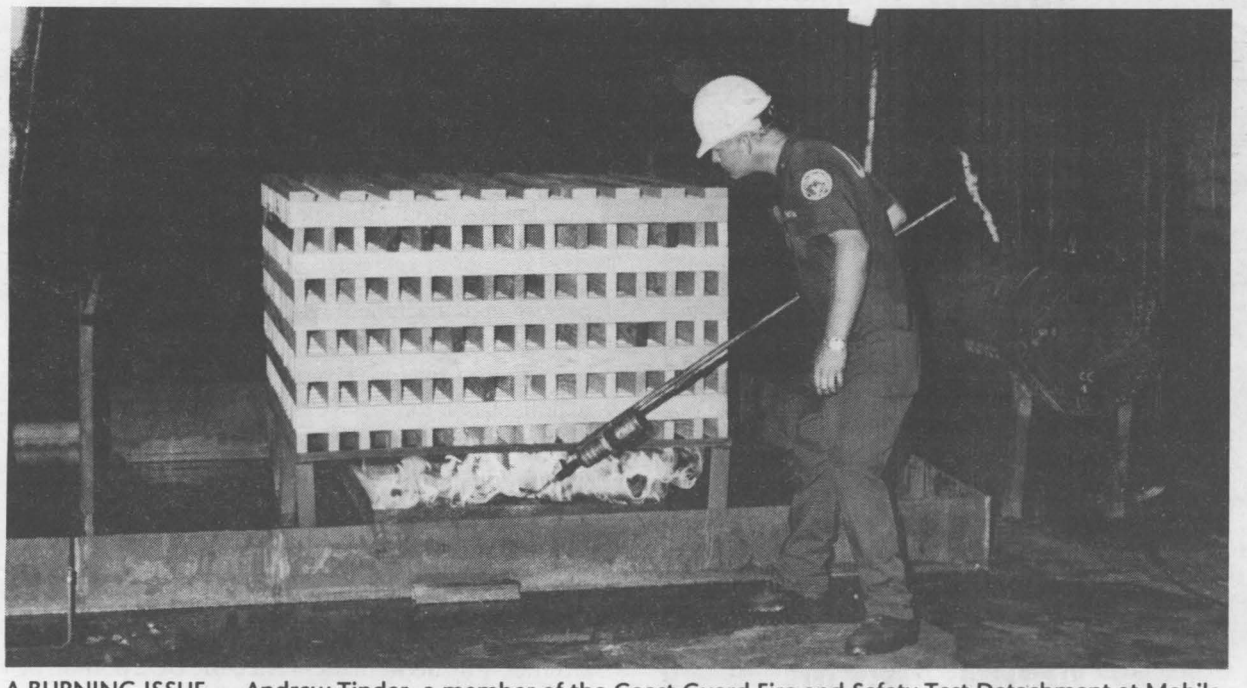


DIRECT CONTAINMENT HEATING — Experiments at Sandia provided high confidence against the likelihood of containment failure in Westinghouse reactors.

The Transportation Development and Transportation Systems departments teamed with other Sandia organizations on the DOE/Environmental Management **SeaRAM research program,** which is validating the safety of shipping radioactive materials by sea. Sandia developed state-of-the-art analytical tools for performing comprehensive analyses to evaluate sea accident frequencies and severities. SeaRAM consists of three technical activities: maritime database evaluations and risk assessments; thermal analyses of onboard fires related to fire incidents in the database, including fire tests to benchmark analyses; and structural analyses of ship collisions related to collisions in the database. (6600, 1400, 1800, 9100)

The **Thermal Enhanced Vapor Extraction System (TEVES)** was a full-scale demonstration to remediate actual soil contamination at Sandia's Chemical Waste Landfill. This system showed the combination of soil heating technology along with vacuum vapor extraction increased the mass removal rate by 500 to 1000 percent. A field demonstration of this type required innovation in the negotiation of regulatory permits, full system integration, and the complex process monitoring needs of a research program. Field experience from the TEVES project will give environmental restoration staff real cost and technical performance measures to avoid traditional excavational treatment methods that are much more costly. (6600)

The NRC has sponsored research to **resolve the direct containment heating (DCH) issue in nuclear power plants.** A DCH event could threaten the integrity of the reactor containment building. Results of large-scale experiments and model development have been integrated in a probabilistic framework, and the likelihood of containment failure was shown to be negligible for all Westinghouse plants. This work has saved ratepayers hundreds of millions of dollars, since backfits to existing plants are not required. The work received a Sandia President's Silver Quality Award. (6400)



A BURNING ISSUE — Andrew Tinder, a member of the Coast Guard Fire and Safety Test Detachment at Mobile, Ala., ignites a wood crib aboard a Coast Guard ship in preparation for a SeaRAM test. (Photo by Diana Helgesen)

Sandia supported the successful construction of **the 10 megawatt Solar Two solar power plant.** Solar Two is a $49 million utility/industry-led project (50/50 cost-shared with DOE) to retrofit the Solar One Plant with a molten salt receiver and thermal energy storage system. Solar Two will facilitate the commercialization of solar power tower technology for electricity generation through the large-scale validation of the technology. Sandia supported the project on issues related to salt chemistry, heat trace, heliostats, control systems, and materials selection. Solar Two was to begin operating in February 1996. (5300, 6200, 8700)

Sandia completed **major geotechnical investigations of a surface sinkhole** above the DOE Strategic Petroleum Reserve underground oil storage facility at Weeks Island, La., a converted salt mine. Sandia recognized the potential severity and conducted investigations resulting in a DOE decision to

Energy & environment

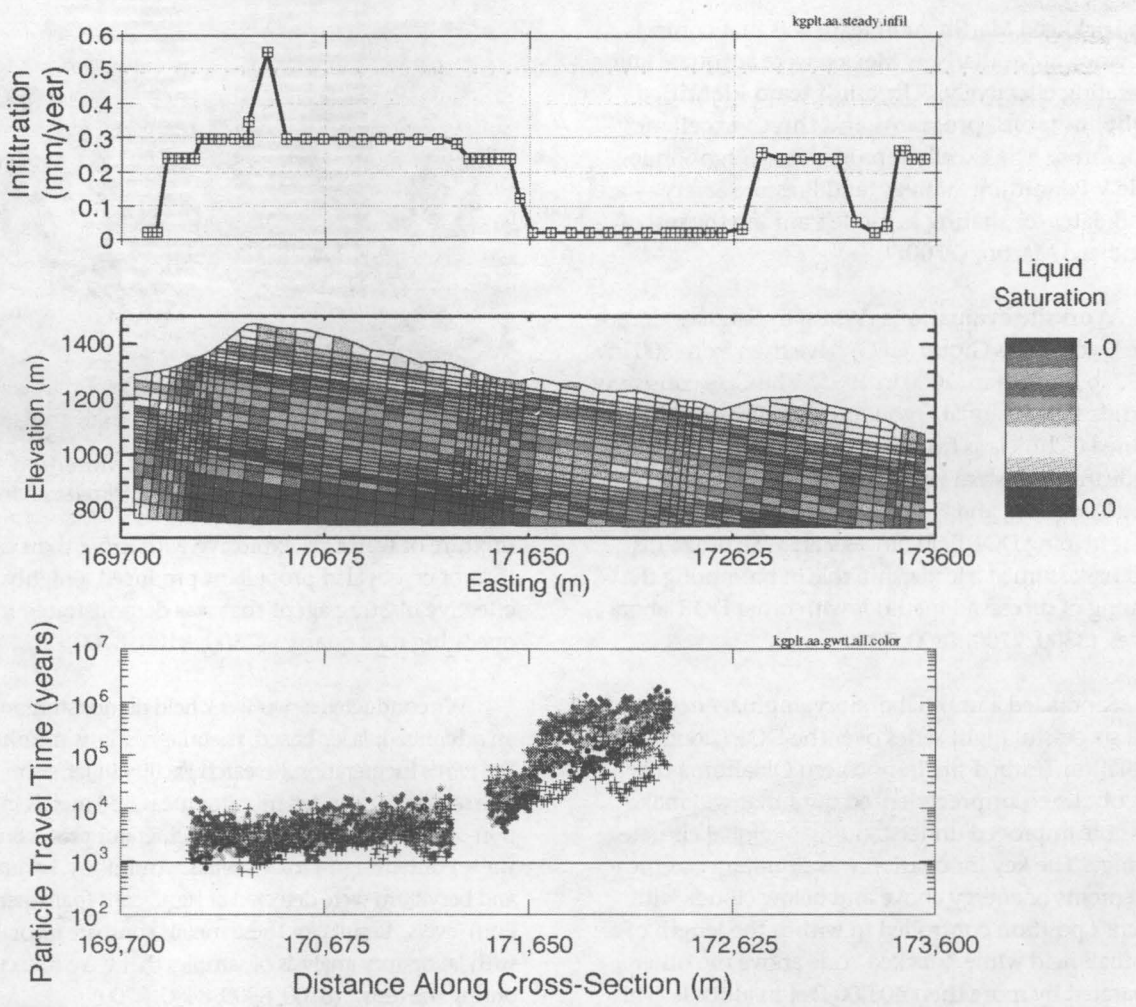
transfer 73 million barrels of oil and abandon the site. To support the three-year withdrawal process, a 200-ft by 60-ft diameter icewall was constructed with Sandia hydrologic sensors below monitoring and controlling brine injection to prevent further dissolution. (6100, 1500)

Rio Grande High School students in the "School Within a School" program received sections of Sandia's extensive Annual Site Environmental Monitoring Report and were asked to provide their comments and opinions. Almost **60 students worked to create a 10-page version** of the full 400-page report. The summary describes, in nontechnical terms, the environmental monitoring work Sandia accomplishes. (3600, 7500, 12600)

Yucca Mountain, Nev., has been proposed by DOE as a potential site for the nation's first long-term high-level radioactive waste repository. Critical issues regarding **groundwater flow through unsaturated and saturated fractured rock** have been assessed and integrated into state-of-the-art geostatistical and groundwater flow models. Results are being used by DOE, several national laboratories, and the US Geological Survey to evaluate the suitability of Yucca Mountain for safe long-term storage of high-level radioactive wastes. (6100, 6800)

The City of Albuquerque presented Sandia with five **"Gold Pretreatment" awards** for excellence in the pretreatment and monitoring of waste water. These awards are issued to organizations to recognize complete and consistent compliance with their industrial waste water permits. (1300, 2400, 7500)

Sandia has pursued DOE approval to dispose of low-level radioactive waste (LLW) at the Nevada Test Site (NTS) since FY93. An audit by DOE/NV was conducted March 13-17, 1995, and **the initial shipment of Personal Protective Equipment** was transported to NTS for disposal on Sept. 25, 1995. This was a historic event that marked success of the first-ever LLW disposal effort by Sandia/New Mexico. (Sandia/California has made a number of such shipments). Eight additional streams are currently being prepared for disposal. (1200, 7500)



PREDICTED ROCK MATRIX saturations and groundwater travel times for a specified infiltration distribution along a two-dimensional cross-section of the unsaturated zone at Yucca Mountain, Nev.

Challenged by DOE to improve its efficiency and performance, the Sandia Environmental Restoration (ER) project has **not only met, but exceeded the performance goals** promised in its 1994 action plan. But the ER team didn't stop there. Pushing its reengineering efforts beyond the goal line, the team submitted a revised action plan that further reduces the total project costs and accelerates schedules. The results have not gone unnoticed. Successful implementation of the action plans has turned challengers into strong supporters of the ER project. (7500)

Air Quality Dept. 7575 and Line Implementation Working Group's (LIWG) team effort developing the Clean Air Act Amendments' Title V operating permit application for Sandia will pay off in **reduced fees and greater operational flexibility.** This permit strategy deals with operating conditions, emission rates, record-keeping, air pollution equipment, and schedules. (7500, LIWG)

Lockheed Martin Corporate Environment, Safety, and Health (LMC-ESH) conducted an audit of Sandia/New Mexico in 1995. The overall opinion of

Production

Sandia has a new mission assignment to fabricate neutron tubes and neutron generators. Two wings of Bldg. 870 were renovated and are occupied; the north wing was demolished and a new two-story wing was occupied early this year. **The Integrated Manufacturing and Design Facility** provides transitional planning and teaming space to facilitate concurrent engineering. This colocates the work and administration of Production Division 14000. (1500, 7900, 14400)

In support of the nonnuclear reconfiguration project for DOE/AL/Weapons Quality Division, Production Division 14000 was able to meet the **programmatic milestones needed to demonstrate neutron generator production** operations at Sandia. The W76 recertification Production Realization Team (PRT) developed and managed the manufacturing processes to include comprehensive infrastructure requirements, training, teamwork, quality, customer requirements, and achievable plans. The monthly build requirements were established and completed to meet directive schedules. Approximately 250 W76 neutron generators were processed, certified, accepted by DOE , and delivered to the Navy. (14400)

Manufacturing Infrastructure Teams **implemented the first phase of a production system** that enabled Product Realization Teams and Operational Users to make the first delivery of neutron generators since Sandia assumed this important production assignment. These

WORKERS COMPLETE finishing touches on new manufacturing facility. (Photo by Randy Montoya)

systems include Production Planning & Scheduling, Quality, Finance, Information Systems, Environmental Testing, infrastructure models, ES&H, Shipping & Receiving, Materials Management, Procurement, Training, Materials, Inspection, Metrology, and Production Operations. This capability is highly matrixed and closely integrated across a wide spectrum of people in the Labs and a number of key suppliers.

The Pinellas-to-Sandia reconfiguration transfer process was completed ahead of schedule and well within budget through the efforts of an integrated team of Sandians residing in Florida and New Mexico. Those 84 new Sandians who lived in Florida for a year helped disassemble and move the neutron generator factory to Albuquerque. They are being assimilated into the Sandia culture as part of the team that is building and operating the new factory at Sandia. (14000)

In support of the mission assignment at Sandia to manufacture neutron tubes, **new furnaces were procured.** These furnaces will also support prototyping activities for switch tubes. Tight temperature control was required to increase throughput and uniformity of product. Sandia technical employees worked cooperatively with vendor engineers to design, fabricate, and test temperature-control concepts. These new furnaces have a hot zone of 13 inches in diameter by 21 inches in height, with a five-degree gradient at 1400 C. (14000, 1400)

Energy & environment

the Lockheed Martin audit team was that controls provided at Sandia/New Mexico were adequate and operating effectively. **The audit team identified eight "notable" programs and three "excellent" programs.** The excellent programs — Ergonomics, Title V Permitting Strategy, and Pressure Safety — are candidates for sharing as models among the rest of Lockheed Martin. (7700)

Worksite evaluations (WSEs) by Sandia's Corporate Ergonomics Group (CEG) have risen from 300 in 1992 to more than 2,000 in 1995. The CEG consists of Certified Professional Ergonomists and professionally trained technicians from the Safety, Occupational Medicine, Industrial Hygiene, Facilities Planning, ES&H Training, and Human Factors departments. Sandia is helping DOE field offices start WSE programs and has assumed a leadership role in promoting the sharing of successful methods with other DOE laboratories. (3300, 7700, 7800, 7900)

Sandia led a multilaboratory, multiagency team in a successful flight series over the DOE Cloud and Radiation Testbed site in northern Oklahoma that has **obtained unprecedented data** that will make possible improved understanding of global climate change. The key innovation was simultaneous measurements of energy above and below clouds with aircraft position controlled to within the length of a football field while "stacked" one above the other separated by more than 40,000 feet in altitude. This work was supported by the Strategic Environmental Research and Development Program and DOE. (2600, 5300, 5700, 8100, 8200, 8400, 8500)

Solid propellant from 200 of Sandia's excess rocket motors was recently used to demonstrate a **recycling alternative to hazardous waste disposal.** The propellant was incorporated into a commercial blasting agent that has numerous mining applications. The cryocycling process, developed in departments 8716, 8742, 8113, and 8745, was used to prepare the propellant for recycling. A proprietary

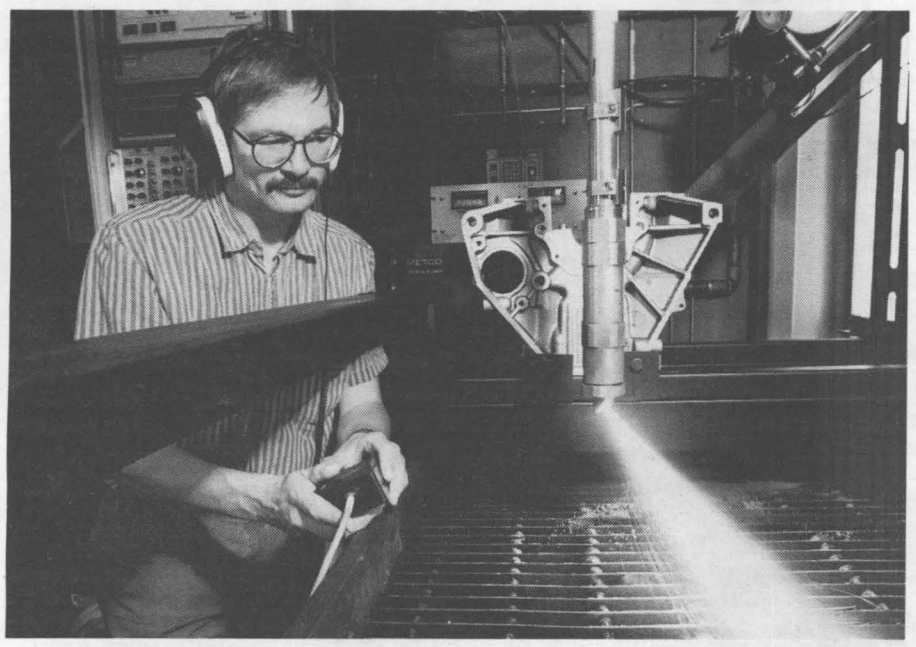
CLOUD DANCER — Specially instrumented Twin Otter aircraft gathers data on global climate change.

mixture of water gel explosive with more than two tons of cryocycled propellant produced a highly effective blasting agent that was demonstrated in an operating rock quarry. (7500, 8100, 8700)

We conducted a two-week field demonstration of an **advanced, laser-based, metal-emissions monitor** at the EPA's Incineration Research Facility in Jefferson, Ark. The remotely operated monitor measured metals in the post-scrubber effluent from an incinerator processing waste containing 14 toxic metals. Antimony, barium, and beryllium were detected at significant (parts-per-billion) levels. Results for these metals compare favorably with laboratory analysis of samples that were collected during the tests. (8100, 8300, 8400, 8700)

In June, a group of Albuquerque area citizens **convened for the first time as a Citizens' Advisory Board** for Sandia and Inhalation Toxicology Research Institute issues relating to environmental restoration and waste management. Sandians from organizations 12650 and 7500 helped organize the board. The board has organized into committees and is dealing with issues of future land use on Kirtland Air Force Base and the Labs' proposal to construct a permanent facility for storage, treatment, and disposal of environmental remediation wastes. (7500, 12650)

Technology transfer



FLAME SPRAY PROCESS — Sandia researcher Tim Roemer (1841) and the flame spray process being developed for hardening the bores of aluminum engine blocks. Sandia has been doing work on flame spray for the past 25 years.

The benefit to stockpile stewardship of defense-needs-driven industrial collaborations was demonstrated when the Electronics Quality/Reliability Center was able to use results from its cooperative research and development agreements with LSI Logic, Intel, and other companies **to assess — in less time, at lower cost, and with higher confidence — the reliability impact of a War Reserve integrated circuit failure** that occurred during assembly at the Kansas City plant. (2200)

The Sandia/ SEMATECH partnership has completed its sixth year with the program growing each year to more than 32 projects in FY95. These projects were multiplexed throughout the laboratories with 262 contributors in 50 organizations. Microelectronics projects included: lithography, packaging and assembly, contamination-free manufacturing research, equipment improvement, factory integration and productivity assessment, materials and bulk process, interconnect, design CAD and test, and strategic technology projects. Close industrial ties were maintained by frequent presentations to the appropriate SEMATECH technical advisory board. (1100, 1200, 1300, 1400, 1800, 2300, 6600, 8300, 8700, 9100, ORNL)

An interdisciplinary Sandia/General Motors research team has developed **improved thermal spray coating technology** to rapidly and economically apply wear-resistant steel coatings to the cylinder bores of lightweight aluminum automobile engines. To achieve the project goals, the team pioneered the use of new process diagnostics, created a greatly improved process-control methodology, and developed the world's first full three-dimensional computer model for a thermal spray process. This advanced technology should also benefit production thermal spray coating of neutron generators at Sandia. (1800, 9100, 8700, 1400)

From October 1994 through September 1995, **Sandia executed 67 cooperative research and development agreements (CRADAs)** with private-sector companies for a total value of $105 million. Through the Small Business Program, 284 technical assistance projects were either completed or begun. Royalties totaled $351,000; 26 new licenses were negotiated. Private-sector access to unique Sandia capabilities was

Advanced manufacturing

We created a novel device for **precision alignment and hermetic sealing of glass** in flat panel displays. The device permits 1 micron/inch accuracy for panels up to 12x12 inches, superior to any existing equipment. Panels are sealed with low temperature glass that is melted by laser radiation or heated vacuum chucks. Finite element modeling enabled us to optimize materials and processes. This work, conducted jointly with a flat panel consortium, was funded by Advanced Research Projects Agency National Center for Information Component Manufacture. (1400, 1800, 2300, 9100)

We have developed **a high density spray forming (HDSF) manufacturing technique** for potential use in the auto industry that significantly lowers the porosity in sheet products compared to conventional spray-formed products. (Porosity of a spray-deposited aluminum alloy was reduced from 3.92 percent to 0.29 percent). HDSF is an alternative to continuous casting for synthesizing and processing specialty materials, especially composites, that may enable production of advanced high stiffness composite aluminum alloys directly into sheet, or the production of very fine grained, homogeneous materials for enhanced forgeability. (8700)

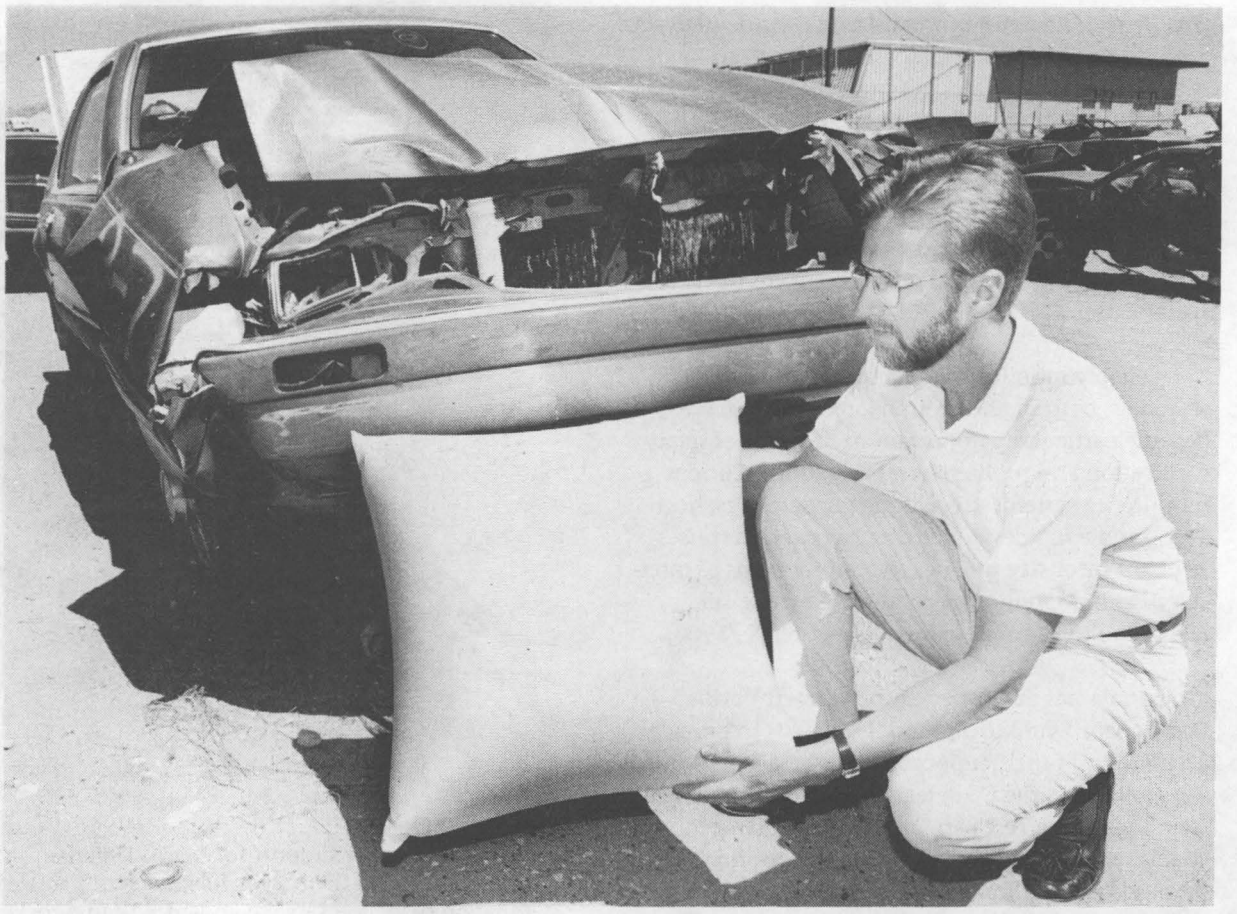
Induction hardening is a manufacturing process broadly used in industry to provide additional strength to specific regions of ferrous parts. It is an environmentally benign, energy-efficient, and flexible in-line manufacturing process that can contribute directly to improved reliability, manufacturing agility, and the development of high-performance, lightweight parts. Control of the process, however, has eluded industry. An **intelligent process control system for induction hardening** was developed under a Sandia/Delphi-General Motors cooperative research and development agreement and moved from concept to production floor in 2.5 years. It is presently used at the Delphi Saginaw plant, controlling the case depth of Saturn intermediate shafts with precision more than a factor of five better than industry standards. This project has received national recognition by the Partnership for a New Generation of Vehicles Program, for having "achieved an important milestone with the first successful commercialization of a technology developed under one of the Partnership's CRADAs." (1800, 2300, 6200, 9100, 9500)

Technology transfer

expanded through the designation of nine additional Labs facilities as user facilities. New technology transfer mechanisms established included Funds-In Technical Assistance, Personnel Exchange, and the Entrepreneurial Leave of Absence. (4200, 8800)

The Portable Integrated Video System (PIVS) is a high bandwidth fiber-optic communications system originally developed for use in nuclear weapons accident recovery. It is an important tool for the Nuclear Weapon Accident Response Group (ARG), and the technology has been shared with Russia for similar applications. In 1995, the PIVS technology became Sandia's first technology transfer collaboration with Native American firms. (5500, 12300)

Teaming with General Motors, Ford, and Chrysler, Sandia is developing **a new automotive catalytic converter** to reduce nitrous oxide (NOx) emissions from lean-burn engines. A viable catalyst will enable the sale of fuel-efficient lean-burn engines that meet Clean Air Act requirements. Sandia has developed a new catalyst formulation and has scaled it up to a full-size automotive converter. In engine dynamometer evaluations at Lockheed Martin Energy Systems/Y12, Sandia's prototype catalytic converter showed a significant reduction in NOx emissions. (6100, 6200, 1400)



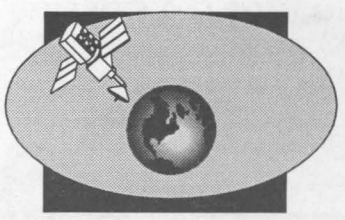
A BETTER AIRBAG — Kenneth Gwinn (1518) shows off the square Sandia/PFG airbag, which is expected to capture a significant share of the automotive airbag market in coming years. (Photo by Randy Montoya)

Sandia is transferring optical diagnostics developed for combustion and welding applications to the US steel industry. During the past year, **successful field trials of the sensors**, including a tunable-diode-laser-based system, a miniaturized thermal-imaging pyrometer, and a novel rangefinder, were completed at Bethlehem Steel. The goal is to implement real-time sensors to track the conversion of iron and carbon into steel, to reduce process time and oxygen consumption, and to improve process efficiency and reliability. Begun in 1993, the Sandia project is managed by the American Iron & Steel Institute and cost shared with DOE's Office of Industrial Technologies. Sandia is partnering with Insitec Co. to commercialize the sensors. (9100)

Sandia and its cooperative research and development agreement partner, Precision Fabrics Group, have **developed a new automotive airbag** whose packed volume is less than 40 percent that of the airbags currently used in cars. Our engineering analysis competency and experimental diagnostics capabilities enabled us to create this revolutionary airbag in only two years. In addition to being smaller, the Sandia/PFG design is also softer (for reduced facial abrasion) and less expensive to manufacture, while it improves occupant protection and minimizes fabric waste. (9100)

A pneumatic seat cushion designed to prevent pressure ulcers in wheelchair-bound people has been developed by Sandia in partnership with the University of New Mexico, Laguna Industries, and Numotech Inc. The project was managed by the Albuquerque office of DOE and sponsored by the Technology Reinvestment Project, with matching funds from the four partners. The seat of a wheelchair features four pairs of air bladders that are cyclically inflated and deflated by battery-powered pistons. This prevents sustained pressure on any one area, which can retard blood flow and oxygen exchange and cause tissue to become ischemic, often leading to serious and potentially life-threatening skin ulcers. (2600, 5000)

Arms control/verification/security systems



In efforts associated with the Nuclear Material Protection, Control, and Accounting Program, we worked in coordination with DOE, the Defense Nuclear Agency, and other national laboratories to provide assistance in the **physical protection of direct-use nuclear material** within the countries of the former Soviet Union. During FY95, we provided assistance in security system assessment, design, and installation at 15 nuclear facilities in Russia, Kazakhstan, Belarus, Latvia, Uzbekhistan, Ukraine, and Lithuania. A showcase system, which integrated US and Russian security equipment, was completed at the Kurchatov Institute. (5300, 5800)

SECURE FACILITY — Russian workers at the Kurchatov Institute in Moscow — a Russian weapons lab — file through an access-control gating system designed with the aid of Sandia security experts.

Recent world affairs have raised US interest in the **safety and security of foreign nuclear weapons**, and DOE has turned to Sandia for insight into the effectiveness of foreign systems designed to provide such protection. The resulting studies have made significant contributions to international stability and our own national security and have reinforced national recognition of Sandia's excellence in the surety and command and control systems of nuclear weapons. (5900)

Wavelet technology, best known for its use in signal and image processing, has been successfully applied to the problem of image fusion, a process in which low-resolution images from a variety of sensor systems are combined to enhance the resolution of all of the component images. **Sandia has developed an image fusion technique** that both outperforms commercially available algorithms and produces data that is readily compressed for efficient transmission. (5900)

During FY95, representatives from the Middle East, South Asia, Northeast Asia, and the Former Soviet Union have participated in **Cooperative Monitoring Center (CMC) workshops, seminars, and visiting scholars programs.** The CMC assists political and technical experts in acquiring the technological tools necessary to implement nonproliferation, arms control, and other security measures. Visitors receive experience with monitoring hardware and software from Sandia, other laboratories, and industry. Supported by DOE and the Arms Control and Disarmament Agency, the CMC works with the State Department, foreign governments, research institutes, and universities. (5300, 5400, 5700, 5800, 6600, 9400)

Sandia has delivered a software package, the **Information Management Environment (IME),**

Arms control/verification/security systems

that provides information and intelligence analysts with easy access to the data and applications required in integrating data from a wide variety of sources. The Iterative Knowledge Base Editor (IKBE) works within IME to provide graphical views of data. Together, these tools greatly enhance analysis capabilities and, since the mix of applications can be adjusted by the systems administrator, the IME is easily customized to the needs of each specific user. (5900)

Reliably monitoring the movement of nuclear materials, both in and around large facilities, has become particularly important in the areas of treaty verification and proliferation evaluation. Current monitoring systems use gamma ray detectors; however, Sandia has developed **an approach that uses neutron intensity profiles** to identify items of interest. This new approach represents a synergistic adjunct to the current gamma ray systems. (5900)

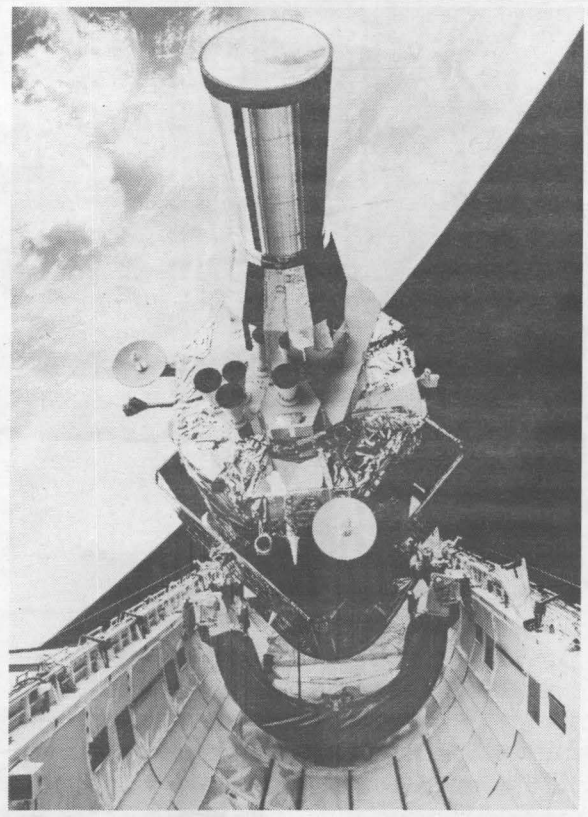
Sandia has developed an **Integrated Verification Sensor Evaluation Model (IVSEM)** to provide accurate and timely support to US interagency working groups and the US delegation negotiating the Comprehensive Test Ban Treaty (CTBT). This model enables a rapid understanding of the performance of proposed international verification networks and of how monitoring effectiveness may be enhanced through station positioning or improved sensor performance. Use of the IVSEM enables the simulation and modeling of some of the CTBT sensor systems for the first time and, as the first model with the capability to perform systems integration of all of the proposed sensor types, the IVSEM is a tremendous advancement in verification assessment. (5400, 5700, 9400)

Using a vapor generator built to Sandia's specifications by Varian, we successfully **produced a known quantity of explosive vapor** for the purpose of testing and calibrating explosive vapor detectors. The calibration was demonstrated for both trinitrotoluene (TNT) and cyclonite (RDX) explosives. This is the first time a vapor generator has been calibrated to a National Institute of Standards and Technology traceable quantity of explosive. (5800)

Sandia has **developed and deployed several prototype automated sensor testing units** that remotely test the operation of sensors located inside buildings. These prototype units have been installed at three DOE facilities for evaluation. This technology will help reduce the cost of security operations, reduce radiation exposure to DOE employees by keeping them out of vaults containing nuclear materials, and reduce the opportunity for the diversion or theft of nuclear materials by minimizing the exposure of such materials to people. (5800)

As a means of mitigating the risk of nuclear material diversion and reducing the human involvement and cost of tracking and accounting for nuclear material, Sandia has deployed the **Personnel and Material Tracking (PAMTRAK)** System at Argonne National Laboratory-West near Idaho Falls, Idaho. This system, designed to track the movements of both personnel and nuclear materials within a facility, employs personnel tags, material movement devices known as WATCH devices, and a Material Monitoring Image Processing System (MMIPS). These components are integrated with a control system that records movements, enforces rules governing such movements, and interfaces with both the security system and the material accounting system. (5800)

Using funding provided by the Defense Nuclear Agency, Sandia developed the **Advanced Exterior Sensor (AES)**, which is an intrusion detection and assessment system for wide-area coverage (360 degrees), quick deployment, low false/nuisance



DETONATION DETECTION — In 1995, Sandia marked 25 years of support for DoD's Defense Support Program with the successful launch of a nuclear detonation detection satellite aboard a Titan 4 rocket. In the photograph above, a similar satellite is deployed during a 1991 shuttle flight.

alarm operation, and immediate visual assessment in any terrain and environmental condition. The AES comprises three modules, including a remote sensor module (RSM) that uses infrared, visible, and millimeterwave radar; a data process module (DPM) that uses an advanced knowledge-based tracking software algorithm; and a display control module that controls up to 16 RSMs and DPMs to provide full monitoring capability. The AES is characterized by simple, reliable operation at a low cost. (5800)

Sandia supported the successful launch and operational initiation of the **nuclear detonation detection payload** for a Defense Support Program (DSP) satellite. These payload sensors and processor systems provide treaty monitoring data for our DOE and DoD customers. Sandia has now supported the DSP for 25 years, with 17 successful launches. (5700)

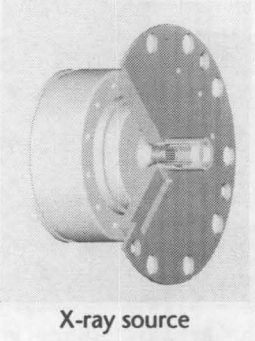
Sandia has entered into a partnership with Citibank to utilize our unique background in security systems engineering, card-based entry control design, and biometric system evaluation to **improve credit card security** and over-the-phone customer identity verification. Thus far, we have completed a card transaction vulnerability analysis study and the initial development of several card security enhancements, including a more secure magnetic stripe and a card authentication scheme. Identity verification work continues, focusing on the evaluation of the over-the-phone performance of several commercial voice verification systems. (5800)

In the area of Cooperative Measures Program with the former Soviet Union (FSU), approximately **350 Sandians interacted with scientific institutes of the FSU**, and relations continue to mature as we see a continuing shift toward greater openness and cooperation. A series of international workshops have been held on topics ranging from security to fuel cells. More than 200 contracts have been placed with 65 FSU institutes for work ranging from basic science to the investigation of accident environments; a security system has been installed at the Kurchatov Institute; we have secured a Moscow support contractor; and we are providing staff support to the US embassy in Moscow. (5300)

A US/Russian Cooperative Remote Experiment for **bilateral monitoring of direct-use nuclear material** is being conducted with the Kurchatov Institute (KI) and Argonne-West and was demonstrated to Secretary of Energy Hazel O'Leary, KI Vice President Ponomarev-Stepnoi, Ambassador Vorontsov of Russia, and representatives of the national news media. We supported the secretary in a demonstration of the remote monitoring system concept, including a satellite link to a demonstration system using excess fissile material at Oak Ridge to the International Atomic Energy Agency (IAEA) and Director General Blix at the IAEA General Conference. (5300, 5700, 9400)

In support of CALIOPE (Chemical Analysis by Laser Interrogation Of Proliferation Effluents), which is a broadly matrixed five-laboratory program in UV laser remote sensing, Sandia successfully **demonstrated multispectral fluorescence and absorption-based methods** at significant standoff distances at the Nevada Test Site in July 1995. Sandia's contributions to this program are focused on the detection and characterization of solid, liquid, and gaseous effluents through the use of lidar (light detection and ranging) technology coupled with intelligent analysis tools that enable near realtime identification of complex chemical mixtures. (1100, 2200, 5700, 8100, 9300, 9400, 9500)

Pulsed power & testing



X-ray source

In collaboration with colleagues at Los Alamos and Lawrence Livermore national laboratories and the Atomic Weapons Establishment in the UK, **we have developed an intense (20 trillion-watt) X-ray source** that will be used to study the physics of radiation flow in weapons. We create this X-ray source from a magnetic implosion of a tungsten plasma on the Saturn accelerator. The long time-scale and large spatial scale of this X-ray source cannot be produced with any other above-ground simulation facility presently in existence. (9300, 9500)

Sandia has **developed a training simulator** enabling testing specialists to maintain proficiency on optical tracking systems at Tonopah Test Range during a time of limited testing. This system integrates virtual reality visualization technology with the physical tracker hardware to create a realistic training experience. The tracking simulator allows the user to pre-program test sequences, from B-1-delivered gravity bombs to a cruise missile flight test, and to experience a wide range of test conditions. The tracking simulator helps ensure that critical test capabilities are maintained for the weapons program. (8100, 8200, 9700)

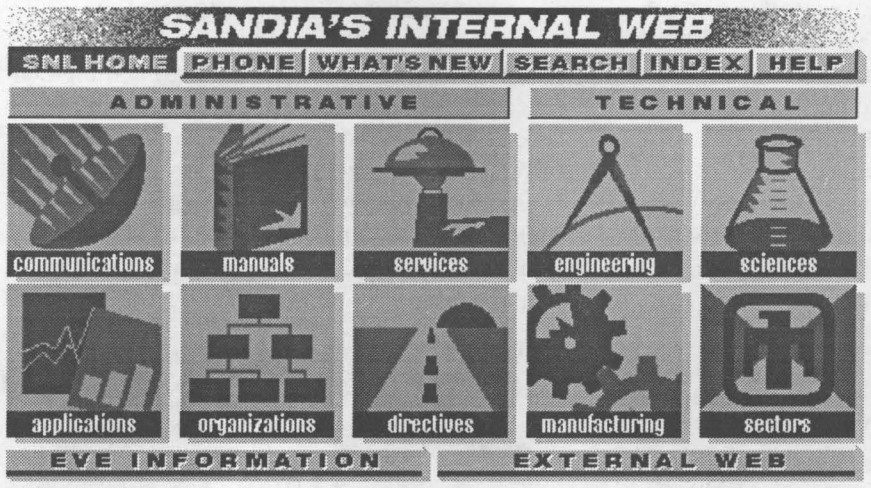
We **demonstrated that a Photoconductive Semiconductor Switch (PCSS)** delivers more peak power with extremely fast switching in a smaller volume than any other switch technology used in advanced firing sets. PCSS is optically triggered and is fabricated with highly reliable semiconductor processing. This year we reduced the size by a factor of 1000, increased off-resistance by a factor of 100, and demonstrated use in firing system applications (>3 kV and >3 kA). (9300, 1300, 2600, 2500, 2100, 1400, and 1500)

Laboratories support

The Enterprise-information Viewing Environment (EVE) project is **implementing a multimedia, hypertext-based productivity tool (Sandia's Internal Web) based on Internet technologies.** This project has provided Sandians the capability to view information, ranging from financial reports to "Hot News," with point-and-click convenience. The Internal Web has been adopted by Sandia's Chief Information Officer and endorsed by Sandia's top management as the medium for electronic viewing of widely distributed, lab-related information. (4600)

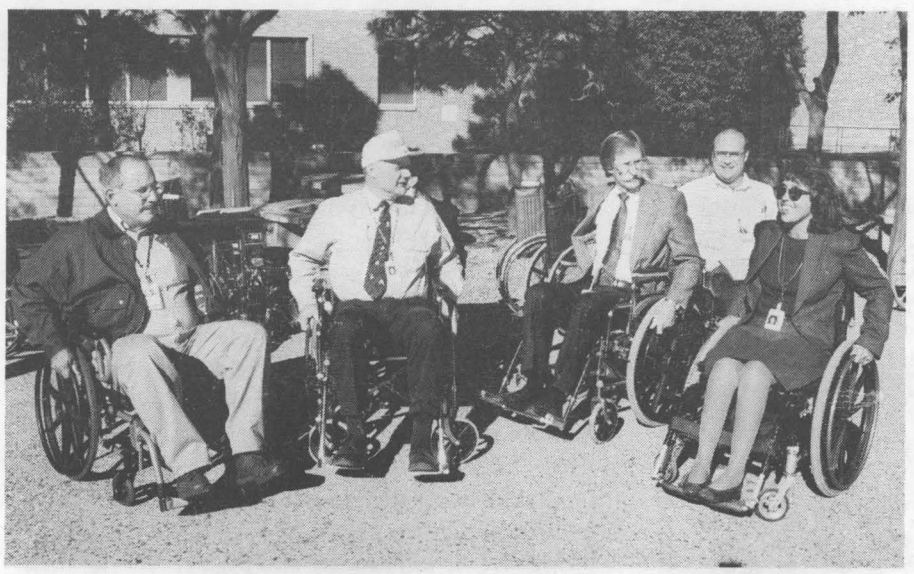
The **Web Interface Template System (WITS)** is a tool developed to define software applications that have a Web browser as the user interface and access a Sybase database. Development, modification, and implementation are greatly simplified because you can define applications without writing a program. WITS has been used to create five Web applications, with two more in process. SAND Report 95-2409 explains WITS functionality and how to obtain, install, and use the software system and will be available on Sandia's Internal Web. (4800)

Benefits Dept. 3343 accomplished the goal of reducing the escalation of health care costs for Sandia and DOE while designing plans that would meet employees' needs by introducing the **Triple Option Plan (TOP).** The plan allows Sandians to use options that will reduce their personal, as well as Sandia's, costs. The new plan was implemented Jan. 1, 1996. (3300)



WELCOME HOME — Sandia's Internal Web home page became a familiar site for thousands of Labs employees during the past year, providing a user-friendly front-end to a vast information system.

The IDEAS for Improvement program solicits suggestions for improving processes and the way work is done at Sandia. The program taps into the good ideas people have for improving Sandia. Suggestions implemented in FY95 affected all areas of Sandia but were mainly focused on improving processes in human resources, financial procedures, and environmental safety and health. Metrics are kept on suggestions and are used to improve the IDEAS process. (4000)



DISABILITY AWARENESS — Sandians under the guidance of Debbie Faculjak (2615) spend a day experiencing the workplace environment from a wheelchair as part of a Labs-wide emphasis on heightening awareness of diversity issues.
(Photo by Randy Montoya)

More than 100 Diversity Champions played a pivotal role in **heightening the awareness of 100 Sandia leaders on a broad spectrum of diversity issues** at Sandia's second annual Human Resources Conference in March 1995. Champions were partnered with Sandia VPs and directors to increase their awareness of diversity issues prior to and during the conference. An on-site childcare center at Sandia was among conference discussion topics. (3600)

The Department of Labor's Office of Federal Contract Compliance Programs **audit of Sandia's Affirmative Action program and human resources programs** and policies was completed on July 13, 1995, and produced no systemic findings. Sandia's preparation, policies, programs, and good-faith efforts combined to demonstrate the Labs' strong commitment to Equal Employment Opportunity and Affirmative Action. Employee teams from throughout the Labs reviewed processes, identified problem areas, and made recommendations for improvement in preparation for the audit. (3600)

Human Resources and Procurement are **redesigning the process used to acquire the services** of on-site contractor workers who support Sandia programs. This project designates the Staffing Department as the point of contact to obtain such service. Procurement will award performance-based, long-term contracts with local companies that support the staffing organization. Once implemented, future cost savings of $20 million annually are expected. (3500)

The Human Resources (HR) reengineering effort was launched with **a "Red Team" review that measured Sandia's HR practices** against commercial industry norms. The Red Team report emphasized a need to bring HR closer to the customer. An immediate response to the recommendation to place HR generalists in the line organization resulted in a collaborative pilot project among divisions 2000, 6000, and 14000 and HR Division 3000. Two HR "Customer Service Managers" (CSMs), seasoned HR professionals, were assigned to reside with a line division to assist with strategic human resources issues. The pilot was declared a success ahead of schedule based on positive customer input, and the program has been expanded, with two additional CSMs serving divisions 4000, 5000, 7000, and 10000 for FY96. (3000)

The Human Resources staffing function has been reengineered to be responsive to changing business requirements. The new process **reduces cycle time to hire by 50 percent,** provides "one-stop" interaction with HR for the hiring manager, and has resulted in a reduction of 10 out of 22 people to support the hiring function. The new process is a shift to requisition-based staffing and uses a new technology, Resumix Employment Expressway (REX), to match candidates against predefined skills needs. (3000, 3500, 3600, 8500, 10600)

As part of DOE Secretary Hazel O'Leary's quality initiative, the first-ever DOE Energy Quality Award was initiated in FY95. Sandia completed this self-assessment process based on the Malcolm Baldrige National Quality Award criteria. This application received the **Energy Quality Accomplishment Award.** The primary product, the application feedback report, is being used by a cross-functional team to identify potential strategic improvements. (4000, 4500, 6000, 12900)

Sandia Quality Leadership Council meetings have been significantly improved over the last two years using **systematic quality processes.** Some of the improvements include: achieving clarity in decision-making; increased teamwork among the members; use of outcomes-based agendas; and becoming more strategically focused. Evaluations of all agenda items and the overall meeting are completed by all members at the conclusion of each meeting. The data from the evaluations are used for continuously improving future meetings. (4000, 12100)

Sandia is involved in the **Strengthening Quality in Schools (SQS) project,** which helps schools improve through use of Malcolm Baldrige criteria and modern quality principles. Nineteen schools achieved positive Phase II results. Some examples are: 25 percent reduction in failures, 50 percent increase in reading comprehension, 90 percent decrease in tardies. SQS is expanding to 90 schools, 11 community colleges, five universities, businesses, and the state Department of Education. (4000, 12900)

Sandia kicked off its reengineering program in April 1994 with a goal of reducing administrative costs by $130 million between FY95 and FY98. **Reengineering teams developed process and cost-savings methodologies** and managed integration with other process teams. Services provided to process owners ranged from total project management to facilitation and training. During FY95, the reengineering program engaged four corporate administrative services areas in more than 25 reengineering and process-improvement projects, netting total Labs savings of $25 million, with a projected cumulative net savings FY96 to FY98 of $130 million. (3000, 4010, 4020, 7000,10000)

The Safeguards & Security Center **reduced annual costs ($175,000) of Preliminary Employment Investigations (PEIs)** by 60 percent in FY95. The PEI process improvements were achieved through computer access to law enforcement and credit data bases. Both the Albuquerque Operations Office and the Pantex Plant are considering implementing this process at their facilities. Sandia/California began using it early this year. (7400)

On May 17, 1995, Sandia/New Mexico conducted exercise **"Rubble Glow,"** the largest, most comprehensive full-participation emergency management exercise ever held at the Labs' New Mexico facilities. Exercise planning required six months of coordination, integration, and liaison with internal and external response organizations. The teamwork developed among the many participating organizations will help us be effective in future emergencies. (3300, 7300, 7400, 7500, 7700, 7800, 7900, 12600)

From February to June, 1995, several Sandians from Division 7000 were involved in the response to **the DoD Base Realignment and Closure**

Laboratories support

(BRAC) recommendation to realign Kirtland AFB. A number of Sandians supported the Mayor's Task Force and congressional leaders by leading an interdepartmental team to assess and present the true dollar and FTE costs of the Air Force's proposal. The Task Force was instrumental in overturning BRAC's original recommendation on Kirtland, saving approximately $30 million in annual costs to Sandia and DOE, and helping avert a $500 million annual economic loss to Albuquerque. (7200, 7300, 7400, 7800, 7900)

A major cost avoidance was accomplished in the Packaging and Transportation Program by the installation of the **Automatic Traffic Management System** to audit freight bills. The new system has reduced billing discrepancies by $300,000. (7600)

The Facilities Development Center **completed three major buildings** adding 290,500 square feet of new space to Sandia. Two old, substandard buildings were decontaminated and demolished. Three others underwent sampling to determine decontamination requirements prior to demolition. A new emphasis was made to support customer-funded work, including relocation of personnel from one office to another, modifications of space, and recabling of several buildings to improve communication capabilities. (7900)

Sandia's Motor Pool Department negotiated with DOE and KAFB to supply **fuel service to Sandia/New Mexico**. This joint effort will allow Sandia to eliminate underground fuel storage and avoid the $500,000 cost of replacing the current fuel system in 1998. (7600)

Based on feedback from customer satisfaction surveys, the Custodial Services Department **implemented night team cleaning crews**. These teams clean 37 percent more areas, resulting in an annual cost saving to Sandia of $147,457. (7600)

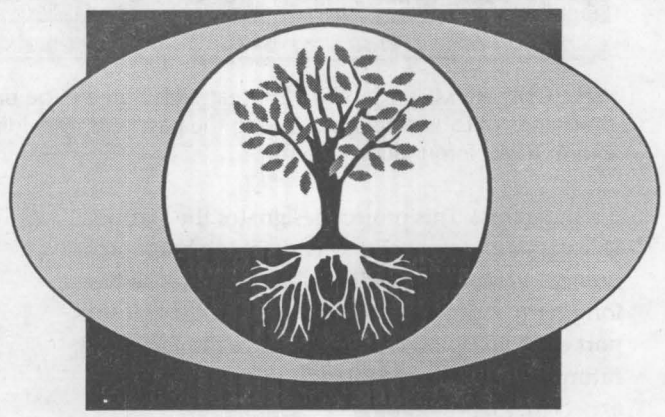
Volume licensing and network-based software distribution of Microsoft Office, Apple System 7.5, and Netscape software were implemented at the Labs. Software products are selected from a menu displayed on a user's computer and installed directly from the network. Just-in-Time Purchasing worked closely with the California site to negotiate low software prices and to help automate processes that relieve staff of individually ordering software upgrades. Also, Sandia took advantage of Lockheed Martin licensing programs for Netscape and Apple System 7.5. The estimated cost savings of these licensing agreements is $180,000 over a two-year period. (8900, 10200)

The Work for Others Sector **streamlined the processes needed to prepare a WFO proposal.** Changes to DOE Order 4300.2C now allow delegation of responsibility for many items to Sandia, and this has significantly reduced the complexity of the required forms. In addition, the WFO Sector was the first organization to publish its manuals on the Sandia Internal Web. These improvements resulted in reduced workload at Sandia and DOE's Albuquerque Operations Office. (9800)

During the past year the Procurement Center **implemented a new professional services process** to obtain such services when needed for less than 18 days. The process reduced procurement cycle time from an average of 66 days to fewer than four days within two months after its implementation. In addition, the approvals were lowered to allow for department manager, rather than director, approval. Suppliers now can provide a verbal quotation and have to deal with just 29 pages of information rather than the 117 in the old process. (10200, 15100, DOE/KAO, DOE/AL)

Chief Financial Officer (CFO) organizations **expanded co-location activities in FY95.** The Financial Management and Resource Planning Center co-located 35 percent of its staff with line organizations and the Procurement Center placed several buyers with line organizations. Line organizations responded favorably to the co-location efforts, as indicated by the number of co-located employees nominated for Employee Recognition Awards by line organizations. (10200, 10400)

Laboratories Support



The CFO partnered with Defense Programs, Energy and Environment, Work for Others, Laboratory-Directed Research and Development, and Indirect management areas to **significantly improve Sandia's internal budget process** based on feedback from project/department managers and budget coordinators. (10400, 2100, 2600, 3500, 4500, 5100, 6900, 9900, 12100)

Sandia's approach to copier service was changed to achieve a cost savings of $500,000 per year by implementing **the "cost-per-copy" program.** The savings is realized by optimally locating and sizing efficient, reliable copiers. This reduces the total number of corporate copiers purchased or leased and reduces maintenance costs. (7600)

BY THE COPY — Sandians get an overview of the operation of a new copy machine brought in as part of the Labs' cost-per-copy program.

The Controller's organization **successfully reengineered Accounts Payable** during FY95. A team was established to resolve payment of old invoices, in addition to segregating work for efficiency. As a result of the project, past-due invoices were reduced by almost 90 percent, resulting in a 95-percent reduction of monthly overtime by the Accounts Payable Department. (10500)

The Ethics director and the Ombuds office implemented **an integrated program in dispute resolution and ethics.** In 3 $^1/_2$ years, Ombuds have handled more than 400 conflict and dispute cases per year using diplomacy and mediation. The Ethics director has instituted all the discovery and training requirements of the Defense Industry Initiative. Services expanded to include support to training in decision making and dispute resolution. The program has been recommended as a best business practice for all Lockheed Martin sites. (11)

In August, Media Relations Dept. 12621 designed and hosted a special **Joint Information Center training course** for DOE's Albuquerque Operations Office. Approximately 50 people representing national labs, DOE, and public and community relations practitioners from local hospitals and law enforcement agencies attended this three-day course, which provided instruction on how to manage a public relations response in a crisis. (7300, 12600)

Sandia held its first **Washington, D.C.-based press conference** to announce the joint development with Precision Fabrics Group of a revolutionary automotive airbag. It resulted in significant national media coverage — including CNN, CBS, PBS, Discovery, AP, and Reuter — which reached an estimated 69 million people. The publicity relied heavily on video produced by the Visual Communications Department. (1500, 4000, 12600)

The Laboratory Communications Service Center developed **a corporate overview presentation on compact disk** using advanced interactive multimedia technology. It communicates a consistent and compelling Sandia corporate image to external audiences. Content was digitally integrated into a multipath presentation comprising more than 40 subject areas. Three-dimensional graphics were created for the user interface, which applied human factors principles. (12600)

The Recorded Information Management Department developed an **updated history video and several history displays** during FY95. The Records Inventory Project team developed and delivered the administrative portion of the records retention and disposition schedule to DOE Headquarters for review. The team has provided technical and adminstrative assistance to Lawrence Livermore and Los Alamos national laboratories and the National Energy Petroleum Reserve Office in Oklahoma. (15100)

The Contracts Center **completed an inventory of Sandia records,** established an Administrative Records Retention Schedule, updated the Organizational Conflicts of Interest process, established a DOE Orders baseline, conducted a DOE/Sandia Lab Appraisal, originated/revised/canceled 180 Sandia policies and instructions, improved the Tiger Team Corrective Action Process, and began redevelopment of the Sandia Issues Management System, a centralized appraisal tracking system. (15100)

On April 25, 1995, DOE closed out Sandia's successful participation in a **Human Radiation Experimentation Project,** which had begun under the auspices of the Secretary of Energy in January 1994. At the close-out in April 1995, Sandia was singled out for its thorough and complete search and excellent documentation of laboratory work on this project. The DOE reviewers concluded that the Sandia work "... is a model of excellence for others engaged in similar activities."

Sandia's Patent and Licensing Center 11500 received **261 invention disclosures in FY95.** Sandia's patent professionals were responsible for preparing and filing 82 patent applications. Forty-one patents resulted from Sandia R&D issued in FY95. In addition, the Patent and Licensing Center brought its Sandia Internal Web home page up, thereby making all patent-related information and forms available electronically Sandia-wide. In addition, it provides a wide range of links to various external sources relating to intellectual property issues. (11500)

$37 million Facilities project recharges Sandia's aging electric power systems

Project to replace 30-to-50-year-old equipment scheduled for 1998 completion

Sandia's Power Systems Modernization (PSM) construction project, now well under way, is a massive overhaul of the electrical power distribution system. About 30 percent complete, it promises improved safety and efficiency, as well as reliable performance and ease of maintenance.

Built over decades, the old power distribution system, which fed about 545 major and 400 minor buildings, has been unable to keep pace with Sandia's existing and future power needs. Much of the equipment is 30 to 50 years old and at the end of its useful life. DOE audits and Tiger Team findings reinforced the need for a primary power distribution system upgrade at Sandia.

REWIRING THE LABS — J & S Electric employees Leonard Gragg (left) and Ben Cordova work on terminating high-voltage cable. Their work is part of Sandia's $37 million Power Systems Modernization project.

Power Systems Modernization project

In 1994, DOE authorized the $37 million PSM project. "Most buildings will be served by the new power service," reports PSM project manager Brad Wisler of Corporate Construction Program Office Dept. 7903. Coordinated by Facilities Development Center 7900, the new system has been under construction for more than a year and is scheduled for completion in January 1998.

The PSM project upgrades the existing primary distribution system and provides additional backup and alternate feed sources to reduce the extent and duration of power outages affecting connected buildings. According to Stan Harrison, Manager of Site Utilities Engineering Dept. 7909, the new system is designed to operate with the loss of any primary-system component, such as a substation transformer or primary high-voltage cable. It will also comply with modern code requirements to reduce electrical hazards.

John Rathbun of Operations Engineering Dept. 7816 points out that electrical codes have changed considerably during the past few decades, improving worker and equipment safety. Systems built before the code changes are not required to follow present codes, and older systems have inherent problems that newer systems built in compliance with the codes do not have. For example, to isolate even a small section of the system for repair or maintenance required large parts of the system to be de-energized. "To do this sufficiently," John says, "we had to have outages that were unacceptable to our customers."

Equipment was sometimes damaged by faults that occurred in the electrical system. Faults, John explains, are disturbances — such as a tool dropped in a panel — that disrupt energy flow through the electrical system.

Pigpens and transclosures

Stan says a major thrust of the PSM project is to eliminate transformer "pigpens" and transclosures. Pigpens are substations that use transformers that were intended for overhead mounting on poles, but were instead mounted at ground level using perimeter fencing to prevent unauthorized access to exposed, energized parts. Electric codes state that access to exposed live parts requires two separate, conscious acts; however, only one conscious act — opening the fence gate — is required to access pigpen transformers.

Transclosures are substations that likewise use transformers intended for overhead mounting, but in this case they are covered by metal enclosures to prevent access. They are not designed to contain the arc blast that can result from fuses blown from internal faults, however, and this can be a serious problem. John says an internal fault can happen when a transformer's internal windings overheat, causing the transformer to break down. He says the arc can be extremely large, and massive amounts of energy flow through these arcs and can melt huge panels or cause explosions.

Replacement of pigpens and transclosures by pad-mounted transformers will correct such problems. The new steel-encased transformers are safer, more robust, and more capable of handling internal failures typical of electrical systems. Pad-mounted transformers are designed for applications at ground level, sitting on a pad of concrete or other suitable material. Transformers are currently being replaced throughout Tech Areas 1, 2, and 4.

Other PSM projects

A major part of the PSM project converts the primary system in Tech Area 1 from the existing 2.4 kilovolt (kV) ungrounded system into a 12.47 kV grounded, primary system. The existing 2.4 kV system is more suited to a single-building manufacturing facility than to a large laboratory complex. A loop configuration will be incorporated into the new system, making it more reliable and flexible. The configuration will also allow maintenance and construction workers to access the system during normal working hours without extensive power outages to user facilities.

The current single source of power feeding the loop is another problem, says Stan. A disruption in that single source from Public Service Company of New Mexico (PNM) would mean a total loss of 115 kV utility power to Sandia. A second source of power from PNM is needed to make a truly redundant transmission system. This will be the final undertaking of the PSM project. Construction on the second line and associated breaker station is scheduled to begin late this summer.

Another PSM project will install a second 115 kV transmission line to connect with an existing 115 kV line, forming a complete loop. At present, only one 115 kV line and four 46 kV lines come into Sandia from PNM. The loop will make the system more reliable and ensure that maintenance work or a failure in any single segment won't cause extensive power interruptions. The new 115 kV line will be routed along Ninth Street, and new power lines and poles will be installed this summer.

"We're on schedule, within budget, and meeting technical objectives as described in the original plan," Brad Wisler says, "thanks to the successful combined efforts of all the Power Systems Modernization project team members." When the project is complete, he says, Sandians won't see many obvious physical differences, but Sandia will have a safer, more reliable, and maintainable power system with the capacity to meet future needs.

Town Meeting series opens with VP Dan Hartley on Sandia's future

Dan Hartley, VP of Laboratory Development Div. 4000, will be the first speaker in the recently revived Management Town Meeting series on Tuesday, Feb. 27, when he addresses employees about the future of Sandia.

Dan will spend the first 20 minutes of the hour-long meeting discussing "Seeing Our Future — And Getting Us There!" His choice of topics reflects senior management's focus on anticipating the changes of the millenium so that the upcoming Strategic Plan can be more visionary.

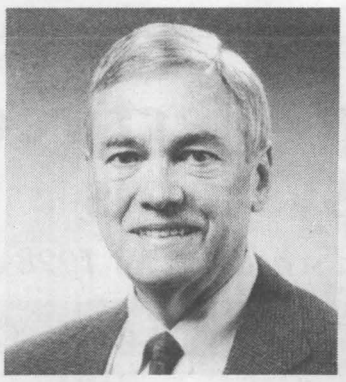
During the final 40 minutes, Dan will respond to questions from the audience. He is not restricting questions and comments to the "Sandia 20 years from now" theme; he says he'll try to deal with any current Sandia issues the audience is concerned about, but he encourages attendees to focus on the long term.

The meeting is scheduled for 10:30 to 11:30 a.m. MST at the Technology Transfer Center (Bldg. 825) at Sandia/New Mexico; it will be video-linked to the CRF auditorium at Sandia/California.

The series is sponsored by Public Relations and Communications Center 12600.

Mileposts

February 1996



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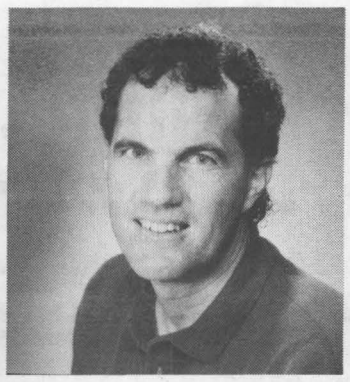

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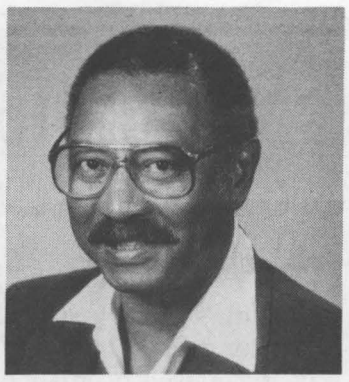

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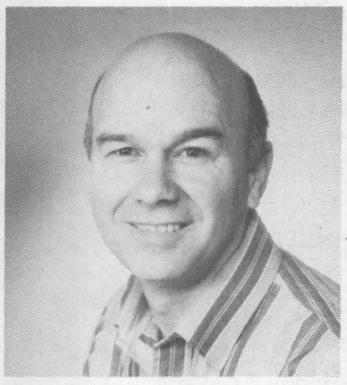

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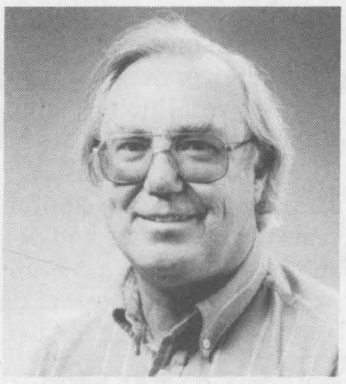

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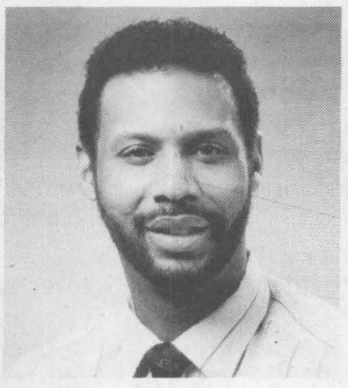

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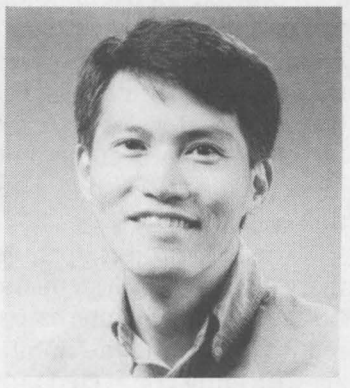

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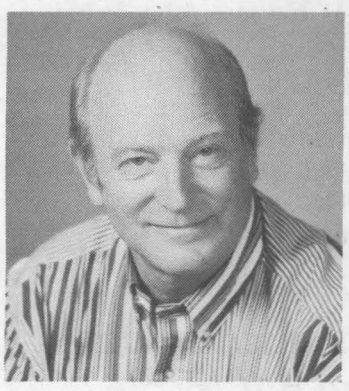

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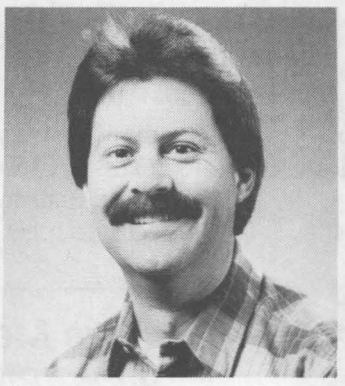

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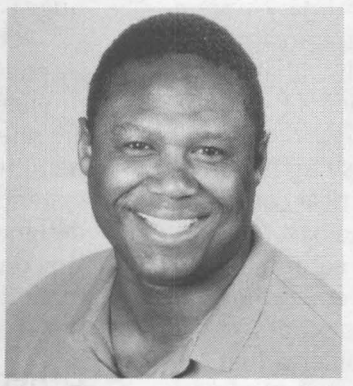

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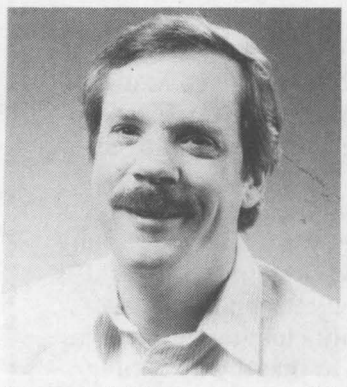

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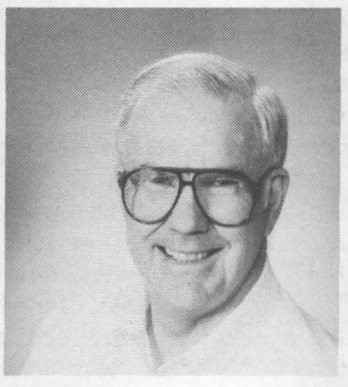

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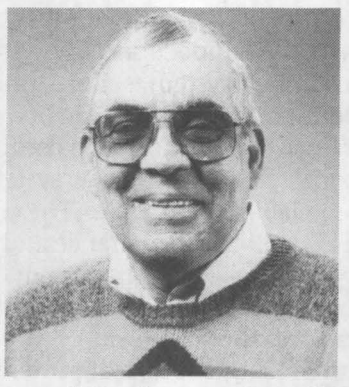

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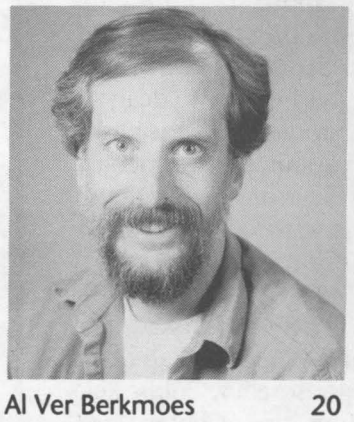

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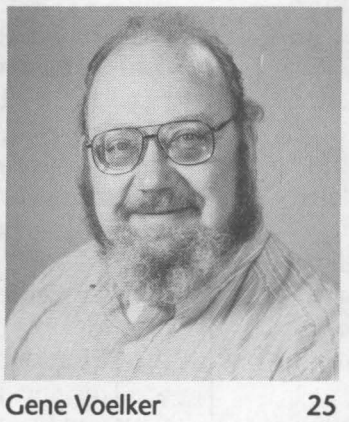

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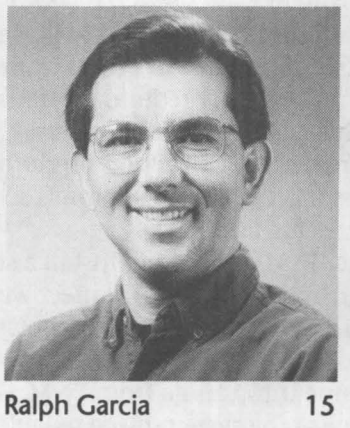


Ralph Garcia 15
7432

Sandia Classified Ads

Sandia Classified Ads Sandia Classified Ads Sandia Classified Ads

MISCELLANEOUS

BABY ITEMS: crib, port-a-crib, stroller, high chair, backpack carrier, Snuggli, bike seat, tricycle, more. Davies, 298-8928.

GARMENT BAG, Eddie Bauer, new, $75; girl's bicycle, banana seat, Columbia, blue, 21-in., $25. Simon, 299-8468.

GUMBALL MACHINE, giant, $600 OBO; snowcone ice crusher, $75; boat w/trailer & motor, $700. Shock, 877-3728.

FRAM AIR FILTERS, Model CA2740; fit Honda/Mazda cars & Ford/Mazda trucks, $4 ea. or 2/$7.50. Schkade, 292-5126.

QUEEN-SIZE WATERBED, mattress & heater, $25. Daniels, 299-0136.

NAVAJO CONCHO BELT, sterling silver, signed by artist, 7 conchos, $1,200; Navajo sampler concho belt, Floyd Beceuti, $1,800. Duncan, 281-8792.

QUILTS, handmade, pastel colors, 6-point star or appliqued flowers, excellent condition, $200 ea. Smith, 243-0714.

MOTORIZED TREADMILL, heavy duty, great condition, $125; stationary bike, $45; full-size metal desk, $40. Ahr, 883-0459.

POKER TABLE, w/solid wood top, $50; table lamp, $5; Tappan microwave, $100. Creel, 839-7335.

WOMAN'S CLOTHING, designer & name brand, Ferragamo shoes, excellent condition. Jordan, 299-4004.

BURIAL PLOTS, Sunset & Sandia Memorial Gardens, can be used for 2 people, bargain prices. Babcock, 299-3121.

SIERRA COMPUTER GAMES. $15: Kings Quest VI, Hand of Fate. $10: Camelot, Quest for Glory II, Iceman. Hsia, 293-9349.

ANTIQUE JUKEBOXES, '46 Rockola 1422, $6,500; '52 AMI D-40, $800; '55 Wurlitzer 1800, $800. Sena, 873-1665.

BICYCLE TRAINER EXERCISER (attaches to bike front fork, uses back wheel to turn resistance cages), paid $70, asking $40 OBO. Baldo-Pulaski, 345-0432.

MATTRESS/BOX SPRING SET, Sealy, queen, firm, 1 yr. old, paid $1,000 new, perfect condition, asking $400. Nicholas, 293-9027.

DINING SET, glass table, w/4 chairs, $100; couch, dark blue, excellent condition, $150. Sanchez, 898-2332.

STETSON, mist gray, 6-7/8, paid $140, asking $70; 30 piano rolls, $150; huge china cabinet/TV center, dark wood, $1,200. Coe, 266-6579.

CHILDREN'S PLAYHOUSE, well constructed & large enough to walk in, $250 OBO. Chavez, 842-6374.

TREADMILL, $150; Epson dot-matrix printer, $50; ATI Wonder VGA card, $35; joystick, $5. Hilts, 275-1758.

DIVE COMPUTER, Aladin Pro model, altitude compensating to 13,000 ft., excellent condition, $600 new, asking $225. Babcock, 892-7199.

MUD & SNOW TIRES, 4 Michelin LT235/85R16, load range E, near new, mounted on 8-lug wheels, $200. Wright, 856-6923.

SUPER NINTENDO, 2 controllers, 9 games, excellent condition, paid over $450, asking $300. Anderson, 897-2772.

AAPG BULLETINS, 9/83-2/85, 4/85-8/86; *Economic Geology*, 8/75, 12/75, 6-7/77, 12/77, 5/78, 9-10/78; free, but must take all. Szklarz, 292-3995.

VGA MONITOR, $50; double waterbed frame, pads, pedestal drawers $50; good cabin stove, $20; coffee & end tables, $25. Hoyt, 266-0110.

HEATED SKI BOOTS, Caber CRH75, rear-entry, man's size 10-1/2 to 11, excellent condition, $80. Eldred, 237-2223.

NORDICTRACK WALK-FIT TREADMILL, like new, $400; Airdyne exercise bike, $35; VCR cabinet, $25; corner TV cabinet, $35. Courtney, 864-3184.

TWO CEILING FANS: 1 black w/ lights; 1 Southwest design w/ lights; both good shape, $50 ea. Kovacic, 256-9867.

LAPTOP, Toshiba T1910, 486-33, 4MB RAM, 120MB disk, 14.4 fax/modem, mono display, DOS/Windows, ClarisWorks, WinFAX, $850. Echeverria, 293-6198.

TWO DESKS, w/hutches, excellent condition, white laminate, $50 ea.; white dresser, 5 drawers, 43.5H x 30W x 16D, $30. Meeks, 828-9825.

ISOLATION TRANSFORMER, BK Model 110, 90V to 140V, 350VA continuous, $50. Henry, 266-6467.

FITNESS SYSTEM, DP Ultra GympacTM; adjustable bench, pulley weight system, $225 OBO. McConnell, 271-2011.

WASHER, Frigidaire, '70s model, white, needs minor welding repair, $40. Brock, 296-7307, leave message.

BABY ITEMS: bassinet, $110; infant swing, $40; car seat/carrier, $40; high chair, $40; gate, $20. Fredrich, 296-0858.

SUPER NINTENDO, (punchout) arcade style, $150 OBO. Ortega, 323-7244, after 5 p.m.

SOFA, earth tones, $75; papasan couch, $75; 5-drawer dresser, $45; student desk & chair, $35. Fleming, 831-0903.

LOFT BED, black-tube construction, w/built-in shelves & desktop, complete w/mattress, hardly used, $200. Russell, 294-0229.

COMPUTER, 386-SX, w/desk, DOS 6.0, Windows 3.1, Excel, Word, math coprocessor, more, $600 OBO; wood desk, 30 x 60, $60. Lewin, 898-2303.

LUMBER, rough-cut oak & poplar, 2 x 6 x 8. Devejian, 895-9420.

HP COLOR SCANNER, Model HPIIc, PC & workstation, without software $495, w/software $595. Senglaub, 296-7476.

BABY ITEMS: stroller, $35; swing, $35; toddler bed, $65; bike seat, gates, booster seats, more, great condition. Mendez, 242-1277.

EXERCISE BIKE, DP Trimfit Airdyne, w/electronic module, $50. Flores, 296-7919.

CARPET & PAD, new, $200; oak dresser, w/mirror, $500; office chair, $25; must-go items/moving. Banks, 291-1794.

SANDIA MEMORY GARDENS, Garden of Mercy, 2 plots, 2 vaults, bronze double marker, $2,500 OBO. Haycraft, 299-3220.

WOOD-BURNING CAST-IRON STOVE, chimney kit, tools & screen, no fan, $235. Randolph, 299-2057.

DOME TENT, large, make offer; Ruger 10/22 carbine, 25 yrs., perfect; solar pump. Beck, 294-4591.

PAPASAN, $50; gray government-style desk, $50 OBO; antique chest, 3-drawers, 30-in. high, $100. Bonzon, 828-1066.

STANDARD SCREEN DOOR, 32 in., w/frame & plunger, $25; assorted display cases, $15 and up. Peterson, 256-7514.

DOORS: combination storm/screen, self-storing glass, 1 ea., black, 36 in., $45; 1 ea. white, 32 in., $30. Luikens, 881-1382.

WOOD STOVE, Orley fireplace insert, model 243, good condition, $350 OBO. Puissant, 821-2447.

BABY ITEMS: Century car seat, $20; girl's clothes, to 4T. Sullivan, 298-4880.

WEIGHTS, bars, Weider bench, Marcey sit-up bench, 27 oz. TPS bat, Rawlings glove, bags, balls. Gunckel, 831-6719.

MICROWAVE, small Emerson, used few times, $75. Woodward, 293-4369.

ATI VIDEO CARD, Mach32 w/2MB DRAM, 16 million colors, w/drivers & manual, ISA, $100. Marshall, 293-3207.

OAK CHINA BUFFET, lighted, new condition, 2 etched-glass doors/shelves, 1 drawer, plenty of storage, $550. Cocco, 856-1580.

BABY ITEMS: swing, $25; toddler carseat, $15; infant carseat, $15; Johnny-Jump-Up, $8. Sjaardema, 299-8042.

WEIDER STAIRSTEPPER, adjustable resistance, independent action, multi-function electronics, $100 OBO. Sisneros, 292-1854.

GIRL'S WOODEN DRESSER, white, 6 drawers, w/mirror & 4-drawer chest, $300/set OBO. Farris, 243-3268.

TWIN BED, w/mattress & matching dresser, maple finish, $65. Zarrella, 831-1981.

WASHER AND DRYER, Kenmore, white, dryer in excellent working condition, washer needs some work, $150 OBO. Howard, 839-9203.

DEADLINE: Friday noon before week of publication unless changed by holiday. MAIL to Dept. 12622, MS 0413, or FAX to 844-0645. You may also send ads by e-mail to Nancy Campanozzi (nrcampa@sandia.gov). Questions? Call Nancy on 844-7522.

Due to space constraints, ads will be printed on a first-come, first-served basis.

Ad rules

1. Limit 18 words, including last name and home phone (We will edit longer ads).
2. Include organization and full name with the ad submission.
3. No phone-ins.
4. Use 8½-by 11-inch paper.
5. Type or print ad; use accepted abbreviations.
6. One ad per issue.
7. We will not run the same ad more than twice.
8. No "for rent" ads except for employees on temporary assignment.
9. No commercial ads.
10. For active and retired Sandians and DOE employees.
11. Housing listed for sale is available without regard to race, creed, color, or national origin.
12. "Work Wanted" ads limited to student-aged children of employees.

RUGER #1, mint condition, trigger job, extremely accurate varmint gun, complete w/ loading dies & brass. King, 899-1770.

TWO ADJOINING LOTS, Sandia Memory Gardens, $1,175/both. Hodgden, 409-636-2351.

EXERCISE BIKE, Tunturi stationary, $60 OBO. Sears, 293-8478.

RIFLE, .22 single shot, good condition, used approximately 10 times, $79. Locher, 256-3406, ask for Mo.

WASHER AND ELECTRIC DRYER, Kenmore, white, large capacity, heavy duty, $300; frost-free refrigerator, 18-ft., white, $225. Parry, 884-7934.

CAMPER SHELL, for shortbed pickup, white, w/bubble windows, see at 1820 Hiawatha NE, $250 OBO. Morales, 296-2169 or 878-9764.

THREE GERBILS, w/complete cage setup, wheels, passageway compartments, very nice pet setup, $35. Padilla, 281-9550.

TOLE PAINTING MATERIALS, 25+ pieces of wood, ceramic, & crockery, $50; fabric, 5 boxes, $10. Lachenmeyer, 268-7818.

TRANSPORTATION

'90 TOYOTA PICKUP, $6,250; '87 Suzuki Samuri 4x4, $2,250; '68 VW Bug, $750. Brown, 892-1447.

'76 FORD F-150 PICKUP, 6-cyl., 3-spd., 8-ft. bed, camper shell, reliable, $1,700 OBO. Fugelso, 275-3870.

'92 JEEP CHEROKEE, white, PS, PB, AC, 4WD, 4L, 6-cyl., new tires, excellent condition, 81K miles. Romero, 869-5610.

'84 LINCOLN CONTINENTAL, great condition, new radials, AC, cruise control, white w/maroon leather interior, $3,495 OBO. James, 345-4006.

'94 TOYOTA, 4-runner, 3.0L, V6, AT, 4x4, fully loaded, full power, pewter pearl, 17K miles, like new. Escobedo, 298-6219.

'93 PLYMOUTH VOYAGER MINIVAN, AC, AT, 6-cyl., 25-mpg, 67K miles, excellent condition, $10,900 OBO. Burns, 281-3922.

'84 MAZDA GLC, 2-dr. hatchback, meticulously maintained, runs extremely well, under NADA book value, $1,500. Ruby, 821-0982.

'85 CADILLAC SEVILLE, "Gold Edition," FWD, good-to-excellent condition, everything works, under blue book, $4,200. Lyons, 281-9283.

'65 CHRYSLER NEW YORKER, green, rough but works, recent brakes, tires, front-end suspension, $475 OBO. Roose 296-4129.

'86 BUICK PARK AVENUE, well-maintained, runs well, $2,700. Gallegos, 266-3977, ask for Richard.

'82 MAZDA GLC, 3-dr. hatchback, AT, AC, beige, runs great, only 88K miles, $1,000. Haschke, 299-0348.

'89 CHEV. K1500 TRUCK, 4x4, Silverado, Z71, loaded, Brahma camper shell, perfect condition, 85K miles, $10,900. Dwyer, 271-0741.

'91 SUBARU LEGACY, 4x4 sedan, AT, AC, new belts & CV joints, excellent condition, 98K miles, $7,500. Jones, 887-1805.

'87 SAAB 900S, 2-dr. hatchback, AT, PS, PW, sunroof, body/engine excellent condition, maintenance records available, $3,900 OBO. Faculjak, 823-9686.

'92 JEEP CHEROKEE, white, PS, PB, AC, 4WD, 4.0L, 6-cyl., new tires, excellent condition, 81K miles. Romero, 869-5610.

'93 PLYMOUTH DUSTER, V6, AC, 5-spd., CD, tint, 30K miles, 60K warranty, 2 new tires, $9,300. Strauss, 888-0784.

'85 SAAB 900, 5-spd., AC, good condition, 127K miles, Kenwood stereo, $1,900 OBO. Matsko, 881-7655.

'89 CHRYSLER LEBARON, convertible, AT, AC, PW, PL, cruise control, new tires, very clean. Martinez, 296-9035.

'94 FORD RANGER, extended cab, white, 5 spd., AM/FM, $10,000, JODI. Pate, 880-1604.

'77 DATSUN 810, 6-cyl., fuel-injected, 4-spd., 1 owner, very reliable, alloy wheels, 167K miles, $750. Roach, 296-0795.

'80 FORD MUSTANG, well maintained, original owner, 4-cyl., 2-dr., AC, almost new tires & battery. Filusch, 299-5932.

'91 MUSTANG, 5.0L, LX hatchback, AT, AC, PS, PB, PW, AM/FM cassette, cruise, less than 20K miles, $11,500. Harris, 299-4559.

'86 ISUZU PICKUP, 4WD, spacecab, 5-spd., AC, AM/FM cassette, 94K miles, $4,000/offer. Mowrer, 281-5595.

'95 DODGE NEON SPORT, 4-dr., 5-spd., airbags, 4W, ABS, PW, PL, PM, cruise, CD, $12,300. Kerry, 293-6105.

'86 CHEV. BEAUVILLE VAN, 3/4-ton, 8-passenger, very good condition, fully loaded, 1 owner, $3,500 OBO. Sanchez, 865-5973.

'80 DODGE RAM D50 PICKUP, white, 106K miles, 4-cyl., 4-spd., excellent condition, $1,850. Klenke, 898-8771.

'88 CUTLASS SUPREME, all power, cruise, AM/FM cassette, original owner, 92K miles, classy car, $4,700. Pitts, 293-5481.

'88 FORD THUNDERBIRD, turbo coupe, new AT & tires, all options, white w/charcoal interior, rare find, $5,200 OBO. Bailey, 281-4766 or 229-2990.

'89 GMC JIMMY, 4x4, full-sized, 68K miles, new tires, $10,500. Breeze, 275-9002.

'80 DODGE RAM D50 PICKUP, white, 106K miles, 4-cyl., 4-spd., excellent condition, $1,850. Klenke, 898-8771.

'86 ACURA INTEGRA LS, 4-dr., AT, 1 owner, accident-free, runs/looks great, 95K miles, $3,950. Dugan, 281-1317.

'92 SATURN SL2, 5-spd., CD, sunroof, all power, remote/alarm, leather, 39,800 miles, immaculate, $11,400. Armstrong, 293-7956.

'89 DODGE CARAVAN, PL, PW, 6-cyl., +101K miles, bids taken through 2/27/96, reserve right to refuse all bids, subject to prior sale, sold as is. SLFCU, 237-7382.

'84 SUBURBAN, Silverado, 4WD, 3 seats, trailer pkg., $5,200. Bentz, 857-0728.

'85 BLAZER S-10, 4x4, 4-cyl., 5-spd., good conditin, runs well, $3,500. Padilla, 877-2653.

'94 MITSUBISHI MIGHTY MAX, V6, 5-spd., Alpine stereo system, tool box, new tires & spoke wheels, nice, $9,000 OBO. Bayless, 299-4656.

RECREATIONAL

HAWAII TIME-SHARE, Kahana Falls resort, Lahaina, Maui, August 17-24. Muniz, 898-5198.

GRAND CANYON RIVER TRIP, 9 days, May 30-June 7, Lee's Ferry to Lake Mead, $1,450. Shunny, 265-1620.

'95 MOUNTAIN BIKE, Cannondale F700, 23.5 lbs., 800-X-ray grip-shift, XT-LX components, titanium seat, Control Tech seat post, $900. Nelson, 275-2557.

NISHIKI SERAL ROAD BICYCLE, excellent condition, $150.00. Claussen, 293-9707, leave message.

'77 MIDAS MOTORHOME, Class C, 23-ft., excellent condition, new tires, rear rack, $5,000. Beall, 869-2939.

CROSS-COUNTRY SKIS, Tua waxable, 200mm, metal edges, 3-pin bindings, $75. Koenig, 294-2264.

REAL ESTATE

3-BDR. MOBILE HOME, '92 Fleetwood, 2 baths, fireplace, stove & refrigerator, dishwasher, 16' x 80'. Medrano, 831-5104.

3-BDR. HOME, Willow Wood at Eubank gate, 1,750 sq. ft., 1-1/2 yrs. old, 2-car garage, 2 baths. Arndt, 271-1599.

3-BDR. HOME, brick, 1,580 sq. ft., minutes from KAFB, beautiful updated den, 1-car garage, family/retiree neighborhood, $114,000. Brannon, 260-1322.

3-BDR. HOME, NE Heights, Antelope Run, 1,504 sq. ft., 2 baths, bright, open-floor plan, $165,000. Tadios, 271-2377.

INTERLACHEN LAKES FLORIDA LOT(S), growing community, spring-fed lakes, minutes from Ocala National Forest, $8,000 ea. Barrett, 275-6187.

3-BDR. HOME, immaculate, 1-3/4 baths, in desirable Parkland Hills, many updates, convenient SE location, hurry. Gomez, 266-8154.

3-BDR. COUNTRY HOME, unique, east of Sandias, 1,600 sq. ft., 2.5 acres, APS or Moriarty, $149,900. Dean, 281-3489.

4-BDR. HOME, 1,860 sq.ft., good condition, Comanche/Chelwood, great schools/park, $135,000. Hoier 275-1938.

3-BDR. HOME, on 2 acres, well maintained, perfect setup for horseman, backyard/trees, south of Rio Bravo, $149,950. Fernandez, 877-1565.

WANTED

REFRIGERATOR, small, compact, to be used in office. Karler, 271-4235.

PUMP .22 RIFLE, Remington; small outboard trolling motor. Plummer, 823-1619.

CAR STEREO, Toyota factory, AM/FM cassette, from '89-'94 pickup, 4-runner, or similar. Luna, 881-6808.

CHILDREN'S PLAYHOUSE, Fisher-Price, need castle or playhouse. Maestas, 299-6514, leave message.

TOYS, BOOKS, PUZZLES, cheap or donated to mother/child play group, ages 4 months to 3-1/2 yrs. Torres, 828-1679.

WOMEN TENNIS PLAYERS for Coronado Club-sponsored women's 3.0 tennis team. Chirigos, 298-3837.

SOFTBALL PLAYERS for SERP B-League team, season runs from April to August. Pratt, 256-7408, ask for Tom.

SHOT GLASSES, antique & new, to round out collection. Hamilton, 294-5850.

WHEELCHAIR to borrow or buy, model "Breezy," by Quickie, or other lightweight folding wheelchair for retiree. Matlack, 256-7371.

BASIC NORDICTRACK. Underhill, 294-5774.

COMPUTER, IBM/compatible 386DX/486SX, VGA monitor, keyboard & mouse. Sarkis, 266-2790.

SOMEONE to do small house repair & re-stucco job. Jones, 883-1284.

LOST & FOUND

FOUND: One pair of work gloves, Building 802, on Friday, Feb. 2. Wendell, 844-8690.

SHARE-A-RIDE

VANPOOL, from Santa Fe. Lopez, 345-9931 (day) or 982-9684 (evenings), ask for Rosemarie.

Sandia News Briefs

Retired Sandian named CASA 'Advocate of the Year'

Retired Sandian Bob Pinkham has been named the 1995 "Advocate of the Year" of the statewide Court-Appointed Special Advocate (CASA) program. CASA volunteers are appointed by the court to serve as advocates for neglected and abused children, specifically in court cases regarding the placement of children with adoptive or foster parents. Bob, who retired in 1985 after 33 years with Sandia, was a division supervisor, working primarily in the components area. According to county CASA director Randy Noah, "Bob stays on until permanence is guaranteed and the child's needs are met for the long term . . . Bob never loses sight of the kids we are all here to speak up for."

Sandia communicators win national awards

Visual Communications Dept. 12614 earned several awards for entries submitted to the recent "Communicator Awards," a national program that recognizes excellence in the visual communications field. *Ergonomics Detective C.T. Dodd* won Awards of Excellence in the "Employee Communications" and "Training" categories. *Performance Management Evaluation Discussions*, *Introducing MuSE*, and *Sandia's New Supplier Quality Program* each won an Award of Distinction in the "Government" category. *Robotics Safety* won an Award of Distinction in the "Training" category. Three Sandia-produced videos won honorable mentions. The contest had more than 1,000 entries from 42 states.

Sandian wins "Friendship Quilt"

Sandian Woody Weed (2471-2) was the winner of "Roberta's Friendship Quilt" (*Lab News*, Dec. 1, 1995), a hand-stitched quilt raffled off recently by the Sandia Quilters. The raffle earned $2,600 for People Living Through Cancer. The Quilters embarked on the fund-raising project after member Roberta Chinn of Financial Systems Dept. 4815 was diagnosed with iung cancer. In quilt parlance, a "friendship quilt" is a blanket crafted from blocks, or squares of material, collected from neighbors, relatives, and friends. For information about the Sandia Quilters, call Cindy Gregory (3526) at 275-3855.

Send potential Sandia News Briefs to Lab News, *Dept. 12622, MS 0413, fax 844-0645.*

Staying on top of TOP (Triple Option Plan)

June 30 is the deadline to file Medical Care Plan claims: Medical or prescription drug claims incurred as of Dec. 31, 1995, must be filed with Mutual of Omaha (medical) or with Caremark Prescription Drug Services (prescriptions) before June 30, 1996, to be reimbursed. File medical claims with Mutual of Omaha using the Mutual of Omaha claim forms. Send prescription drug claims to Caremark using the back side of the medical claim form and mail to Caremark Prescription Drug Services, PO Box 686005, San Antonio, Texas 78268-6005.

Changing your Primary Care Physician: To change the Primary Care Physician of record (printed on your TOP ID card), call Prudential Member Services at 1-800-845-6986. Primary Care Physicians are assigned through Prudential Member Services and cannot be changed by contacting the Sandia Benefits Department. If you call Prudential on or before the 15th of the month, your Primary Care Physician of record will be effective on the 1st of the following month. However, if you change after the 15th of the month, the change will be effective beginning the first of the following month. (Example: If you requested a change on Feb. 14, 1996, the change is effective March 1, 1996. However, if you requested the change on Feb. 17, 1996, then the change is effective April 1, 1996.) A new ID card reflecting the new Primary Care Physician is issued by Prudential.

Caremark Prescription Drug Plan: In California, some pharmacists are confused about the system that should be accessed to allow coverage for TOP participants. Some pharmacists have been entering the PruCare HMO Plan rather than the TOP Caremark Plan. This results in the pharmacist showing non-coverage for our TOP participants. TOP participants should encourage pharmacists to enter the codes shown on the back of the TOP ID card to access the correct eligibility database for TOP participants.

Employee meetings with Prudential: Prudential will be available to answer questions or resolve problems about the Triple Option Plan at the following times and locations. Employees do not need to attend the entire session but can drop in at any time during the period.

Albuquerque: Feb. 20 and 21, Area 1 Cafeteria (Bldg. 861), 11 a.m.-1 p.m.

Livermore: March 19, Bldg. 904 Auditorium, 10-11 a.m.

Meetings for retirees only: Prudential representatives will be available to address retirees' questions or concerns about the Triple Option Plan at these times and locations:

Albuquerque: Feb. 16, March 1, March 15, and March 29, Coronado Club, 11 a.m.-1 p.m.

Livermore: March 19, Bldg. 904 Auditorium, 11 a.m.-noon

(See an upcoming issue of the *Lab News* for information about using the TOP Referral Process with the Primary Care Physician option.)

Coronado Club

Feb. 22, 29 — Thursday bingo night. Card sales and buffet start at 5 p.m., early birds' bingo at 6:45 p.m.

Feb. 16 — Valentine dance. $6.95 all-you-can-eat buffet, 6-9 p.m. Music by Midnight Magic, 7-11 p.m.

Feb. 18 — Sunday brunch buffet, 10 a.m.-2 p.m. $6.95 adult members; $1 for children 3 to 12; free for children 3 and under. Music for buffet by Bob Weiler, 1-4 p.m.

Feb. 23 — Western night dinner/dance. $6.95 all-you-can-eat buffet, 6-9 p.m. Music by Nite Rider, 7-11 p.m.

Recent Patents

David Myers (1303), Steven Brueck, and Ashwani Sharma (both UNM): Silicon Metal-Semiconductor-Metal Photodetector.

James Gee (6219): Method of Making a Back-Contacted Solar Cell.

Retirement open houses

Sandia is holding open houses in honor of retirees **Mary Gilliland** (1341) in the Bldg. 858 Commons Area on Tuesday, Feb. 20, 11:30 a.m.-1 p.m.; **James Lohkamp** (2151) in the Area 1 Cafeteria (Bldg. 861) on Monday, Feb. 26, 2-4 p.m.; and **Wayne Vine** (1500) in the Area 1 Cafeteria (Bldg. 861) on Tuesday, Feb. 27, 2-4 p.m. Refreshments will be served. Friends and acquaintances are invited.

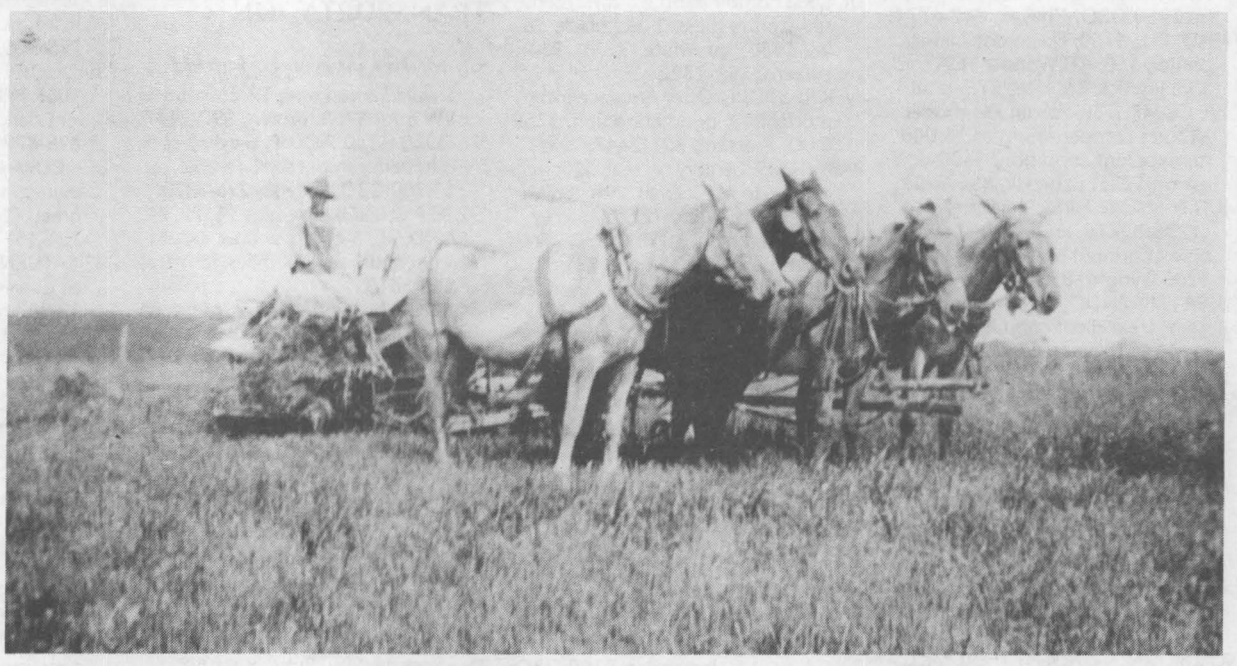
Congratulations

To Ann-Marie and David (2314) Grice, a son, Caleb Mitchell, Jan. 11.

To Tara Allen (14712) and Dave Langowski, married in Albuquerque, Jan. 27.

To Susan and Ken S. (9111) Chen, a son, Steven Choy, Jan. 28.

Favorite Old Photo



This old photograph is my favorite because it shows my grandfather, Claude Jacobs, with his "yellow mules" John and Wye (on the right) and Doc and Nell. He is riding a binder, which was used to cut wheat and tie it in bundles. The bundles were then stacked by hand into shocks. Once the shocks were cured, they were loaded onto wagons and transported to the threshing machine, where the grain was stripped from the plant. This photograph was taken about 1918 on the farm owned by his father and grandfather where he and his seven brothers and sisters were born. Grandpa used these and other mules to farm in Livingston County, Missouri, for most of his life before passing away in 1988 just short of his 90th birthday. Today his daughter, my mother, is the fourth generation to manage the family farms where she grew up and where my siblings and I were born and raised.

— Phyllis Pryor (7801)