Sweep 'Metallurgy and Ceramics' Category

Sandians Win Four '92 DOE Basic Energy Sciences Awards

Sandia researchers added to the Labs' successes of recent years by winning four of DOE's 1992 Basic Energy Sciences (BES) Outstanding Accomplishment Awards in materials science.

Teams based at Sandia/New Mexico and Sandia/California garnered all three awards in the category of metallurgy and ceramics, plus another in materials chemistry.

The awards in metallurgy and ceramics:

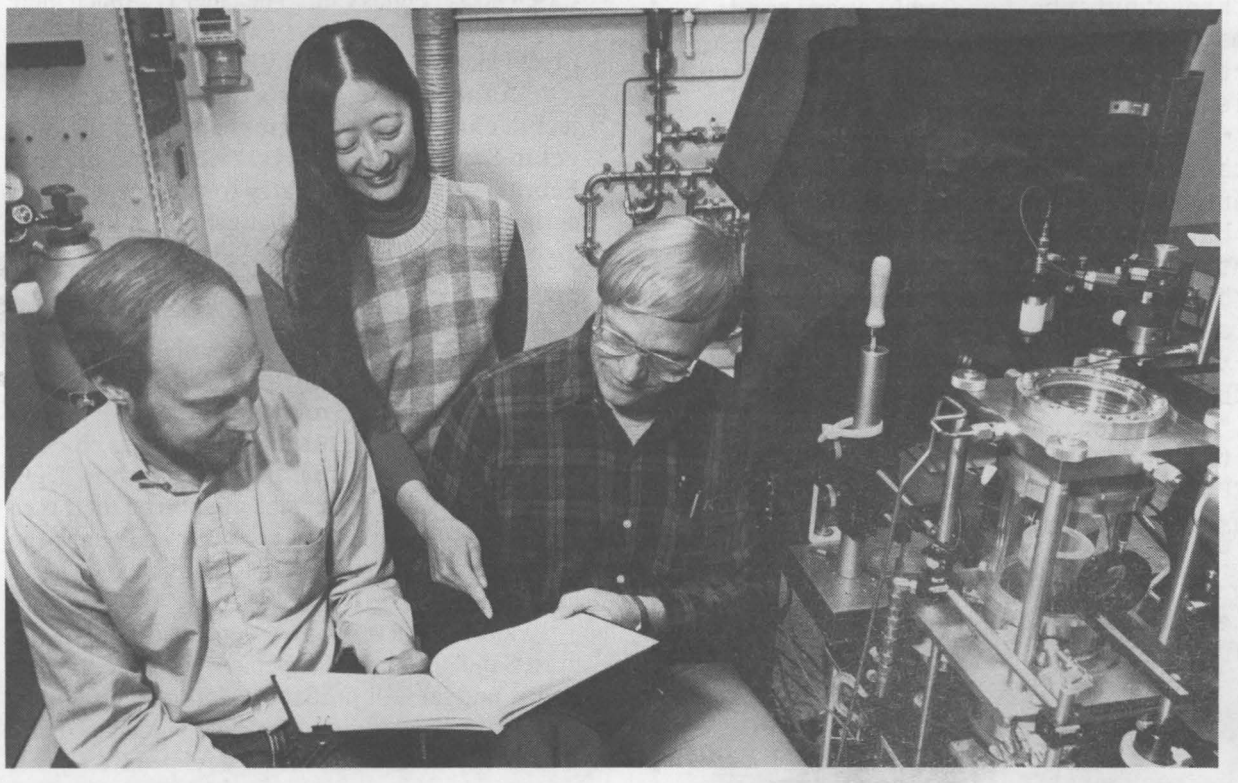
Outstanding scientific accomplishment, to Michael Mills (8712) and Daniel Miracle for "High Resolution Transmission Electron Microscopy Observation and Embedded Atom Method Calculation of Dislocation Cores in $NiAl_3$." Miracle is employed at the Wright Research and Development Center, Wright-Patterson Air Force Base.

Sustained outstanding research, to Barney Doyle (1111), Tom Picraux (1102), Jim Knapp (1111), and Sam Myers (1112) for "Advanced Ion Beam Techniques for Materials Analysis."

Significant implications for DOE technologies, to Jeff Brinker (1846), Alan Hurd (1841), Randy Schunk (1511), and Carol Ashley (1846) for "Sol-Gel Film Formation Model."

In materials chemistry, the award for **sustained outstanding research** went to Bill Breiland, Mike Coltrin (both 1126), Greg Evans (8745), Pauline Ho (1126), and Bob Kee (8745) for "Chemical Vapor Deposition Sciences."

The annual BES awards recognize outstanding accomplishments in basic research. Nominations are judged by the researchers' peers at DOE facilities.



IN MATERIALS CHEMISTRY, team members Mike Coltrin (left), Bill Breiland, Pauline Ho (all 1126), Greg Evans, and Bob Kee (both 8745, seen on page six) garnered the award for sustained outstanding research in the field of chemical vapor deposition (CVD). Research at Sandia during the past 10 years has greatly advanced the understanding of CVD, the backbone of the microelectronics industry.

Why Brittle at Low Temperature?

Michael Mills and Daniel Miracle studied the atomic structure of a nickel-aluminum alloy to try to discover why it was brittle at low temperatures. Because of its light weight, high strength, and thermal conductivity, the alloy is desirable for components subjected to high temperatures, such as turbine blades or electronic devices.

The researchers used high-resolution transmission electron microscopy (HRTEM) to obtain images of the material's atomic structure. The images revealed that imperfections in the crystal structure of the alloy, which "give" in response to stresses and make the material flexible, tend to be more resistant to movement at low temperatures. The ability of

(Continued on Page Five)

Changes Recommended, Adopted

DMTS Selections Begin This Month

Following recommendations made by a team representing each Sandia division, the selection process for the next round of Distinguished Members of Technical Staff (DMTS) is about to begin.

The team, comprising two people from each division, assessed the FY92 process. The recommendations for FY93, after review by Executive VP Orval Jones (20) and several vice presidents, are being adopted for the selection process expected to begin late this month.

The team's recommendations:

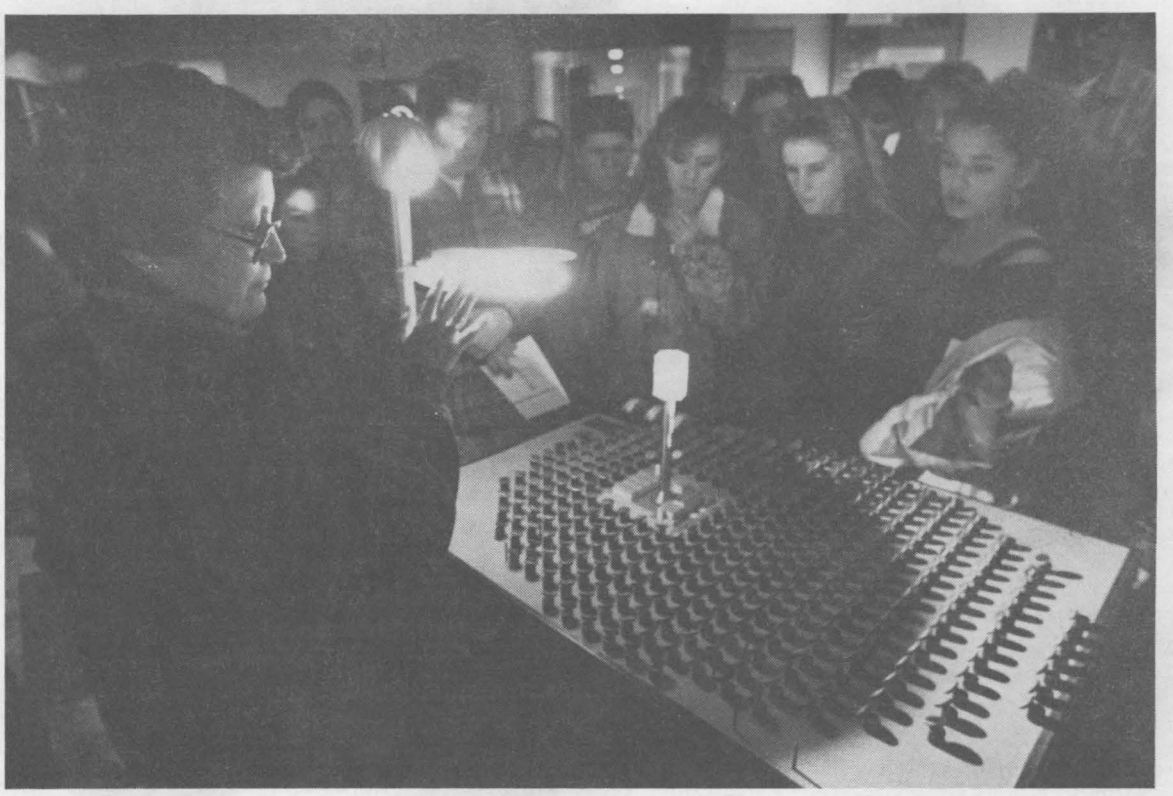
- Individuals may nominate themselves.
- Division review panels, which provide listings of nominees' strengths and weaknesses, will be part of the process. Each division review panel may establish its own approach for considering the basic criteria, with direction from its vice president.
- The community service section that was in the FY92 nomination packet will be discontinued.
- An initial "Nomination for Consideration" form must be used for all proposed DMTS nominees. These forms will be available in the *Weekly Bulletin* and from division personnel representatives. Anyone nominated will acknowledge his or her concurrence by signing the form.
- A standardized nomination package will be used to follow up the "Nomination for Consideration" form. This package consists of six pages and must be completed for each nominee. No

The big change: Individuals may now nominate themselves for DMTS consideration.

(Continued on Page Five)

LAB NEWS

VOL. 45, NO. 4 SANDIA NATIONAL LABORATORIES FEBRUARY 19, 1993



STORMY WEATHER — Juanita Sanchez of Public Relations Dept. 7161 gets ready to move a cloud across a model of a solar facility. Looking on are eighth-grade earth-science students from Estancia Mid School. The model, located at Sandia's Solar Thermal Test Facility ("solar tower"), doesn't represent any particular solar installation but demonstrates the central-receiver concept. Light from the "sun" at left is reflected off model heliostats onto the central receiver elevated in their midst. Juanita coordinates the community relations tour program, which is primarily for school and community groups. To request a tour, call her on 844-1307. (Photo by Mark Poulsen)

This & That

Yes, We Had Accomplishments! – With all the change, restructuring, renaming, reorganizing, repositioning, transitioning, and other such goings-on during the past year, it would be easy to overlook the many accomplishments that Sandians achieved. But we just couldn't let that happen. Our top accomplishments – 116 strong if I counted correctly – are detailed in our FY92 Labs Accomplishments section in the center of this issue. Thanks to the many folks throughout the Labs who submitted accomplishments, to Sandia's VPs for making the final selection, and to LAB NEWS Writer Howard Kercheval for coordinating it all this year. Many employees save this section to show visitors and family members.

* * *

"Best Buzz" Winner – What a fantastic bunch of entries we got in our contest to produce the best coherent 25-word sentence with the most buzzwords in it. It was mighty close, but our semi-distinguished panel of self-styled experts selected the entry submitted by Tom Ashwill (6214): "Conditionally empowered (CE) by integrated third-generation (ITGEN) functional programming concepts (FUPCO), the advanced proactive management organization (APAMO) multi-tasked Quality ES&H (QUESH) logistics into optimized top-down feedback processes (OPTOFEPRO) for balanced policy consensus (BALPOLCON)." As a logical extension (well, Tom actually called it an absurdity), the buzzer is then in a position to say casually, "The BALPOLCON OPTOFEPRO QUESHed the FUPCO APAMO over lunch at the cafeteria." Tom may be pushing the envelope by not including acronyms in his 25-word-limit count, but he's certainly thinking outside the box. Still, we're a bit worried – he also says, "The sentence sort of makes sense to me!" We had so many good entries that we're printing several "dishonorable mentions" (see page nine). Thanks to everyone who entered.

* * *

Patient Pleads for Patience – If things went according to plan, on the day this issue is published, I'll be recuperating from back surgery to try and correct a pinched nerve that's been bugging me for years. Unfortunately, the recuperative period is measured in weeks, so I won't be around for a while. Managing Editor Charles Shirley gets the high honor and privilege of doing my job and his too while I'm gone, with the able assistance of the severely dedicated Department 7162 staff. They're dedicated, but small in number, so please understand if they can't get to your needs immediately if you call. A promise: If you'll be patient while I'm a patient, I promise *not* to show you my scar when I return!

* * *

Seeking Ancient Images – We're running short of "favorite old photos" these days. In fact, for the first time in recent memory (the only kind I have any more), we don't have any favorite old photos waiting to be published. We like to use 'em to spice up our pages when we have the space, so give Managing Editor Charles Shirley a call on 844-6210 if you have one you'd like us to consider; California Sandians should contact Barry Schrader on 294-2447. Old pictures that show action, emphasize the unusual, or illustrate historical contrast have the best chance. Photos of Great Granddad Gus standing and smiling at us probably won't cut it, but if you've got a shot of the old boy wrestling a bear in a turn-of-the-century saloon, we'd love to hear from you. Get the picture? •LP

Too Early to Tell for Sure, So . . .

Labs' FY94 Budget Still 'Uncertain'

A front-page headline in the *Albuquerque Journal* captured a lot of employees' attention two weeks ago: "N.M. Labs Might Lose $100 Million." The story continued inside the paper under a more level-headed headline: "Labs Drafting Leaner Budgets in Case Federal Funds Cut." The latter is a much more accurate assessment, says Paul Stanford, Sandia's Chief Financial Officer and VP 100.

"As always, next year's fiscal outlook is subject to change until Congress approves the budget in September," he says. "At this point, mid-February, it's just too early to predict with any certainty what the FY94 budget might look like, except that it will be down."

The Feb. 6 *Journal* story was prompted by a request from DOE Headquarters that the national labs submit, as an exercise only, updated budgets which together would trim $1 billion from the DOE's total Defense Programs budget for FY94.

Paul emphasizes that the request was an exercise only, and that its purpose was to show DOE Headquarters where the labs might trim their own DP budgets *if it became necessary*. He says the Labs completes many similar exercises for DOE each budget cycle.

Paul says that his own "gut feeling" is what most Sandians already expected: the Defense Programs budget will probably decline, while other budgets, such as environment, waste management, technology transfer, and energy-related R&D, will probably increase. The net result: "We will probably end up with at least a five-percent loss in funds, as well as eating inflation," he says. "However, funding shifts are generating imbalances in our employee skills mix." •JG

feedback

Q: I received a brochure selling an entertainment book along with Sandia Laboratory Federal Credit Union (SLFCU) material — in Sandia interoffice mail. My daughter is selling the same item as a non-profit fund-raiser for Albuquerque Public Schools.

Since SLFCU is using company mail for the profit-making version of the same sales program, can I use company mail to advertise for my daughter's fund-raising project?

A: Employees are prohibited by SLI 1900 from using company mail for personal reasons. SLFCU has an agreement with the Labs to use company mail, which includes paying the Labs $12,000 a year for Mail Center services.

R.L. Shepardson (7600)

LAB NEWS

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LARRY PERRINE, Editor (505/844-1053)
CHARLES SHIRLEY, Managing Editor (844-6210)
JOHN GERMAN, Writer (844-5199)
HOWARD KERCHEVAL, Writer (844-7842)
RANDY MONTOYA, Head Photographer (844-5605)
MARK POULSEN, Photographer and Production Coordinator (844-0421)
JANET CARPENTER, Editorial Assistant (844-7841)
LISA CHAVEZ, Assistant (844-7841)
LAB NEWS FAX (505/844-0645)
BARRY SCHRADER, California Reporter (510/294-2447)

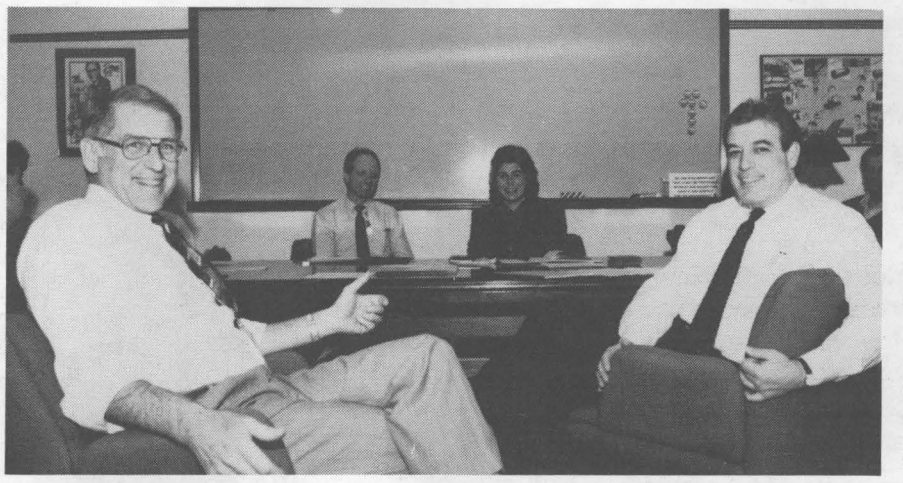
BEHIND THE SLEEK PANELS, this is what an airliner looks like. At last week's dedication of a research center for improving the safety of aging aircraft, Dennis Roach (2741, second from left) points out features of a Boeing 737 to (from left) Bruce Singer, Deputy Service Director, Federal Aviation Administration (FAA) Technical Center; Sandia President Al Narath; Albuquerque Mayor Louis Saavedra; US Congressman Steve Schiff; and US Senator Pete Domenici. The Aging Aircraft Nondestructive Inspection Development and Demonstration Center, located at Albuquerque International Airport, is a joint project of Sandia and the FAA. Watch for more in an upcoming LAB NEWS.

Sandia's 'Window to California'

What's Happening in the California Programs Division

By John Crawford (VP-8000)

Editor's Note: This is the fifth in a series of LAB NEWS articles by Sandia's vice presidents, discussing what's happening in their areas. The next scheduled article is by Paul Fleury (1000).



JOHN HOSTS TRANSIT OFFICIAL — Frank Wilson (right), general manager of the Bay Area Rapid Transit (BART) agency, visited Sandia/California recently to discuss opportunities for cooperative projects. Seen with Wilson are VP John Crawford (8000, left), Mike Dyer (8101), and Mim John (8100). They discussed Sandia transportation initiatives and automated emergency response systems.

SANDIA CALIFORNIA NEWS

As I write this, the Clinton administration is getting under way and beginning to define some new directions. Transitions and changing environments are very high on everyone's consciousness. Times are uncertain. As we spend even more energy planning for a rapidly changing future, our general themes — themes that can ensure our success — must be generic enough to remain robust even in this unpredictable environment.

Diversify, Strengthen Programmatic Base

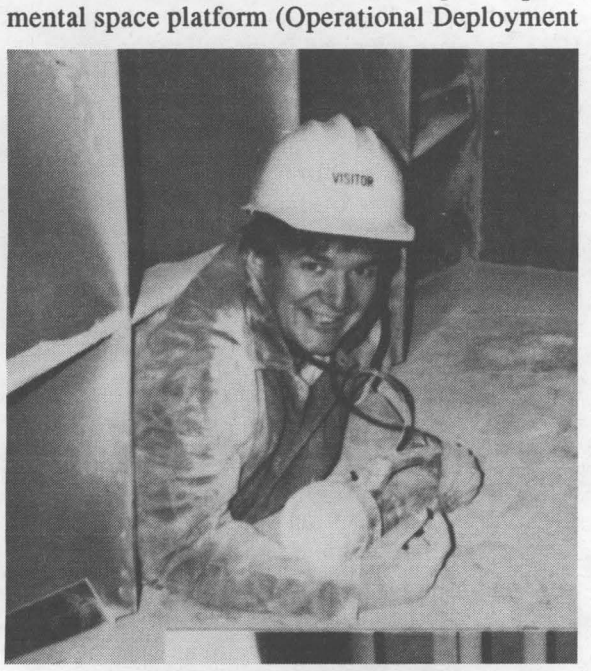
The nuclear weapons program has always been the dominant program at Sandia, particularly in California. I believe it will continue as a major program at this site, but configured differently, as government needs continue to change. Currently, we have no externally driven Phase 3 [full-scale development] programs. Our development programs are driven entirely by our view of what kinds of weapon technologies may be needed for the future.

We are working with our New Mexico colleagues on STEP and Focal Point, a collection of programs aimed at developing generic components, subsystems, and processes that will be available on short notice as future weapon needs arise.

"Our development programs are driven entirely by our view of what kinds of weapon technologies may be needed for the future."

We also work with Lawrence Livermore National Laboratory (LLNL) on specific advanced system designs (PRESS — Pit Reuse for Enhanced Safety and Security) to enable a systematic evaluation of emerging ideas. The dramatic and historic agreements between the United States and the former Soviet Union are directing a great deal of our effort toward weapon dismantlement and stockpile reconfiguration, which will continue for the remainder of the decade.

Our weapon technologies have also allowed us to participate in Work-for-Others programs for conventional defense. We are building an experimental space platform (Operational Deployment Experiment Simulator — ODES), to be used by the Strategic Defense Initiative Organization for several of its experiments. We have recently been authorized to conduct two proof flights of VIP (Video Imaging Projectile), a spin-off from our artillery shell work, and we expect to go to full-scale development next year. Various combinations of nuclear defense and conventional defense, using a common set of technologies and competencies, will likely be a major part of our future.



LARRY BAXTER (8361) climbs out a porthole of a Central Illinois Public Services furnace after taking measurements of slag buildup. Larry helped the utility company understand how the buildup occurred and what could be done to minimize the problem.

Sandia has launched an exciting initiative in advanced manufacturing led by Heinz Schmitt (VP-2000). In support of that initiative, the activities of our newest laboratory building, designated the Integrated Manufacturing Technologies Laboratory (IMTL), will be focused on manufacturing. The IMTL was dedicated last October by former DOE Secretary James Watkins, who was the first Secretary of Energy to visit our Sandia/California site.

The first set of projects for our advanced manufacturing program will be gas transfer systems, telemetry systems, and smart containers, all in support of Complex 21 [the projected smaller weapons complex]. We look forward to a future of truly agile manufacturing and partnerships with industry to develop these concepts with the private sector. Agile manufacturing requires a robust infrastructure to support the entire enterprise, allowing a group to design and build quality hardware in a short time without the expense of building large numbers of prototypes. I see Sandia teaming with the private sector, developing technologies that are at the same time valuable to us for our weapons responsibilities and to the private sector for its manufacturing needs. I would like to see the IMTL become a user facility not unlike our Combustion Research Facility (CRF) so that we have Sandia, industrial, and academic partners jointly developing processes and expertise there that will enable an agile US manufacturing enterprise.

"There appear to be many opportunities for applying our combustion expertise to emerging environmental issues."

A unique capability exists with our CRF staff and facilities. While continuing our fundamental research, we are now also emphasizing environmental applications of combustion research. There appear to be many opportunities for applying our combustion expertise to emerging environmental issues. Among the most notable is the global climate change and atmospheric monitoring work being done by John Vitko (8102) and his team. They have demonstrated significant applications of CRF laser techniques to atmospheric diagnostics and are now an integral part of the DOE atmospheric monitoring program.

A wonderful example of combustion technologies' "real-world applications" is Larry Baxter's (8361) work in partnership with Central Illinois Public Services (CIPS). Larry used his computer modeling expertise to predict the slag buildup in coal-burning furnaces for producing commercial power. The utility company made a special controlled run at its facility and then shut down the furnace. After it cooled, Larry actually crawled inside the furnace and took measurements to check his predictions. They proved accurate, and Larry helped CIPS understand how the slag buildup occurred and what could be done to minimize the problem. One of my favorite photos shows Larry crawling out of the porthole of this huge furnace. That was real science at work!

"We intend to use our California location to enhance Sandia's major transportation initiative."

Our researchers have also been working on supercritical water oxidation and have successfully operated a continuous flow research reactor as well as a super critical flame. The Army requested that Jack Swearengen (8113) and his group design a prototype reactor to help dispose of hazardous waste. Don Hardesty (8361) is leading a general initiative in the area of assured thermal destruction.

As Sandia's "window to California," our vision now goes beyond weapons design partnerships with LLNL. We are developing joint technology partnerships with LLNL and Lawrence Berkeley Lab to work with state agencies and the California-based private sector. California has often identified and faced issues of significance before they have become major national issues. Two examples that are prompting work in environmental areas are clean air legislation and auto emissions legislation. By using our California location as a strategic asset for Sandia, we can work with the state to identify important problems

(Continued on Page Four)

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California Programs

and issues, build partnerships with state institutions and the private sector, and support DOE's mission to use national laboratories and technologies to help industry and the nation. There is also growing recognition in California, driven by recent legislation, that the transportation infrastructure must change dramatically. We intend to use our California location to enhance Sandia's transportation initiative.

A few years ago, we decided to consolidate our major computer operations at Sandia/New Mexico. This required adeptness at high-speed data networking so we could still have productive computer interaction, even though a thousand miles

"Before we ever produced a thing, we had a delighted customer because we had helped him understand his own requirements."

separates our California users and the computers. Dona Crawford (1900) and her group are developing considerable expertise in high-speed data networking, a promising new direction that is producing several partnerships and R&D opportunities. We participate in the Bay Area Gigabit Network, along with telephone companies, universities, the State of California, and DOE, to develop a prototype network tying the Bay Area information infrastructure together. Dona's group is also developing partnerships involving new nationwide networks.

Deliver Quality Results to All Customers

As we become more customer focused, we realize our "customer set" is a complex mixture of internal and external customers, customers to whom we deliver products and services, customers who provide funding, and customers who inspect and judge our compliance with laws and regulations. The challenge is to deliver quality products to all of them in a cost-effective way.

We have all invested time in quality training and in institutionalizing the ideas and themes of quality through the Malcolm Baldrige quality criteria, but in addition a very exciting thing to occur has been the "grass roots" efforts of individuals and small groups of people within Sandia. These efforts have grown from a few isolated incidences to an almost ground swell of people applying quality concepts to their work. A great example involves Mike Birnbaum (11L) negotiating a program plan with one of his Navy customers. After having some initial difficulties, Mike suggested a quality function deployment (QFD) exercise on the requirements of the Navy order, which had never been done before. As a result, our Navy customer and Sandia came away with a clear understanding of what was wanted and needed. Before we ever produced a thing, we had a delighted customer because we had helped him understand his own requirements.

Our increasing use of quality principles and tools is encouraging. Volunteer, trained facilitators

"We must learn to enjoy the challenge of new issues rather than search for the comfort of long-term, guaranteed, stable programs."

(calling themselves the FX group) help others use quality tools. Everywhere I look, I see teams and organizations writing mission statements and goals. These mission statements are far less important than the fact that teams are spending more time understanding their goals and developing common views before they start a project. As leadership consultant Stephen Covey says, "Begin with the end in mind." Under the leadership of Henry Hanser (8007), our recent second annual Quality Tools Forum at Sandia/California drew 400 people to the general session and involved about the same number in workshops where they learned more about the application of quality tools. In just two years, this Sandia-sponsored forum has grown into a major event. Our rapidly growing focus on needs of customers — internal and external — is encouraging. We've begun to understand the power of customer focus.

LIDAR RESEARCHERS (from left) John Goldsmith, Mark Mitchell, and Scott Bisson (all 8351) in the Sandia Lidar Testbed, a mobile research facility. (Lidar is derived from "laser infrared radar.") The laser beam exits from the vertical tube between John and Mark and is transmitted through a hatch in the roof; the returned lidar signal is reflected by the large mirror into the receiving telescope seen at the extreme left edge of the photo.

In today's environment, few programs are accomplished in isolation. Teaming with our colleagues all across the Laboratories, we are forming partnerships with other institutions and private industry, building a constituency for our future. It's my belief that CRADAs (cooperative research and development agreements) with industry have been a marvelous stimulation for developing partnerships. At the California site alone, we have 12 approved CRADAs valued at $56.2 million and another 10 in the approval processes. We are working with AT&T to develop X-ray projection lithography, with DuPont to develop diamond films, and with Pratt and Whitney to improve its welding process; the list goes on. Each CRADA represents an opportunity for Sandia to help strengthen one or more of our US industries. That's exciting.

Many of our industrial partnerships are in the area of manufacturing process development. Our

FORMER DOE SECRETARY James Watkins and a young student look at an exhibit shown at a Math/Science Carnival sponsored by Sandia at Hawthorne School in Oakland last year. Sandia has reached more than 27,000 students in the San Francisco Bay Area with hands-on math and science experiences through the carnival program.

success in developing an agile manufacturing environment will depend on a network of capable industrial partners, with whom we are closely linked, and sharing common practices for rapid exchange of information and products. Our support of Complex 21 for the DOE can be based on these same principles and partnerships. We are currently equipping the IMTL with an extensive fiber-optic network to interconnect it with the entire California site, Sandia/New Mexico, and the evolving national networks.

Sandia has responded effectively to the challenge that former DOE Secretary Watkins made to the national laboratories to help the educational community attract and retain young students (kindergarten through 12th grade) in science and mathematics. One of our most successful programs in California is the Math/Science Carnivals, led by Karen Scott and Ray Ng (both 8526). Through this effort, Sandia has reached more than 27,000 students in the San Francisco Bay Area with direct, personal, hands-on math and science experiences. Sandia is building bridges to educational institutions at all levels through this and other education outreach programs.

Proud People Are the Key

It is my belief that we will make long-term progress in all these areas only if our people truly enjoy and take pride in their Sandia work. It has been said that Sandia management's main weakness is in people skills, as opposed to our technical skills. We are well trained technically, but many of us have not had a lot of formal management and leadership training. Realizing this, we have begun to put more emphasis on management and leadership-skills training for all Sandia managers.

During our recent Leadership Challenge Workshop for Managers, we began to understand that leadership should be exercised throughout the organization. Therefore, we extended the ideas to an all-employee workshop, "Leadership is Everyone's Business," that is continuing.

We're moving toward a more diverse work force, but more important, we are actively seeking ways to improve the way we interact with each other. We at the California site got a real "wake-up call" when the Department of Labor visited in 1990. We were criticized in the follow-up report as having a "hostile environment." We are committed to improving our processes and to sensitizing our interactions. Indeed, a fair amount of our recent training — "Leadership for the Future," "Social Styles," and "Active Communication" — has to do with effective and productive personal interactions.

Is all this training and effort having a positive impact? I believe so, but the real answer will come from all Sandians when we do our next Labs-wide all-employee survey.

Certainly, the future appears to offer extraordinary opportunity for new and innovative work. What the future does *not* offer is stability. Stability will be difficult to achieve, I believe, because our environment will continue to be uncertain and to change rapidly. We must learn to enjoy the challenge of new issues rather than search for the comfort of long-term, guaranteed, stable programs. We need an adaptable organization, an organization that can respond quickly and refocus its efforts in new areas, and one in which individuals easily move on to new projects. This ability to respond quickly, combined with our "can-do" reputation, will help ensure a successful future for us.

•JCrawford(8000)

(Continued from Page One)

'92 BES Awards

these imperfections, called dislocations, to shift appears to be linked to their core structures, says Michael. HRTEM revealed a "remarkable" difference between two types of dislocations, explaining, for example, why single crystals of this alloy behave differently when stressed in different directions.

The team was able to use information obtained at an atomic level and relate it to the material's behavior on a macroscopic level. "That's a huge jump," Michael says. "It's very rare in materials science to be able to make that connection.

Atomic-level information proved to have a direct relation to macroscopic behavior.

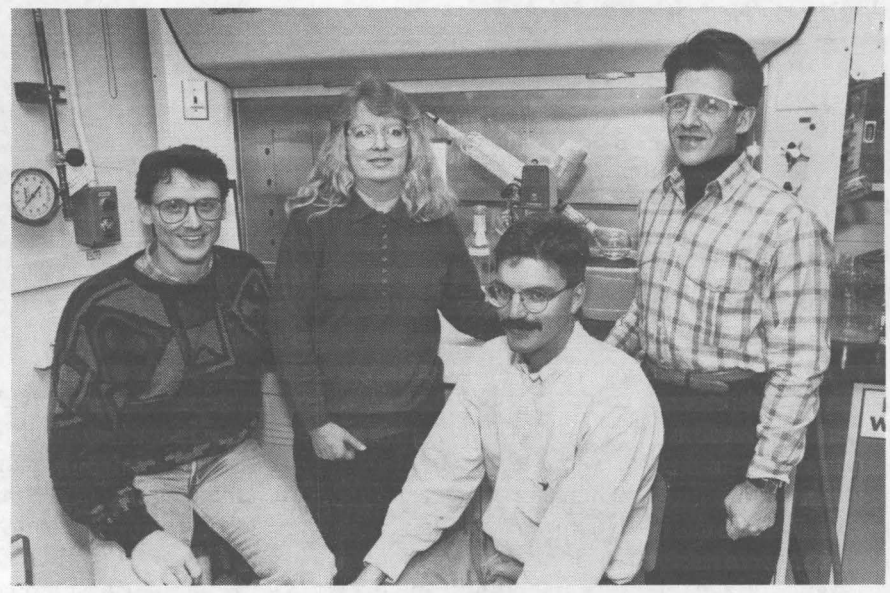
"We found out something very basic about the material that hopefully will help people go about improving the performance of the alloy," he adds.

World Class in Ion Beam Analysis

Through the work of the team winning the "sustained outstanding research" award for ion beam analysis, Sandia became and remains a world-class leader for ion beam analysis (IBA) techniques and theoretical analysis. IBA methods are a highly sensitive means of determining the composition and structure of materials by analyzing the way charged particles interact with a material.

High-energy ions from an accelerator penetrate a material and collide with the nuclei of atoms. The resulting nuclear reactions produce a variety of high-energy particles that re-emerge from the material and are detected. In this way, elements present in the material can be identified, their spatial distributions determined down to millionths of a centimeter, and their positions relative to adjacent atoms measured, all without destroying the material.

Over the years, the BES program at Sandia has supported numerous significant advances in IBA, many of which have found widespread use outside the Labs. Four of Sandia's most significant contributions to IBA for materials science applications are hydrogen profiling by helium-elastic recoil detection (He ERD), materials analysis by ion channeling, external ion beam analysis (XIBA) of components used in magnetic confinement fusion reactors, and heavy ion backscattering spectrometry (HIBS) ultra trace element analysis.



THEIR DEVELOPMENT of a comprehensive model of sol-gel formation by dip coating earned team members (left to right) Alan Hurd (1841), Carol Ashley (1846), Randy Schunk (1511), and Jeff Brinker (1846) a BES award for "significant implications for DOE technologies" in the metallurgy and ceramics category. The research is providing insight into the details of sol-gel film formation.

The "only limitation [of ion beam analysis] seems to be our imaginations."

"IBA is incredibly diverse. Its only limitation seems to be our imaginations," says awardee Barney Doyle. "I think this lab has really done well in exercising this creativity."

By varying the ions, the energies used, and what is measured, a wide variety of IBA techniques is possible. Sandia has 10 accelerators used for IBA, which can accelerate ions from 10 electron volts to 100 million electron volts.

IBA carried out by Sandia researchers played a key role in determining whether a 1989 explosion aboard the *USS Iowa* could be traced to a specific cause. It was used to measure the carbon in metal fibers removed from some of the *Iowa*'s ammunition and to characterize substances on a number of components, helping Labs investigators conclude that the explosion was not necessarily caused deliberately.

One of this year's IBA awardees, Tom Picraux, was a 1990 recipient of one of DOE's top awards for scientific achievement, the E.O. Lawrence Award. Tom was cited for his work with new ion beam channeling techniques that have led to advances in materials sciences and better microscopic understanding of materials.

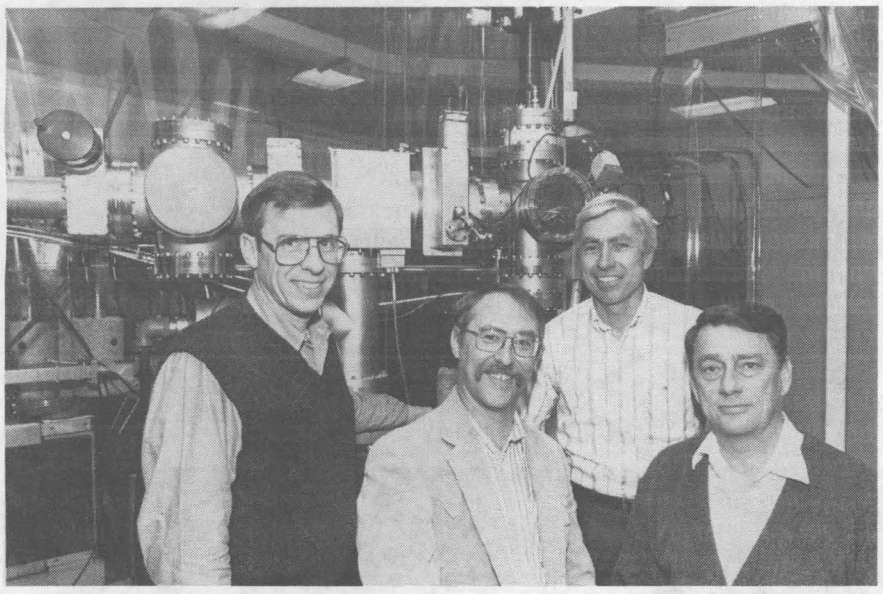
Several IBA techniques have been transferred to industry, and one technique, HIBS, has been patented.

Sol-Gel Work Attracts Industry

The implications of Sandia's sol-gel research have not gone unnoticed by industry. The Gas Research Institute, the Electric Power Research Institute, and Amoco are among those that have entered into or are pursuing partnerships with Sandia to tap into researchers' expertise in the factors that control sol-gel film formation.

The BES program specifically recognized Sandia's development of a comprehensive model of sol-gel film formation by dip coating. This process involves applying a solution to a substrate, in this

(Continued on Page Six)



FOR SUSTAINED outstanding research in ion beam analysis (IBA), team members (left to right) Jim Knapp, Barney Doyle (both 1111), Tom Picraux (1102), and Sam Myers (1112) won a '92 BES award in metallurgy and ceramics. IBA techniques developed at Sandia have found widespread use outside the Labs and have led to better microscopic understandings of materials.

Sandia Continues to Lead Awards

Since 1985, Sandia has won 17 BES awards in materials science, leading all other participating institutions (primarily DOE labs) during that period. Since the competition began in 1981, Sandia has received at least one award every year except 1982. Winners are chosen by the voting of entrants' peers at other DOE labs.

(Continued from Page One)

DMTS Selection

additional documentation will be reviewed unless the division review panel specifically requests it. There will be specific guidelines (such as font type and size) that each nomination package must follow. The package, developed by a subteam of DMTS Sandians, is based on information packets and nomination forms used for professional societies' Fellow nominations; it includes sections on education, professional history, principal technical contributions, Sandia's corporate values, publications/patents/awards, and references.

Salary and Performance Criteria

Because the DMTS designation is a level in the Member of Technical Staff (MTS) classification, there are salary and performance criteria that nominees must meet. The basic criteria are that the employee

- have a minimum of five years of Sandia MTS experience,
- have a ratio of salary-to-corporate-Mid-E according to the following years of service:
  - 5-9 years: top 15 percent of the employee's center
  - 10-15 years: top 20 percent of the employee's center
  - 16-20 years: top 25 percent of the employee's center
  - 21 or more years: top 35 percent of the employee's center,
- have demonstrated technical excellence, either through unique contributions or through a sustained level of outstanding technical contributions, and
- be seen as a role model at Sandia by clearly applying or living the corporate values.

The number of DMTSs on-roll at Sandia is not allowed to exceed 10 percent of the non-supervisory MTS employees (MTS, Senior MTS, DMTS) in each division. Last year's selections brought the number close to this limit, which will mean fewer selectees this year. Because the limit is applied by division, more DMTSs can be named in some divisions than others.

This year's selection process is to begin in late February and conclude in late May or early June. Though that means the DMTS process will be going on at the same time as the performance review process for all employees, it is intended to allow completion before the summer vacation season and before the transition to a new management and operating contractor for the Labs.

More information about the schedule and details of the process will appear in the *Weekly Bulletin.* •

Ready or Not, It's Coming

'Manufacturing Guru' Speaks about Agility in US Industry

In a recent issue, *Business Week* magazine called Lehigh University's Roger Nagel the "manufacturing guru." Last week, a Sandia colloquium on agile manufacturing brought Nagel to New Mexico, and more than 400 Sandians gathered to hear him speak.

Nagel, Deputy Director of Lehigh's Iacocca Institute, is at the forefront of change in the manufacturing industries. As co-principal investigator of an industry-led report titled *21st Century Manufacturing Enterprise Strategy*, he helped shape a vision for US manufacturers called "agile manufacturing," which is expected to replace the century-old mode we know as mass production.

Agile, or flexible, manufacturing capitalizes on human intellect and adaptable technologies to get customized, high-quality products to the marketplace in record time. Designers, engineers, production workers, and marketing and sales people work closely together to allow companies to take advantage of fleeting market opportunities. Customer needs define new products and product improvements. (For more on agile manufacturing, see the Jan. 8 LAB NEWS.)

The report, published two years ago, first articulated the impending shift toward agile manufacturing in the US and gave birth to the Agile Manufacturing Enterprise Forum (AMEF), a forum of executives from various private-sector manufacturing companies aimed at guiding US industry's shift to agile manufacturing.

ROGER NAGEL (left), Deputy Director of Lehigh University's Iacocca Institute, discusses US industry's shift toward a more agile manufacturing environment with Heinz Schmitt, Sandia VP-2000 and leader of the Labs' advanced manufacturing initiative. Nagel spoke at the Labs Feb. 11.

Strong Arms, Backs

During his talk, Nagel articulated three key elements of an agile enterprise: innovative management techniques, flexible technologies, and, above all, a skilled and motivated workforce.

"For most of the 20th century, we hired people with strong arms and strong backs who would follow orders," he says. "One or two people at the top made decisions, and we concentrated on plant and equipment technologies that enhanced workers' physical abilities."

Also in the past, he says, an organization often sold the same single product or part for many years. But in agile manufacturing, he says, each part may be different. In this new environment, people's thinking abilities are what gives an enterprise a competitive advantage.

"You begin selling the abilities of the designers, the production workers, the marketing and sales people who identify market opportunities, and the R&D people who find out how to do the impossible," he says. "We're now looking for well-educated, skilled, and motivated people. They are the major asset of an agile enterprise."

In addition, says Nagel, true agility will require an unprecedented level of cooperation among organizations and businesses. This will require electronic communication technologies allowing people separated by distances to work together more efficiently. In addition, info networks will allow people at various facilities and companies to share corporate assets in temporary business arrangements called "virtual companies."

"You can't do agility alone," he says. "We must learn to communicate electronically across organizational barriers, enabling people scattered throughout organizations to make decisions."

Nagel added that the national labs are a "great collection of skills and expertise" that can be utilized to help US manufacturers make the shift to more flexible technologies. "The national labs are a previously untapped strength for meeting the US industrial mission," he says. "I see a great opportunity for the national laboratories to support industry through CRADAs [cooperative research and development agreements] and a variety of other mechanisms."

Videotapes of the colloquium are available at the Sandia/New Mexico and California technical libraries. •JG

(Continued from Page Five)

'92 BES Awards

case by dipping. The solution dries to form a porous film.

Although thin films using sol-gel techniques have been used commercially for more than 50 years, the details of film formation had not been studied systematically. Sandia researchers studied the fundamentals of the dip coating process, which, in addition to being an important technique by itself, is a prototype for other processes such as spin coating, wiper coating, and fiber formation.

The earlier lack of understanding was both obstacle and opportunity. "That's the beauty and the curse of solution deposition of films — if you understand the process it gives you a lot of flexibility in what you do with the coating," says Carol Ashley.

"Our model helps us to understand how porosity develops in the last few milliseconds of drying."

The team's work, using detailed optical and chemical experiments matched by analytical and numerical theory, resulted in a comprehensive picture of the chemical and physical processes taking place during film formation. The researchers found that the physical and chemical properties of the solution have a strong bearing on the final film structure and its porosity. One unexpected result was that evaporation was greatly accelerated near the surface where deposition occurs, highlighting the need for stringent time controls during film formation.

"Understanding the film deposition dynamics gives us insight into the film's microstrucure, which in turn governs the material properties," says Alan Hurd. "Our model helps us to understand how porosity develops in the last few milliseconds of drying."

The full benefit of the research will be realized by further exploring the important fundamental issues that have arisen in the course of this work, he says.

Second CVD Award

Research done at Sandia over the past 10 years has greatly advanced the understanding of the science underlying chemical vapor deposition (CVD) — the backbone of the nation's microelectronics industry. This work has for the second time won a BES award for materials science.

Sandians won an award in 1984 for developing the first computer model to simulate CVD's gas-phase chemistry and fluid mechanics in a CVD reactor. The model, which was confirmed by laser spectroscopic experiments, was the first to show that whole series of reactions take place in the gas phase. Previously, the accepted model was that all reactions occurred on the deposition surface.

CVD is a widely used process for producing coatings. A gas is introduced into a chamber where it deposits a thin film of solid material onto a heated substrate. It is essential in fabricating microelectronics and also has applications in electro-optics, superconductors, and the making of wear- and corrosion-resistant surfaces.

While CVD has become widespread since its rise to popularity in the 1940s, the science behind it

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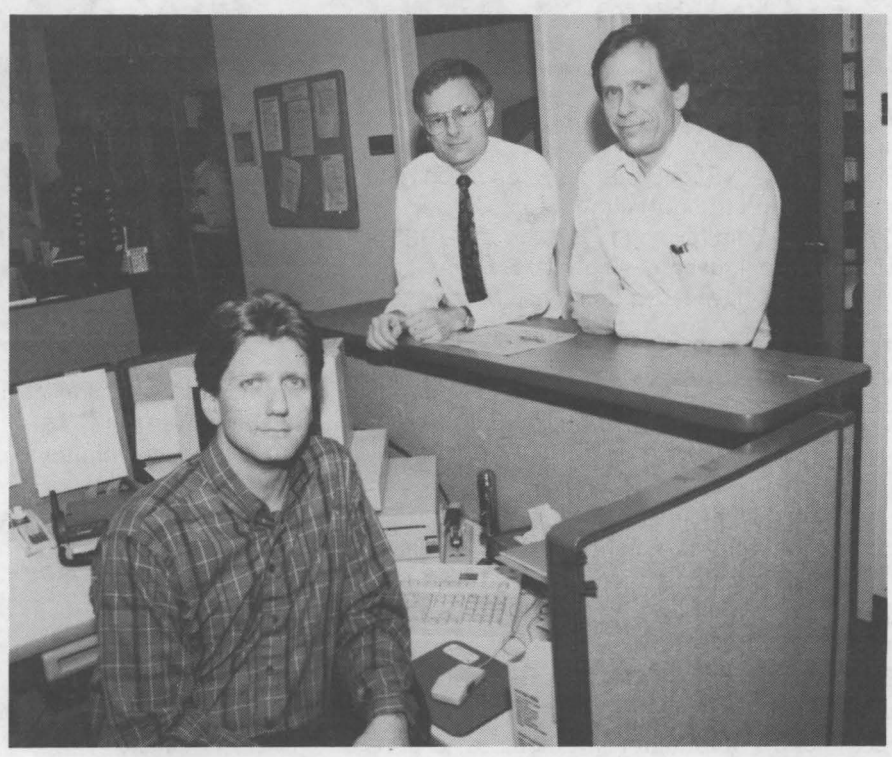

SANDIA/CALIFORNIA BES award winners are Michael Mills (8712, seated) and (left to right) Bob Kee and Greg Evans (both 8745). Michael and Daniel Miracle (not seen) of the Wright Research and Development Center won the "outstanding scientific accomplishment" award in metallurgy and ceramics for their study of how the atomic structure of a nickel-aluminum alloy relates to its brittleness at low temperatures. Bob and Greg were part of a Sandia team that received the "sustained outstanding research" award in the materials chemistry category (other team members are pictured on page one).

Framers Visualize Complete Makeover

Human Resources Rolls Out New Plan for Sandia Work Force

Question: What does Sandia's work force have in common with late 20th century manufacturing concepts, a Slinky, a just-in-time inventory system, and an Olympic high-jumper?

Answer: Agility makes all of them work.

And making the Sandia work force more agile is a core goal of the five-year strategic plan developed by a team of line directors and Human Resources (7500, 600, and 8500) program managers, and adopted in October. The plan is for fiscal years 1993 through 1997.

"We wanted to define a strategy for applying the full talents and creativity of the Laboratories' people toward achieving Sandia's long-range objectives," says Danny Brown, Manager of Human Resources Strategy Office 7590, who coordinated development of the plan.

"During the summer and fall of 1991, Human Resources managers interviewed all the vice presidents, including the two executive VPs, Orval Jones and Lee Bray," says Danny. "That was the beginning of the process. Then we surveyed department managers and what were then division supervisors.

"We analyzed their input along with information gleaned from the Sandians' Perspective Survey [widely known as the Stanek Survey], and came up with six basic issues that seemed to be the most important ones facing the Labs over the next five years," she says.

They were:

• More specific determination of the needs of the three sectors (Defense, Energy and Environment, and Work for Others) as the basis for characterizing work force composition.

• Improved response time in assigning employees to jobs, which requires better and quicker knowledge about changes in funding levels affecting Labs work, in order to exploit business opportunities.

• Increased capability for managers in carrying out their leadership responsibilities, including improvement in performance feedback and evaluation, and increased confidence in the management of Sandia's future.

• Increased skills in business and quality management.

• Improved quality of work life through decreased administrative burdens, increased attention to career paths and employee development, and strengthening of employee-business goal links.

• Greater efforts now toward diversifying our current work force as a means of establishing the framework for attracting what will be a more diverse work force of the future.

Team member Mike Robles, Director of Diversity Leadership Center 600, says the importance of the varied workforce cannot be emphasized too much. "It is of strategic importance that Sandia continue to improve its work environment, in which differences are valued and all employees are fully utilized, to improve our performance as a laboratory."

The next step, Danny says, was to work with the planning team to formulate strategies to address the issues.

Distilled from that process were four major strategic thrusts:

• Performance Management — shared formulation of performance expectations for work outcomes and ongoing management attention to coaching and developing employees.

• Laboratories Staffing — identifying the future needed skills mix and integrating hiring, internal movement, and contracting to get the right person in the right job at the right time.

• Leadership and Management Development — continuous improvement of the skills managers need to lead others and manage organizations, programs, and projects in an environment of ongoing change and an ever-increasing number of external relationships.

• Diversity — creation and continuous improvement of a work environment in which mutual acceptance, respect, acknowledgment, and opportunity are fostered for all employees.

Harry Saxton, Director of Defense Programs Sector Manufacturing Engineering & Support Center 5400, who participated as a team member, says there is a common thread connecting all the parts emphasized.

"Leadership is the key to meeting the challenges the Laboratory will face in the next decade," he says. "Management must create an environment that fosters leadership at every level at Sandia — with particular emphasis on leadership within teams."

Another important ingredient of the whole process, Danny says, was the use of Malcolm Baldrige Quality Award guidelines to set the tone of the five-year strategic plan and, hopefully, human resources planning well beyond that.

Peter Mattern, Director of Core Competency Support Center 1010 and a member of the planning team, agrees. "This kind of long-term strategic thinking and planning for our future work force is essential," he says. "And in the short term, Ralph Bonner [Director of HR Center 7500] and the people in Human Resources are already reallocating their resources to support initiatives in the strategic plan."

Ralph, like Danny, says the ingredient that was new and a departure from past such plans is that it involved the end-users of the resources — the line organizations.

"It was important that the plan be developed by the line organizations, with Human Resources providing input and project support," says Ralph. "We need more of this kind of joint effort, with those who use the resources we provide telling us in advance the kinds of resources they are going to need." •HK

Strategic Plan Briefings Scheduled Next Month

Danny Brown (7590) says summaries of the new Human Resources plan will be mailed to all Sandia employees, beginning about the end of February, and the mailing will be followed by employee briefings.

The briefings are scheduled for 1:30-3 p.m. on March 3 and March 18 in the Technology Transfer Center (Bldg. 825). At least one of those sessions will be video-linked to Sandia/California, although it has not been determined which session it will be.

Members of the Strategic Human Resource Planning team are: Melodie Eyster (150), Mike Robles (600), Peter Mattern (1010), Ron Andreas (2300), Maureen Baca (4309), Virgil Dugan (4500), Paul Shoemaker (4514), Harry Saxton (5400), Dennis Hayes (5600), Dick Lynch (6100), Jim Martin (7400), Ralph Bonner (7500), Dick Fairbanks (7521), Marv Torneby, Karen Gillings (both 7531), Charles Mika (7542), Ed Cassidy (7550), Danny Brown, Donna Filip (both 7590), Mim John (8100), Pat Smith (8522), and Sam Varnado (9900).

New Mexico, California Sessions

Employee Dialogues Scheduled Next Week

Labs President Al Narath will talk with all employees during quarterly dialogue sessions next week. Topics that Al will address include the transition to a new management and operating (M&O) contractor, DOE's mission, and the Labs' accomplishments in achieving its strategic intent. All Sandia employees are encouraged to attend one of the sessions at their location.

Sessions at Sandia/New Mexico will be held Tuesday and Wednesday, Feb. 23 and 24, in the Technology Transfer Center (Bldg. 825). Employees may attend either day, but because of limited TTC space they are requested to attend according to last-name initial:

Feb. 23:	9:30 a.m.	A-L
	11 a.m.	M-Z
Feb 24:	8:30 a.m.	A-H
	10 a.m.	I-R
	1 p.m.	S-Z

Dialogue sessions at Sandia/California will be Thursday, Feb. 25, at 8:30 a.m. and 10 a.m. in the Bldg. 904 auditorium. Employees with last names beginning A-L should attend the 8:30 a.m. session, and those with last names beginning M-Z should attend the 10 a.m. session. •

(Continued from Preceding Page)

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was not well understood. Sandia's CVD program was launched in the late 1970s, specifically to improve silicon deposition for photovoltaics applications. The focus later shifted to microelectronics and recently ventured into research on diamond films.

"In order to improve a process or to be able to manipulate it for special needs, you need to know the basic physics and chemistry behind it," says researcher Bill Breiland.

Due to the pioneering nature of their work, the Sandians had to develop a variety of tools for their studies, including computational and laser diagnostic methods. They also used high-level theoretical calculations to obtain needed thermochemical data.

Recent work has focused on improving alternate CVD reactor designs. They chose to design their own version of a rotating disk reactor because it was ideally suited for basic research. This work is now being applied by industry to build the next generation of reactors.

Sandia recently shipped a scaled-up rotating-disk reactor to SEMATECH (a consortium of semiconductor manufacturers) for use in CVD process development programs. "The event is noteworthy because it shows the possibility of taking a concept developed under BES and developing it into a real product," says Bob Kee.

For their pioneering work on chemical vapor deposition, a Labs team had to develop new research tools.

The CVD work has generated substantial interest from industry. Currently, CVD researchers have established four cooperative research and development agreements (CRADAs) with industry; five more are in the works. •JClausen(7161)

Sympathy

To Terri Chiarella (7560) on the death of her father in New York, Dec. 12.

To Gary Montague (7733) on the death of his mother-in-law in Silver City, N.M., Jan. 18.

More Options, Flexibility

Sandia Plans Savings with New Savings Plan

Analyses, audits, and planning for the transition to a new management and operating contractor have been going on at Sandia since last May, and now the first "real" change in that direction is finally about to happen — to a new savings plan administrator.

The selection of Fidelity Institutional Retirement Services Company to service the new plans was announced early last month, and a team representing the Labs and Fidelity has been working out details of the transfer from the AT&T savings plans since then.

The new plans will be established June 1. The complexity of the changeover — in particular the valuation and reconciliation of account balances to be transferred — also will necessitate a period (probably about three months) during which transactions within savings plan accounts will be limited. Specifics on this and other plan features will begin appearing in Sandians' mailboxes soon.

Information by Mail and Mouth

Detailed information about the new Sandia plans — which include more investment options and greater flexibility than the existing plans — will be mailed in advance of presentations at the New Mexico, California, and other locations. Presentations by Fidelity are being planned for all participants, including retirees.

Here are comparison features of some points of both the existing and the new plans:

• Eligibility, employee contribution levels, and company matching contributions will remain the same for the new plans as they are currently. The frequency of changes participants can make to their contribution levels and pre-tax/after-tax investment mix are still being discussed.

• Investment options currently include AT&T Shares Fund, Guaranteed Interest Fund, Diversified Equity Portfolio, and South Africa Restricted Fund (and for the Long Term Savings Plan for Management Employees, the Government Obligations Fund). New options being considered for both plans will be the Interest Income Fund (essentially the same as the Guaranteed Interest Fund), Fidelity Short-Intermediate Government Portfolio, Fidelity Balanced Fund, Fidelity Growth & Income Portfolio, Fidelity US Equity Index Commingled Pool, and Fidelity Contrafund.

People with investments in the AT&T Shares Fund will not be able to make further contributions into that fund after June 1, 1993, but the existing balances will be maintained until transferred to another fund or withdrawn. Dividends will no longer be reinvested in that fund. Instead, dividends will be invested in the other plan options in the same allocation as the investment direction chosen by each participant. Transfers out of that fund are allowed and will be required no later than the end of five years after the successor plans begin.

Although many employees have expressed a desire to keep the AT&T shares option, US law prohibits a 401(k) plan from offering single-company stock unless it is the stock of the company offering the plan. Since Sandia will no longer be an AT&T subsidiary after Sept. 30, 1993, this option can no longer be available.

• Contributions to investment options in the present Long Term Savings Plan for Management Employees are limited to all in one fund or equal parts in two or three funds. Contributions in the present Long Term Savings and Security Plan are limited to all in one fund or equal parts in two funds (with employer matching contributions directed to the AT&T shares fund). The proposal provides for investment in any combination (except the AT&T Shares Fund) in 10-percent increments, for both plans.

• Changes in investment direction are now allowed only four times a calendar year; the new plan's proposal will allow changes daily, in 10-percent increments.

• Transfers of existing fund balances now are allowed four times each calendar year in 10-percent increments; the new plans propose allowing such transfers daily, but still in 10-percent increments, and any multiple of 10 can be used. (For example, participants may transfer existing balances of 10, 20, 30, 40, etc. percent.) Both the current and new plans impose some restrictions on transfers among the Bond and Guaranteed Interest Fund (renamed Interest Income Fund), since they are competing funds.

• A major change will be in the valuation of account balances and frequency of participants' statements. The current plan assets are valued at the end of the month and participants can call for the prior month's ending balances in their accounts. Participants' statements are issued semi-annually. The new Sandia plans will have assets valued daily, and quarterly statements will be provided to participants. Participants will be able to call and receive their account balances as of the close of the market the prior day, or the close of that day if they call after the market closes.

May Add Investment Options

Rebecca Spires (7542), project manager of the new savings plans, says Sandia's primary goal was to initially provide plans similar to the existing ones.

"But the latitude we have now gives us much greater flexibility," she says. "For example, we are launching the new plans with more investment options than we have now, and we have the flexibility to add investment options later."

Rebecca says the investment options in the new plans comprise both the familiar options and three new additional funds with broader risk and return characteristics.

She says participants should not call American Transtech about the transition period or the new plans since the company's phone operators are not prepared to answer those kinds of questions.

"Material will be sent to participants, and there will be ample opportunity to ask questions both by phone calls to Fidelity and in meetings," she says.

Also, she asks that participants update their current addresses with their department secretaries, and that individuals who are retired or who terminated with money still in the savings plans, or employees who are on leaves-of-absence, notify the Benefits Office of their new addresses so the new Sandia Corporation Savings Plan information can reach them. •HK

Transition Pace On Schedule

Sandia's transition from AT&T to a new management and operating contractor is "on schedule," according to Labs and DOE officials involved in the process.

"We're on schedule and evaluating proposals," says Dennis Krenz, chairman of DOE's Source Evaluation Board (SEB). "We hope to have a competitive range [from those offering bids on the contract] determined by late March."

Jack Hickman, Manager of Transition Program Office 33, says the news is about the same from Sandia.

"Our internal preparations for a smooth transition are proceeding on schedule and according to the program plan," says Jack.

"Although we have no insights on the progress of the evaluation process now under way at DOE, the SEB has, in the past, demonstrated the ability to maintain schedule," he adds. "So I expect them to have their initial evaluation completed by the end of March and then begin discussions with those offerors in the competitive range."

VERIFICATION ISSUES drew understandable interest from both sides during a conversation between David Kay, right, Secretary-General of the Uranium Institute in the United Kingdom, and Tom Sellers, Director of Monitoring Systems & Technology Center 9200, late last month. Kay, who presented a colloquium at Sandia, gained overnight media attention in the aftermath of the Persian Gulf War when he led a team of inspectors who were held in a Baghdad parking lot after Iraqi officials refused for a time to allow them access to suspected weapons information. Tom is holding a Cobra Seal, a fiber optic bundle that can be attached like a bicycle cable lock to equipment whose use is restricted or prohibited. When the loop is attached, it creates a pattern that is recorded by the Cobra Seal Verifier Kay is holding. The pattern can be checked by the Verifier later to determine whether the object being monitored has been tampered with. The equipment is used in treaty verification work.

Sandia News Briefs

Sandia to Co-sponsor National Security Seminar

Labs President Al Narath is scheduled to deliver a luncheon address March 12 during a National Security Seminar co-sponsored by Sandia and the Reserve Officers Association. The luncheon will be held at the Kirtland Air Force Base NCO Club; the seminar is at the Base Theater.

The theme of the all-day seminar is "Policy Options for a Changing National Strategy." Featured speakers include former US Ambassador Richard Staar; Lieutenant General Daniel Graham, former Director of the Defense Intelligence Agency (DIA) and Deputy Director of the Central Intelligence Agency and founder of High Frontier; and Elizabeth Pickering, Professor of Soviet Studies at the DIA's Defense Intelligence College and US inspector for the Intermediate-Range Nuclear Forces (INF) Treaty. Sandians who want to attend should send a $15 check (includes lunch) to LTC Andrew Rosenau, 1408 Willys Knight Dr. NE, Albuquerque, NM 87122. For more information, call Lewis Roach (7612) on 844-0838.

Last Labs-Developed Insulin Implant Removed from Patient

The last implantable Insulin Delivery System (IDS) developed by Sandia was surgically removed from a human patient on Dec. 14, 1992. The Sandia IDS, designed for a two-year implant life (limited only by battery capacity), remained in the patient for more than nine years. Except for the dead battery, the removed IDS was still functional, showing little indication of mechanical fatigue or corrosion.

Sandia designed and developed the implants from 1979 to 1983, and UNM's School of Medicine performed the world's first three human implants using Sandia IDSs beginning in January 1981. In 1983, the technology was transferred to industry. Since then, approximately 680 people worldwide have received industry versions of the implants. For more information, contact Ruben Urenda (2643) on 844-3866 or Jerry Love (2337) on 845-8202.

Gloria Chavez Elected to Health Physics Society Board of Directors

Gloria Chavez, Manager of 7000 ES&H Coordination Dept. 7002, was recently elected to the Health Physics Society's board of directors by its general membership. She will serve a three-year term beginning July 11. The Health Physics Society is an international society with more than 6,000 members. Approximately 30 members are Sandians.

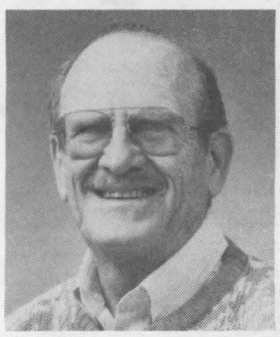
Local Workshop Fosters Interaction among DOE Mathematicians

More than 80 researchers from DOE's math and computer science community gathered at the Albuquerque Marriott Feb. 3-5 to attend an Applied Mathematics Workshop sponsored by DOE's Office of Scientific Computing (OSC). Richard Allen, Manager of Applied and Numerical Mathematics Dept. 1422, coordinated the workshop.

The goal was to encourage technical interaction and formal collaboration among DOE's math and computer science researchers. Forty talks and 20 poster sessions described a variety of current applied mathematics research supported by OSC.

Send potential Sandia News Briefs to LAB NEWS, Dept. 7162.

Recent Retirees



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Don Peterson
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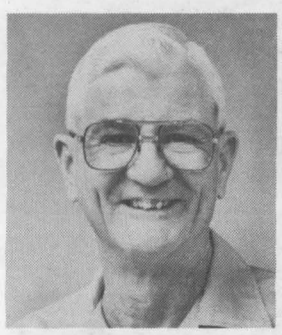

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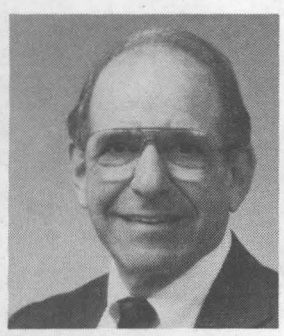

Ben Bader
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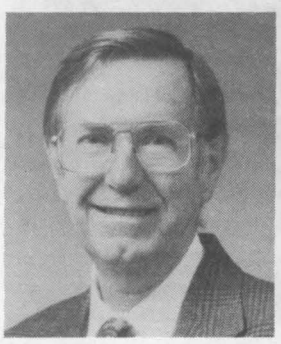

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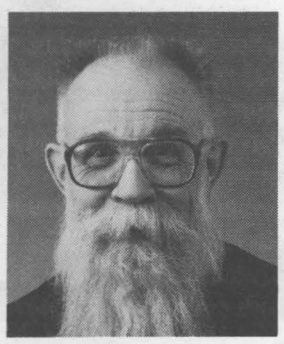


Gus Simmons
700 33

this month in the past...

Sandia LAB NEWS

40 years ago...In the "best intentions" department: An ad offered an *Encyclopaedia Britannica Junior* set with atlas and four yearbooks, admitting that "most volumes have never been opened." Speaking of books, the Sandia library had been founded a few years before and was growing, but perhaps a LAB NEWS caption exaggerated when it said, "The answers to almost all technical problems can be found in the technical library." No record exists of laboratory experimenters' or field testers' responses to that claim.

30 years ago...A feature article about the purchasing organization noted that in the previous calendar year, Sandia spent $13 million in New Mexico for goods and services. (During fiscal 1992, the Labs purchased $291 million worth of goods and services in New Mexico and $133 million in California.)

25 years ago...A Sandia team was using the Sandia Peak Tramway as a platform for studying return of radio-frequency signals from uneven terrain. It was chilly duty: The Sandians had access to the tramcar only during the frigid hours of 6 to 9 a.m. The tramcar was used to carry two racks of electronic equipment, with a movable antenna suspended in front.

Deliberately Disgraceful

By Semi-popular Demand, Here Are the 'Buzziest' Buzzwords

By Charles Shirley, Managing Editor

During the past couple of weeks, a muffled buzzing hung over the Tech Areas as buzzphrase crafters honed their best efforts and mailed, faxed, or carrier-pigeoned them to the LAB NEWS.

Our panel of judges — LAB NEWS staffers — was allowed to name only one winner (see "This & That," page two), but so many of the entries provoked their ire (or hilarity), they insisted that some of the "dishonorable mentions" be included. (The judges actually suggested that these "buzzword paradigms be socialized," but that's best not repeated in polite company.)

Here are some they thought you would particularly enjoy, with the names of the person ("champion"?) who submitted each:

"Process owners and stakeholders responsible for socializing the SNLA to SNL/New Mexico name change championed a quality, win-win project for Sandians who walk the talk." — Michael Widmer (7322).

"Empowering others to act to shift the paradigm and confront the status quo models the way to encouraging the heart and prevents a dysfunctional infrastructure." — Robert Moats (8643) submitted this buzzphrase, but he tried to throw the judges off by crediting the sentence to "Foster Collaboration."

Cliff Renschler (1812) offered a dishonorable-class sentence — "What this laboratory really needs is a proactive champion to first empower, and then actualize, a paradigm of teaming, while partnering to leverage our infrastructure" — but what hurt most was his note that "I found 21 of my words in the last issue of the LAB NEWS." (We'd like to think his count included "what," "and," and "to.")

"The bottom line is the demographic diversity of our programmatic infrastructure, which necessitates a paradigm shift to introduce synergy into our human resource assets." — Paul Heppner (8476).

The judges weren't sure whether this was an entry or a social comment, but they couldn't pass it up: "The Road Show's expressive champion socialized 'How to Grow a Total Quality Strawman on Benchmark Metrics,' proving the lesson's learned, but is it SAFE?" — Amy Tapia (6900).

For pure obfuscation, it's hard to beat this entry of John Orman (2864): "The report timeframe terminating this quantum has scoped optimal self-actualization in nurturing a meaningful clarification throughput for viabilizing the contingent objectives prioritized."

In the end, we found we had enough notable entries to establish a new institute for the further study of buzzwords — to be called the National Advanced Center for the Advancement of Champions for Paradigm Socialization (thanks to Renae Perrine, 6200, for a win-win title that's going to look mighty nice on the letterhead). •

Welcome

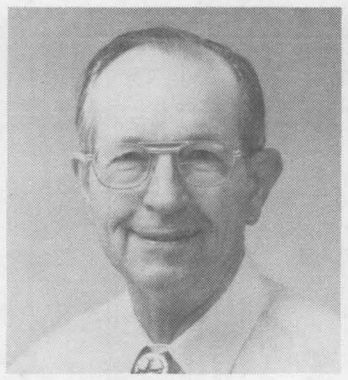
Albuquerque — Rarilee Conway (7723), Boyd Hamilton (7721), Marjorie Kirkel (151), John Rhoads (5513), Karen Rullman (21), Cecelia Williams (6621). *Other New Mexico* — Ronald Malpass (7433), Renee Montoya (154), Bayard Roberts (7214), Ronald Williams (7180).

Elsewhere: *New Jersey* — Dwayne Knirk (326); *Pennsylvania* — Sally Liu (1333).

MILEPOSTS

LAB NEWS

February 1993



Melvin Brock
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Denise Finley
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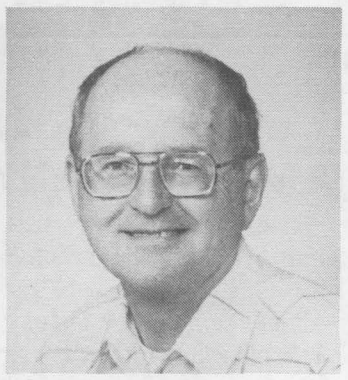

Carl Furnberg
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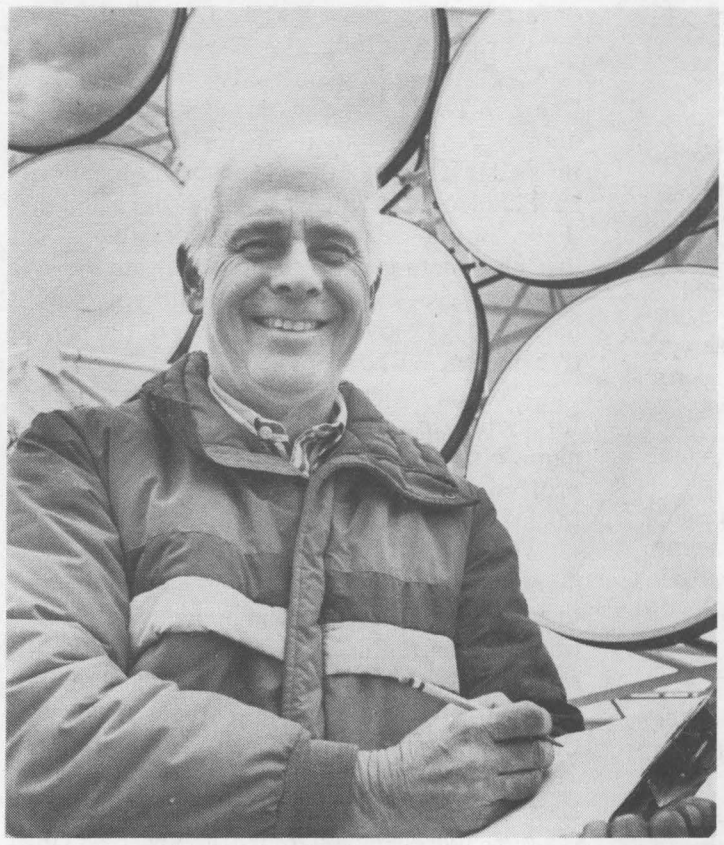

Wayne Erdman
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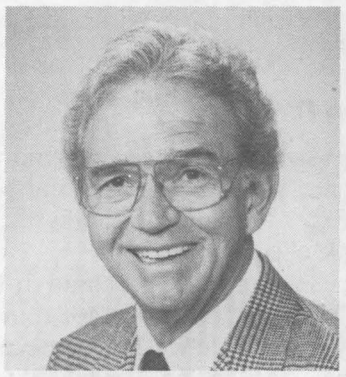

Jack Pons
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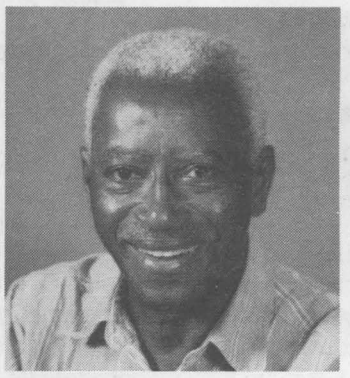

Clyde Taylor
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Mary James
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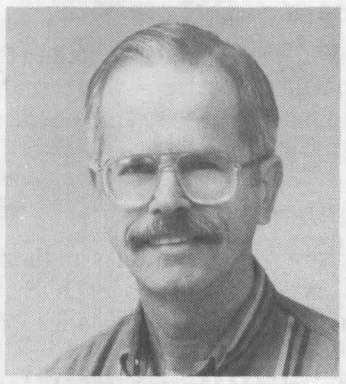

Doug Schuler
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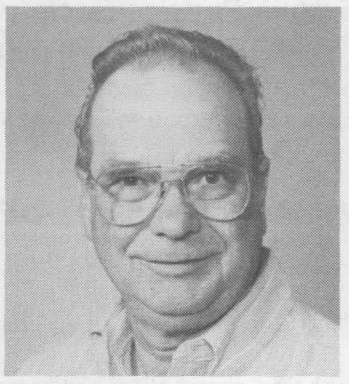

Carl Wackerly
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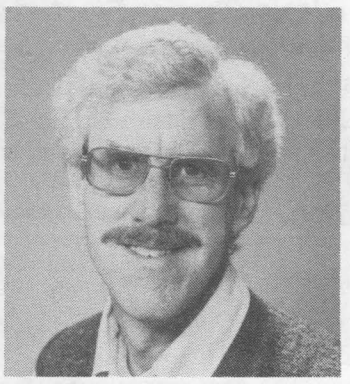

Carl Melius
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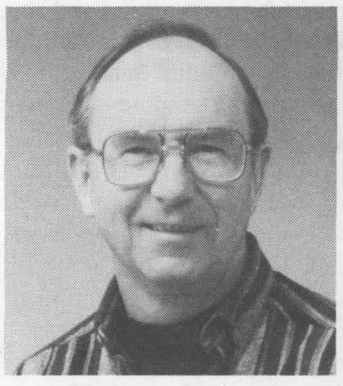

Larry Seamons
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Tamara Orth
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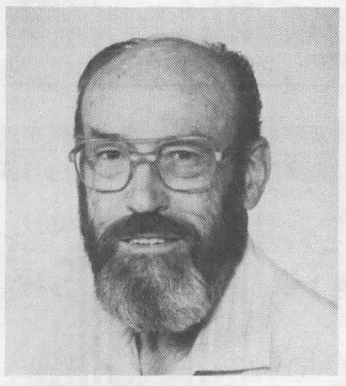

Jim Gruver
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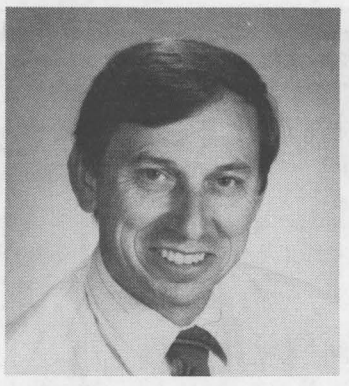

Hermann Folkendt
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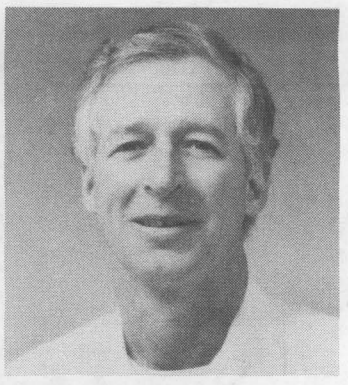

Vic Schulze
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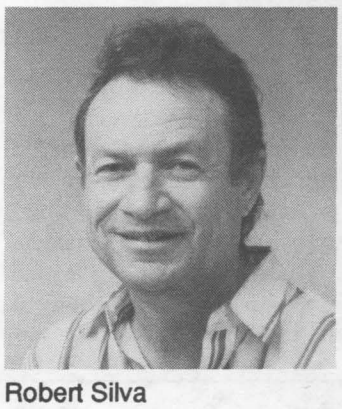

Robert Silva
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Emily Joiner
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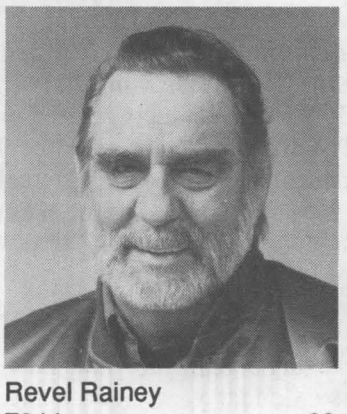

Revel Rainey
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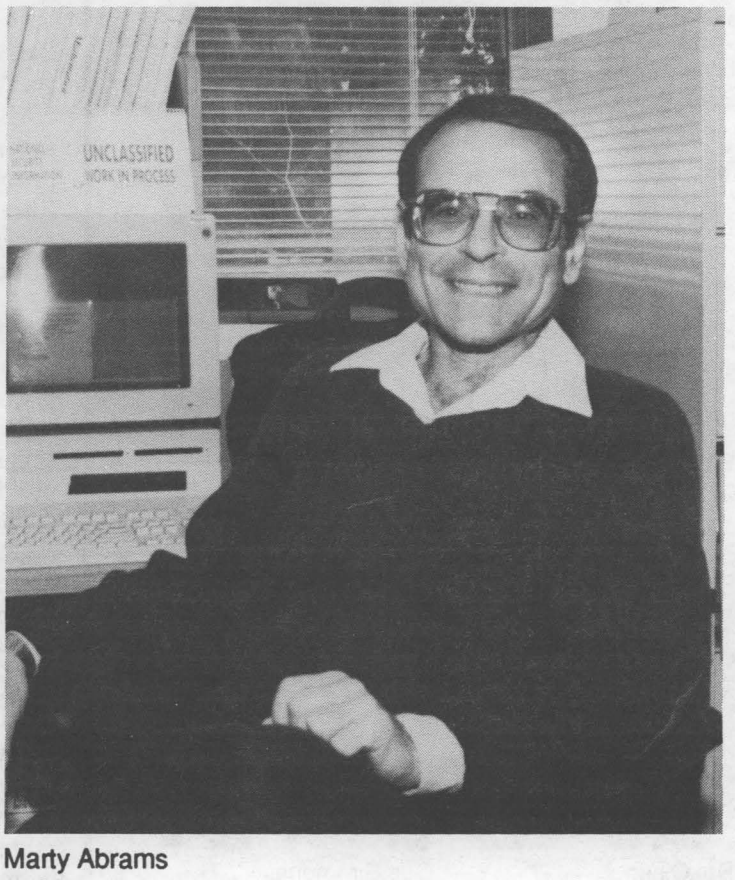

Marty Abrams
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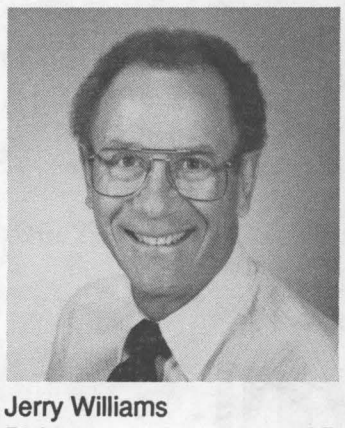

Jerry Williams
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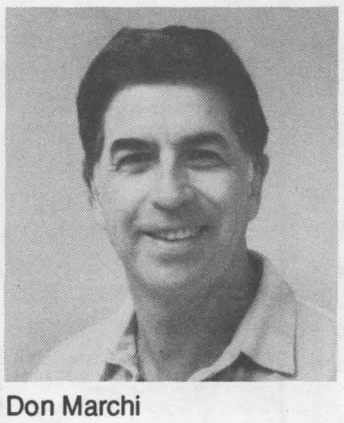

Don Marchi
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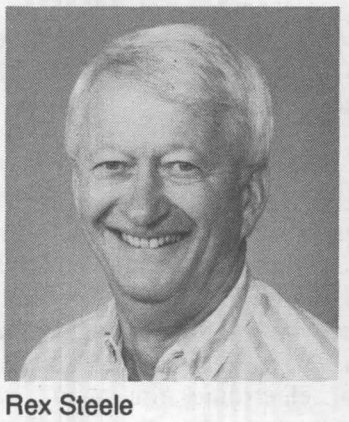


Rex Steele
8281 30

feedback

Editor's Note: This is a much-condensed paraphrase of a lengthy inquiry about specific classes and an equally lengthy and detailed answer to that inquiry. We thought, though, that the general subject might be of interest to Sandians.

Q: I am a secretary interested in broadening my skills through Sandia's educational programs. The opportunities are very much appreciated and I plan to take advantage of them. I am concerned, however, that some courses are being canceled—some of them without thoughtful consideration. I think it is particularly important to maintain a variety of offerings in the Out-Of-Hours Program because most of us have to be at our desks during normal business hours. Does Sandia intend to continue offering courses like these?

A: An April 1991 survey indicated there was an interest in after-hours classes, so Sandia offered them. Over a period of several months, however, low enrollment showed the interest was not as great as had been expressed. Based on that recent experience, classes after hours were not successful and we have no current plans to offer them. We will, however, explore that possibility again in the future.

Meanwhile, to meet the needs of those who would like to have classes after hours, Jean Chapman, manager of Creative Computer Services, has agreed to arrange one-on-one customized instruction. Anyone interested in this arrangement may call Jean at 255-7563 to discuss cost and other details.

Ralph Bonner (7500)

UNCLASSIFIED ADVERTISEMENTS • UNCLASSIFIED ADVERTISEMENTS • UNCLASSIFIED ADVERTISEMENTS • UNCLASSIFIED ADVERTISEMENTS

Deadline: Friday noon before week of publication unless changed by holiday. Mail to Dept. 7162.

Ad Rules

1. Limit 20 words, including last name and home phone (the LAB NEWS will edit longer ads).
2. Include organization and full name with each ad submission.
3. Submit each ad in writing. No phone-ins.
4. Use 8½- by 11-inch paper.
5. Use separate sheet for each ad category.
6. Type or print ads legibly; use only accepted abbreviations.
7. One ad per category per issue.
8. No more than two insertions of same "for sale" or "wanted" item.
9. No "for rent" ads except for employees on temporary assignment.
10. No commercial ads.
11. For active and retired Sandians and DOE employees.
12. Housing listed for sale is available for occupancy without regard to race, creed, color, or national origin.
13. "Work wanted" ads limited to student-aged children of employees.

MISCELLANEOUS

SHOP MANUALS, for '88 Cherokee, '86 Maxima, '82 Celica, '78 Challenger, & '74 Datsun 710; $10/ea. or all for $40. Miller, 281-4397.

TWO-PERSON KAYAK, Aquaterra, excellent condition, light weight, fiberglass, adjustable feathering paddles included, $350. Koch, 296-2923.

COMPUTER, Packard Bell 386sx, 16 2MB RAM, 40-meg. HD, no monitor or mouse, like new, $425. Bordlemay, 883-4926.

SOFA SLEEPER, 70-in., plaid, like new, $100 OBO. Bland, 265-6286.

AUTO PARTS: Jeep CJ 5&7 doors, soft top; some motor parts; stock 15-in. wheels; HD Ford Ranger mini-rear bumper, $40. Mulder, 294-5858.

McCLEAN WHEELS, 15 X 10 reversed w/15 50 tires, 6-hole pattern, excellent condition, set of 4, $700. Montoya, 869-3346 (home) or 857-1737 (pager).

WEIGHT BENCH, free standing, made by Marcy. Gallegos, 867-6284.

AUTO PARTS, too many to list, call and I will mail you the list. Chavez, 842-6374.

BAR STOOLS (3), wooden, w/swivel tops, back & arm supports, fruitwood color, sturdy. Branstetter, 292-5978.

CEMETERY LOTS, five adjoining, in Sunset Memorial Park, must sell, $650/ea. OBO. Summers, 881-7765.

BABY ITEMS: crib, $75; Swing-O-Matic, $25; playpen, $10. Schofield, 268-8011.

TRAVEL PACK, new REI "Tashkent," w/integral shoulder straps, good padded waist belt, & detachable fanny pack, gray, $115. Brammer, 266-5158.

PUPPIES: Dachshund, AKC-registered, black; Doberman, AKC-registered, 1 black, 1 red, 1 blue; $200/ea. Puccini, 255-0568.

SKI BOOTS, cross-country, size 41 (shoe 8), 3-pin, for light touring, $10. Lorence, 275-3586.

SNOW GOOSE DECOYS, 3 dozen G&H field decoys, excellent condition, $140. Savage, 296-0528.

SEARS EXERCISE BIKE, $20; Radio Shack computer chess game, w/110-volt power supply, $10. Prior, 281-5532.

REESE EQUALIZER HITCH, 750-lb. rating, $130. Ross, 821-6366.

BACK SAVER CHAIRS, $25/ea. or 2 for $40; exercise trampoline, small, $40; large safe, $50; dress form, $20. Mozley, 299-4204 or 265-2625.

DOGHOUSE, for small dog, well built, never used, $40. Whelan, 255-3529.

ENTRY LOCKSET, w/keyed-alike dead bolt, 3 sets, $25 for all, extra keys. Booker, 299-3554.

CHINA, Franciscan Ware, Desert Rose, 9 cups & saucers, $8/set OBO; printer, Star Model NX1000, new ribbon, manuals, excellent condition, $50. Patrick, 883-1413.

DRUM MACHINE, w/manuals, Model DR110, $75; MXR distortion pedal, $30; Hitachi color TV, 13-in., $75; all items OBO. Schultz, 275-9349.

MICHELIN TIRES, one pair, X24 P215/70R 15 MS, good condition. Wagner, 823-9323.

SHOP HOIST, 4-ton industrial, boom height 48"-120", continually adjustable lift range 0"-120", boom extension 48"-84", base width 46"-72", $225. Snelling, 294-5751.

HIGH CHAIR, Fisher Price, good condition, $20. Denaple, 298-2778.

LAPTOP COMPUTER, NEC multispeed 640K w/two 3.5-drives, CGA output, manual & charger, $225 OBO. Hassig, 292-3350.

NORTHWESTERN GOLF CLUBS, woman's, 3, 5, 7, & 9 irons & putter, 1 & 3 woods, Voit golf bag, $95. Sheehan, 821-3607.

PIANO, Yamaha studio model, excellent condition. Assink, 345-2957.

TELESCOPE, Unitron, 60mm refractor w/Alt-Az mount, folding wooden tripod legs, finder scope, wood storage box, $250. Van Den Avyle, 898-6474.

TWIN BED, w/wood headboard, bedspread & sheets available, $100 OBO. Stoever, 296-3717.

CONSOLE STEREO, Magnavox, radio works, 4-spd. turntable does not, nice piece of furniture, $25. Roeschke, 266-8988.

TRAILER HITCH, frame mount for '92 Olds 88 or similar chassis, 3,500-lb. capacity, $55. Holmes, 292-0898.

SOLOFLEX, w/leg extension add-on, like new, never been used, $550. Hotchkiss, 268-0266.

HIDE-A-BED, blue flower design, good condition, double bed, $150; dresser, 54"L x 33" H, 6 drawers, foggy mirror, painted, $100. Graham, 836-2752.

COATS: full-length, brown suede w/fox trim on collar & hem; gray quilted down coat, 3/4-length. Locher, 266-2021.

TURBO PASCAL 6.0, new, all manuals, $45; lawn mower, push-type, w/grass catcher, good as new, $50. Harris, 822-0236.

CAMERA, Konika FT-1 motor, lenses include 40mm, 135mm, 70-210mm & 2X extender, filters, flash, good condition, $250 OBO. Ohlhausen, 271-1240.

PRINTER, Epson LX810, NLQ, $125. Edenburn, 869-2911.

TEKTRONIX OSCILLOSCOPES: 454 150 Mhz, $525; 556 50 Mhz, $175; 151 gigahertz sampling plug-in, $250. Frost, 293-4676.

TRUNDLE BED SET, including mattresses, $85; 6-drawer dresser w/mirror, $100; 4-drawer bureau, $75; student desk, $75; chair, $25. West, 296-1483.

GAS LOG SET, 24-in., complete, $200. Baca, 265-2881.

PLACE SETTINGS, 4, Pfaltzgraff Yorktowne, lots of extras; Moulinex vegetable juicer, used twice. Sorrell, 292-0874.

TICKETS TO "THE BEACH," '93 season, admit one person, Little League fundraiser, regularly $9.50, sell for $6.50/ea. Noriega, 867-5735.

QUEENSLAND HEELER PUPPY, female, 6-mos. old, housebroken, all shots, found abandoned, very smart, free to caring home. Adams, 823-1845.

'85 SCOTTY CAMPING TRAILER, 16.5 ft., self-contained, very clean, tandem wheels, spare, refrigerator, furnace, AC, canopy, more, $3,500. Hueter, 299-7263.

ELECTRIC BLOWER, Craftsman, w/vacuum attachment; wheel chair, Everest Jennings, w/footrest; bedside commode. Pitti, 256-1629.

SNOW & MUD TIRES (2), w/rims, 205R-15, 5-bolt GM, $30. Harstad, 298-6551.

CONSOLE TV, 25-in., cable-ready, w/remote, excellent picture, $250 firm; Salomon ski boots, size 11, $30. Apodaca, 294-5525.

BUMPER POOL/GAME TABLE, play pool, cards, or use as a dining table, balls included, $100. Etheridge, 888-2633.

TOW BAR, "Blue Ox," $195; credenza, dark brown, $25; radio mounting kit for Honda or Acura, $5. Van Deusen, 299-4328.

SEWING MACHINE, Emdeko Mark V, w/carrying case, works great, $65. Simon, 899-0109.

LOBO BASKETBALL TICKETS, for Utah & BYU games, 3 seats for each game, $78 for all. Redmond, 899-9744.

NINTENDO SYSTEM, infrared remote w/4 controllers, Super Mario Brothers & Volleyball included, adult owned, $75. Smith, 298-5868.

CAMERA, Canon T-90, w/extra lens (28mm to 300mm), 300TL speed lite flash, mint condition, $575. Bowland, 256-1861.

BENTWOOD ROCKER, thick wood, nice condition, $30; child's bean bag chair, royal blue, $10. Johnson, 299-5459.

PIANO, professionally restored, mahogany, 5'2", $3,500 OBO; Casio PMP-400 keyboard, $100; desk chair, $10. Hamilton, 271-8643.

KITCHEN CABINETS, 6 wall, 4 base, butcher block counter top, 11-1/2-ft., available around March 15, $275. Coalson, 298-0061.

HIGH CHAIR, $15; coffee table, cherry wood w/glass, $50; secretarial desk, $100; two chairs, $25/ea.; all OBO. Lowe, 299-7725.

CREDENZA, maple wood & finish, 2 pull doors, magnetic latches, 2 levels, 60"L x 18"W x 30"H, $55; three Persimmon woods, $45/ea. Stang, 256-7793.

KODAK SLIDE PROJECTOR, stack loader & 8 boxes of slide clips, $250 OBO. Korbin, 821-8461.

TRANSPORTATION

'73 FORD GRAND TORINO RANCHERO, no engine, chrome wheels, camper shell. Gallegos, 247-9284.

'74 INTERNATIONAL WORK TRUCK, 3/4-ton, w/utility bed, 64K original miles, excellent condition, $1,995. Green, 989-3791.

BICYCLES: Woman's Fuji Gran Tourer, black, 10-spd., like new, $85; man's Schwin LeTour, yellow, 10-spd., $50. Frames, 344-6451.

GIRL'S BICYCLE, Diamond Back, 20-in., $50; AMF tricycle, 12-in., $5. Prior, 281-5532.

'87 DODGE RAM 150, LWB, 318, AT, AC, PS, PB, stereo, 90K miles, runs great, asking $3,700. Jones, 247-3455.

'90 CHRYSLER GRAND VOYAGER SE VAN, AT, PS, PB, AC, cruise, tilt, AM/FM cassette, $13,500. Caton, 281-9420, between 6 & 9 p.m.

'78 OLDS CUTLASS SALON, for parts, front damage, otherwise excellent condition, driveable, low mileage, V-6 & T350 transmission, $500. Zaffery, 294-6768.

'89 CHEV. S10 PICKUP, silver, AC, 37K miles, AM/FM stereo, excellent condition, $4,500 OBO. Moya, 877-9765.

'91 FORD F150 XLT PICKUP, all power, cruise, dual tanks, hitch, matching camper shell, lots more, $13,900 OBO. Rowe, 299-0961.

REPOS: '86 Ford F150 Supercab pickup, XLT Lariat package, 1/2-ton, 8-cyl., AT, 132,750 miles; '92 Geo Prizm, 4-dr., 45,550 miles, AT; bids accepted through Feb. 24; we reserve the right to refuse all bids; subject to prior sale. Sandia Lab FCU, 293-0500 ext. 344.

'92 TOYOTA PICKUP, base model w/rear bumper, flaps, 7K miles, like new, $6,700 OBO. Turner, 281-4264.

CHILD'S MOUNTAIN BIKE, REI Novara, 14-in., 12-spd., red, $120. Van Den Avyle, 898-6474.

BOY'S BICYCLE, Schwinn, 10-spd., very good condition, $50. Harris, 822-0236.

'85 ESCAPER RV, 21-ft., 16K miles, generator, loaded, excellent condition. Mathis, 255-9944.

'78 CHEV. CAMARO, V8, 96K miles, AT, PS, PB, AM/FM cassette, $1,500. Jewell, 293-4838.

'87 PORSCHE 944s, immaculate condition, only 19K miles, loaded, red, $13,800. Johnson, 898-8439.

'92 BOUNDER MOTORHOME, 32-ft., diesel pusher, 10.6 mpg, basement model, fully equipped, TV, VCR, roof AC, must sell, below book. Hall, 892-7819.

'90 HONDA CRX, AC, AT, new condition, 36K miles, $8,700. Hanes, 292-6512.

'84 MAZDA 626 LX, 2.0 diesel, 5-spd., 4-dr. sedan, AC, cruise, power everything, great condition, $4,000. Silva, 254-9230.

'73 PORCHE 911T, coupe w/sunroof, good condition, new dash, runs great, $6,000. Armstrong, 254-9230.

'83 ELDORADO MOTOR HOME, 27-ft., 460, PS, PB, 2 ACs, completely serviced, 6 new radials, loaded, excellent condition, asking $17,900. Smith, 292-6425.

'86 HYUNDAI, hit front, not running, for parts, $75. Robertson, 299-7561.

'84 FORD LTD, AT, PW, PL, PS, 93K miles, runs, needs work, good body, $950 OBO. Johnson, 296-1917.

'67 PONTIAC BONNEVILLE, 4-dr., AC, PS, PB, rebuilt engine, $700. Jones, 883-2554.

'87 JAMBOREE RALLYE MOTORHOME, 26-ft., Class C, 460 Ford engine, sleeps 6, awning, cruise, 54K miles, excellent condition, $21,000. Pasko, 294-9728.

'82 HONDA CIVIC, 5-dr. wagon, 76K miles. Wilcox, 899-8356.

REAL ESTATE

3-BDR HOME, 2 baths, Nor Este, professionally landscaped, backs to greenway, landscaped atrium, tile roof, large patio & kitchen, sale or rent. Young, (703) 415-3461.

2-BDR. HOME, double carport, South Valley, next to shopping center, by owner, best offer. Sanchez, 873-4281.

3-BDR. DOUBLE-WIDE, on foundation, on 1/2 acre, west of Edgewood, Moriarty school district, assumable mortgage at SLFCU, $68,000. Morrow, 281-9607.

3-BDR. HOME, 2 baths, carport, 1,456 sq. ft., on 2 acres fenced mountatin property, trees, 16 miles from base. Miller, 281-4783.

WANTED

PICKUP SHELL, Leer top or Snug top to fit '89 Mitsubishi Mighty Max Macro Cab. Montoya, 869-3346 (home) or 857-1737 (pager).

FILMSTRIP PROJECTOR, 35mm, to borrow or rent. Eley, 255-2617.

MACINTOSH COMPUTER, 2 MB RAM, hard disk, Macintosh Plus, Classic, LC, SE, SE-30, or any Macintosh II model. Castillo, 836-4213.

ROOMMATE, male or female, 3-bedroom house, 2-car garage, large yard, $300/mo. + 1/2 utilities. Ewen, 836-3563.

OLD LP RECORDS, 33 rpm, prefer classical & jazz, will buy collections. Van Den Avyle, 898-6474.

NORDICTRAK, in good condition. Stoever, 296-3717.

MACHINIST TOOL BOX, w/7 drawers, good condition. Harstad, 298-6551.

INSTRUCTIONS, to borrow, for Sharp FO-550 fax machine. Hawkinson, 271-7938.

RIBBER & LINKER, for Brother knitting machine, Model KH-260. Ayers, 888-8922.

HOME, for bearded collie/sheepdog-cross, 50-lbs., 2-1/2 years old, neutered, all shots, trained, very loving, great with kids, no cats. Rex, 892-7454.

LOST & FOUND

FOUND: Coffee mug, tall, white, violets, in Bldg. 891, 4th floor men's room, in December. Mendelsohn, 844-0773.

Coronado Club Activities

Día de Carnaval Brings Special Entertainment to the Club

IT'S CARNIVAL TIME, which means Mardi Gras in New Orleans and Día de Carnaval right here at the Club — tonight, Feb. 19. The evening's music is by "Together," on stage from 7 to 11 p.m. Special entertainment is by "Ballet Folklorico Rio Grande" at 8 p.m. From the Carnaval menu, you can choose chicken or beef fajitas ($7.95), combination plate ($6.95), or the all-you-can-eat buffet ($6.95). We're expecting a sellout, so make your reservations pronto (265-6791).

TENNIS, ANYONE? The Coronado Tennis Club has a fun side and a serious side. The fun is playing tennis. The serious side is helping to maintain and regulate the C-Club's courts. This group supports a strong program of teaching clinics, leagues, ladder play, and tournaments at all skill levels. It's for people who already play and for people who think they might like to try tennis. For more info, call the Sandia Employee Recreation (SERP) office on 844-8486.

LAST CALL FOR BRUNCH! For this month, anyway — there's just one more February brunch and tea dance, on Sunday, Feb. 21. And it's a special one: a Father-and-Daughter occasion when Dads get $1 off the meal price and daughters get a carnation to mark the day. Brunch is served from 10 a.m. to 2 p.m. The tea dance starts at 1 p.m. with the music of "Bob Weiler and Los Gatos" and continues until 4 p.m. Prices: $6.95 for adult members, $7.95 for guests, $2.50 for children 4-12, and free for younger children. Reservations required — call 265-6791.

SUMMER'S A-COMIN' — It's hard to believe, but before you know it you'll be looking for a way to enjoy the long, langorous days of summer. The Club has plans for making this summer the best ever — starting with new, lower prices for pool and patio passes. Watch for more as the calendar leaves turn.

FAMILY ALERT — Next Friday evening, Feb. 26, Pyro the comic juggler will tickle the wits out of kids and parents. Pyro (who really does juggle fire) will perform at 7 p.m. But you don't have to wait that long for the fun to start. At 5 p.m., the buffet line opens and a movie starts. If you don't have any kids — borrow some just so you can bring 'em!

Sandia Calendar

The LAB NEWS gathers Sandia Calendar items from various sources, often several weeks in advance of publication. Events could be postponed or even canceled after the LAB NEWS deadline, so readers should confirm times and dates of interest whenever possible.

Sandia/California LDRD Staff Information Session — Laboratory Directed Research and Development (LDRD) Dept. 1011 presents staff information session about the LDRD process; 8:30 a.m. Monday, Feb. 22, Bldg. 904 auditorium; those considering submitting proposals are strongly encouraged to attend. Contact: Chuck Meyers (1011) on 844-3459 or Laura Lopez (1011) on 844-9064.

Sandia/New Mexico Dialogue Sessions — President Al Narath discusses the transition, DOE's mission, and how the Laboratories' achievements accomplish our strategic intent; open to all employees; 9:30 and 11 a.m. Tuesday, Feb. 23; 8:30 a.m., 10 a.m., and 1 p.m. Wednesday, Feb. 24; Technology Transfer Center (Bldg. 825).

Sandia/California Dialogue Sessions — President Al Narath discusses the transition, DOE's mission, and how the Laboratories' achievements accomplish our strategic intent; open to all employees, 8:30 and 10 a.m. Thursday, Feb. 25, Bldg. 904 auditorium.

Sandia/New Mexico LDRD Staff Information Sessions — Laboratory Directed Research and Development (LDRD) Dept. 1011 presents staff information sessions about the LDRD process; 1 p.m. Thursday, March 4, and 1 p.m. Monday, March 8, Tech Transfer Center (Bldg. 825); those considering submitting proposals are strongly encouraged to attend. Contact: Chuck Meyers (1011) on 844-3459 or Laura Lopez (1011) on 844-9064.

Mail or fax potential items to Sandia Calendar, Dept. 7162, Fax 844-0645.

Open Houses

The Labs is holding open houses in honor of the following retirees: **Harold Rarrick** (2701) in the Area 1 Cafeteria (Bldg. 861) on Thursday, Feb. 25, from 2 to 4 p.m.; **Robert Tomlinson** (2732) in the Area 1 Cafeteria (Bldg. 861) on Friday, Feb. 26, from 2:30 to 4:30 p.m.; **Richard Knutson** (2411) in the Bldg. 878 lunchroom on Friday, Feb. 26, from 1 to 2:30 p.m.; **David Judd** (1957) in the Area 1 Cafeteria (Bldg. 861) on Monday, March 1, from 2 to 4 p.m.; **Adron Pritchard** (7151) in the Coronado Club Zia Room on Wednesday, March 3, from 5 to 7 p.m.; **Charlie Thomson, Jr.**, (7812) in the Area 1 Cafeteria (Bldg. 861) on Wednesday, March 3, from 2 to 4 p.m.; and **Angie Gurule** (7151) in the Area 1 Cafeteria (Bldg. 861) on Thursday, March 4, from 2 to 4 p.m.

Sandia in the News

This is a periodic column listing a selection of print and broadcast news reports about Sandia. It is provided by Public Relations Dept. 7161 and is published to give Sandians a sense of what is being said about Labs work in national and international media.

In its international edition, *Newsweek* recently reported that a "team of researchers from Texas A&M and Sandia . . . have developed a composite of silicon, titanium and oxygen that strips radioactive cesium from 'radwaste.' "

A recent lead editorial in *IEEE Spectrum* dropped in a line about Sandia being involved "in the field of perovskite ceramic materials."

Aviation Week & Space Technology mentioned Sandia's work with Du Pont Labs in Wilmington, Del., and Richmond, Va., to develop technology and manufacturing capability for coating various composite materials with diamond.

The *Times* papers that service the Bay Area "bedroom communities" of Pleasanton, Contra Costa, West County, etc., carried a front page article — with color photo — about CRADA (cooperative R&D agreement) work Robert Schmeider (8347) is doing on flat-panel video monitors, which could eventually be used for super-thin high-definition TVs. A similar story also appeared in *Inside R&D*.

Recent retiree O'Neill Burchett gets coverage in an *El Paso Times* piece about a Silver City inventor's paper brick building material. The story explains how O'Neill has worked with NMSU students on preliminary studies of these bricks. Although more testing will be needed, he's quoted as saying, "It is certainly strong enough to be used in a single-level structure with an appropriate design."

Reuter, an international wire service out of London, picked up on the Sandia/Westinghouse CRADA for research on an electrically rechargeable zinc-air car battery.

The nationally syndicated *Chicago Tribune* column "Discoveries" reported on Sandia work with the University of Texas on making better artificial limbs. "Their technique," the paper reported, "uses ultrasound scanning to make a 3-D map of limbs that shows the precise locations of skin surfaces and bones within the tissue." Project leader Alan Morimoto (1671) is quoted: "Having a 3-D model . . . on a computer allows you to design the prosthesis and make modifications electronically without actually fabricating the model. . . . This translates to a savings of time, materials, and money." •

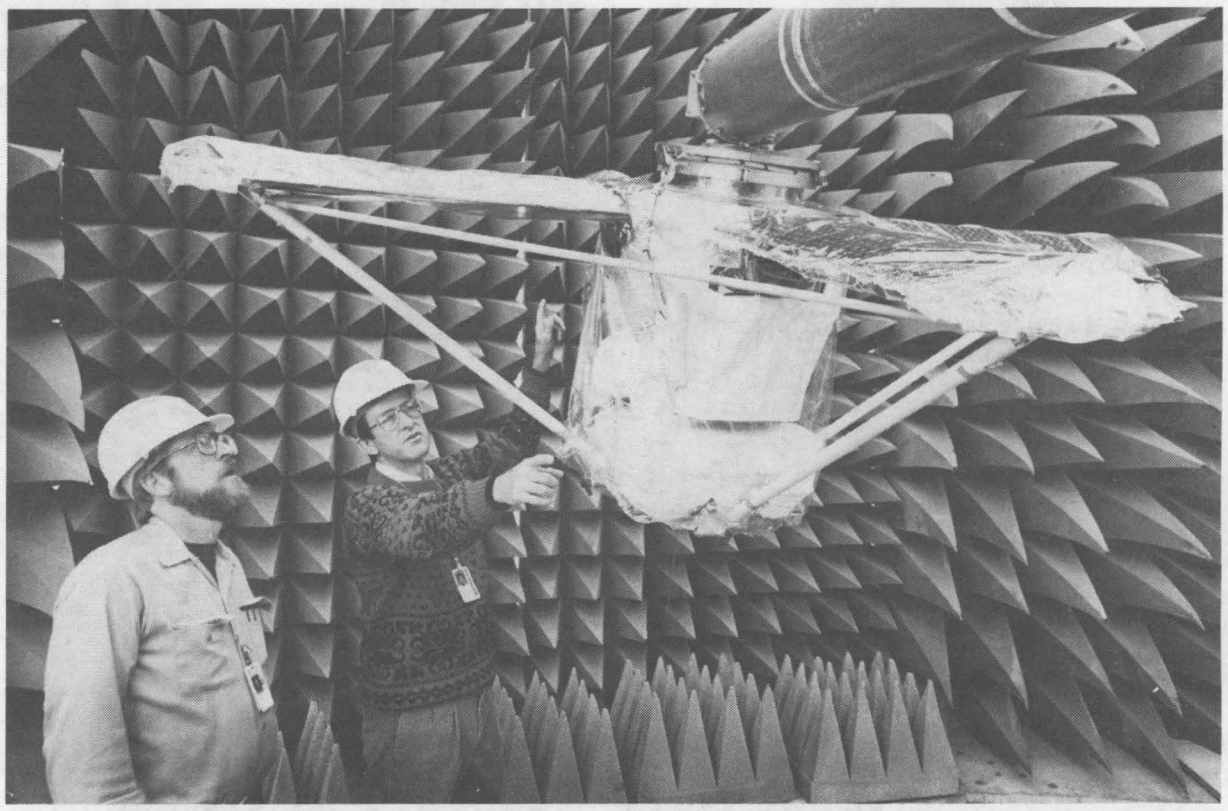
OUTSTANDING PUBLIC SERVICE medal went to Jeff Everett (7904, left) for his work as Scientific Advisor to the US Nuclear Command and Control System Support Staff in the Office of the Assistant Secretary of Defense for Command, Control, Communications and Intelligence. Jeff was in the position from June 1990 to June 1992. Labs President Al Narath presented the medal; Jeff's wife, Terra, was also present. The citation credits Jeff with making "significant improvements in the Nuclear Command and Control System interagency planning process."

Labs Accomplishments FY92

Labs Accomplishments FY92 continues a LAB NEWS project that goes back a dozen years — summing up Sandia National Laboratories' principal achievements.

The work sketched on the following pages was accomplished during the fiscal year that ended Sept. 30, 1992. All Sandia divisions were invited to submit summaries. Although this compilation is not ranked in any way, an attempt has been made to group related items. The organizations associated with the accomplishments are shown in parentheses after each one.

Requests for further information should be sent to Public Relations Dept. 7161, Sandia National Laboratories, Albuquerque, NM 87185-5800.



DAVE ZITTEL (left, 2343) and Tom Armstrong of Los Alamos National Lab discuss tests being conducted on the ALEXIS satellite at Sandia/New Mexico's antenna lab. More on ALEXIS and Sandia's other defense-related work can be found beginning on page five.

To All Sandians:

As I reviewed this collection of Sandia's accomplishments for the past fiscal year, I was struck by the fact that we at the Laboratories are being swept along at the same breathtaking pace that is driving the global changes taking place around our nation. And as we have done throughout our history, we are responding rapidly to the needs these changes are creating for our country.

While it might be expected that the intense pace of events swirling around the entire globe would distract us, a look through this collection of accomplishments should convince anyone that we are remaining focused first on our work. We continue to concentrate on our traditional fundamental tasks — analyzing and solving problems of significance to our country.

Meanwhile, we are also adapting to meet the new needs of a changed and more technologically demanding world — agile manufacturing, robotics, greater computing power, more versatile materials, and more efficient electronics components, to name just a few. And while we are working on these projects, we are also seeking faster, more efficient, and safer ways to dismantle the weapons we helped create to win the Cold War, and equally fast, efficient, and safe ways to support our country's efforts to halt the proliferation of all kinds of weapons of mass destruction throughout the world.

There are many things I could describe, but most important is the pride I feel at being a Sandian involved in projects that will help define the future for the whole world, a feeling I hope all Sandians share with me. Congratulations to everyone who contributed to this "exceptional service in the national interest."

Al Narath
President

LAB NEWS
SANDIA NATIONAL LABORATORIES SPECIAL SECTION FEBRUARY 19, 1993

Energy and Environment

A method for **sorting waste plastics** has been devised to reduce the cost of recycling and produce higher-quality recycled products. A laboratory system has demonstrated the capability of near-infrared spectroscopy (reflectance) and neural network classification techniques. The spectrometer takes readings from a sample of plastic and feeds them into the neural network computer program, which "learns" the patterns for each type of plastic. Results have been highly accurate (96-98 percent) for six plastics categories. Equipment upgrades are being developed to make the system suitable for commercial applications. (2300/6600/1800)

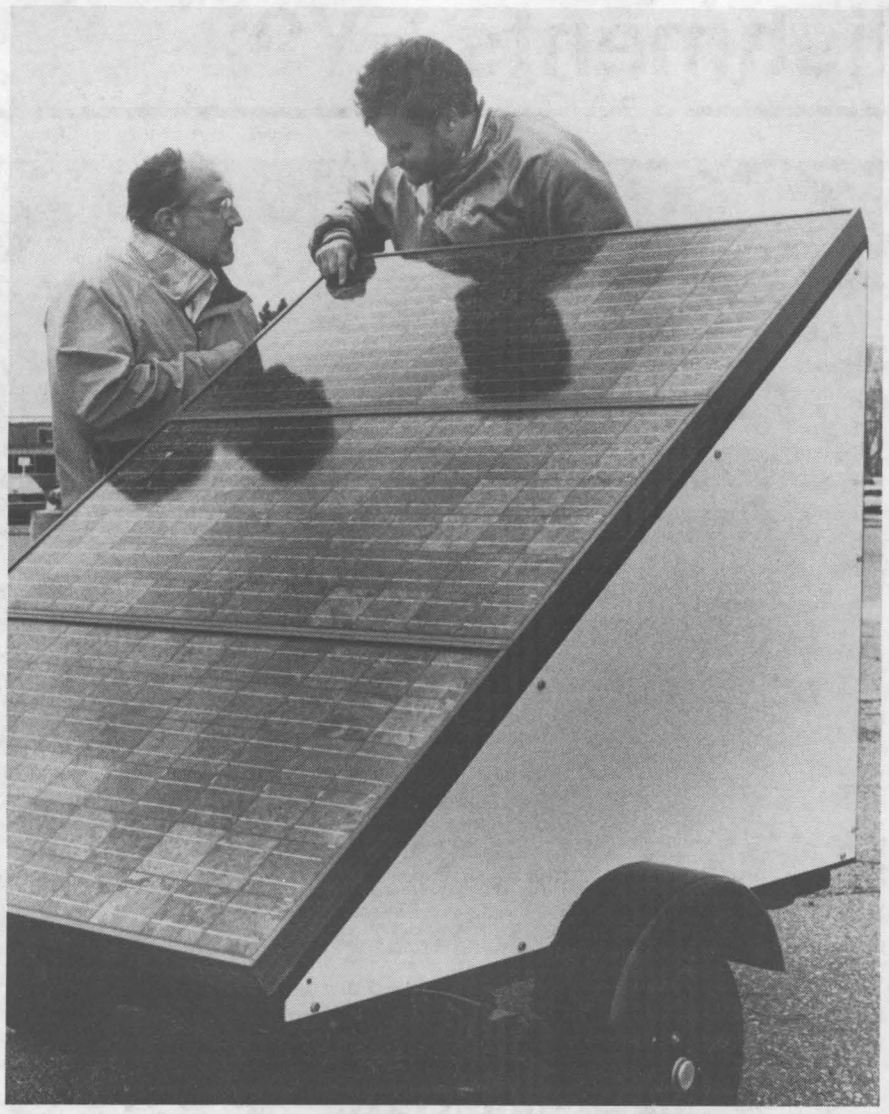
Considerable technical advances have been made toward developing a **lithium ion rechargeable battery** (LIRB) for applications in consumer devices and electric vehicles. This battery is based on a radically new type of negative electrode (anode) that uses lithium ions incorporated into carbon foams. The carbon foams, originally developed by DOE for space defense systems, afford greater safety and higher cycle life to lithium-based rechargeable batteries than those using lithium metal. LIRBs also retain the excellent energy density of lithium metal-based batteries. Potential customers include DOE's Defense Programs sector, the US Air Force (Phillips Lab), DOE's Office of Propulsion Systems, and many major US battery companies. (2500)

A close relationship with the nation's **petroleum industry** has been forged through the Oil Recovery Technology Partnership — a joint program with Los Alamos National Lab — to allow industry to access the capabilities, expertise, and facilities of the two national laboratories. This novel program has been successful through projects such as Sandia's development of a multilevel borehole seismic receiver for improved reservoir characterization that has significantly improved capabilities and performance. Sandia also has contributed to understanding the rock mechanics associated with horizontal wells in fractured formations and to advancing good practices for small independent oil producers operating low-production wells. In this partnership, labs and industry cooperate from the outset in developing, reviewing, and selecting projects. Various new technology transfer methods have proved successful. (6100)

Power for critical services was unavailable to a large number of people in the aftermath of Hurricane Andrew. To help fill that need, Photovoltaic Systems Research Dept. 6218, through its contractor, the Florida Solar Energy Center, sent a team to the area to assist in providing basic electrical power for selected locations. The team worked with local disaster relief groups, as well as the Army and National Guard. **Emergency photovoltaic power systems** (see photo, page two) were provided, set up, and used to power lights, refrigerators for storing vaccines, and other medical and safety equipment, including some transmitters to describe local travel conditions. Department employees also have participated in local, state, and federal agency meetings to explore ways to use renewable energy to provide relief in future natural disasters. (6200)

A new class of **inorganic ion-exchange materials** with a unique ability to extract radioactive cesium-137 from waste solutions containing high concentrations of sodium has been developed by Sandia researchers working in collaboration with Texas A&M University. The materials, called crystalline silicotitanates, show significant potential for efficiently removing not only

Energy and Environment



Hal Post (left, 6218) and Jeff Zirzow (6219) discuss features of a photovoltaic power source built by Jeff that could provide power at a remote site. A team from Sandia was sent to assist in efforts by the Florida Solar Energy Center to provide emergency power sources in the wake of Hurricane Andrew. Arrays using the technology demonstrated in this equipment were used to power lights, refrigerators for medical supplies, and other medical and safety equipment.

cesium-137, but strontium-90 and actinides as well from radioactive waste solutions similar to those stored at the Hanford, Savannah River, and other defense waste sites. The Advanced Energy Technology Center and the Environment and Transportation Center are working with DOE, Westinghouse Hanford Co., Westinghouse Savannah River Co., and Pacific Northwest Laboratory to develop processes utilizing these materials for remediation of defense wastes. (6200/6600)

Sandia's **photovoltaic (PV) technology** evaluation project's two laboratories provided more than 4,000 evaluations of the performance or reliability of photovoltaic cell and module technologies during FY92. The PV Technology Evaluation Lab (PTEL), with its capabilities for testing both one-sun and concentrator hardware, served as the PV industry's partner in assessing the performance and reliability of PV hardware. The PTEL staff conducted more than 500 tests according to various standard test specifications. The staff also hosted 1,100 visitors, providing tours to individuals interested in PV technology. Working in conjunction with the PTEL and the PV Device Measurement Lab (PDML), Sandians provided the solar research community a traceable source for calibration of solar resource monitoring instruments such as reference cells, pyrheliometers, and pyranometers. More than 3,500 tests were conducted in FY92 for PDML customers. (6200)

Sandia completed the first comprehensive performance assessment of the potential **underground repository for highly radioactive waste** at Yucca Mountain, Nev. Drawing on the expertise of the Yucca Mountain Project, both within Sandia and at other organizations, this study estimated releases of radioactive material for 10,000 years into the future. It took into account normal conditions at the site as well as disturbed conditions like volcanic activity. The study made recommendations for the comprehensive program that will investigate Yucca Mountain. (6300)

Drawing on sensitivity analyses provided by long-term performance assessment evaluations of the **Waste Isolation Pilot Plant** (WIPP), Sandia pursued model development and experiments to address the areas of greatest remaining uncertainty. Design of a large, gas-tight seal to isolate large underground test rooms at WIPP was completed, and the test plan for a large, complex hydrologic tracer experiment in the Culebra aquifer at the WIPP site was prepared. As a consequence of the concern and sensitivity surrounding radioactive testing at WIPP, Sandia developed a new test rationale for providing gas generation information to performance assessment. This new approach relies on laboratory tests to allow development of a mechanistic model and uses results of radioactive tests at WIPP to corroborate the model predictions. This approach significantly reduces the quantity of radioactive waste needed for tests at WIPP. (6300/6100)

Richard Nygren of Fusion Technology Dept. 6531 and collaborators Jeff Brooks and Alan Krauss from Argonne National Laboratory received an R&D 100 Award for their novel concept for preferential helium pumping. The concept could significantly reduce the size and complexity of the systems for **vacuum pumping and tritium processing** needed in future fusion reactors. In the preferential pumping system, energetic helium and hydrogen isotopes are implanted in a nickel film. The hydrogen, having greater mobility, diffuses out of the nickel matrix while the helium is preferentially trapped. Successful demonstration of the preferential pumping concept was carried out on the TEXTOR tokamak at KFA Julich, Germany. The TEXTOR experiment was a cooperative effort involving Sandia, Argonne, UCLA, and KFA Julich. Significant supporting data was provided by Barney Doyle and Charles Barbour of Ion Solid-Interactions and Defect Physics Dept. 1111 and by Craig Outten, a student working in Department 1111 as a Magnetic Fusion Energy Program Fellow. (6500)

Solvent emissions released during the cleaning of **rosin-based fluxes** used for soldering electronic equipment account for as much as 20 percent of ozone-depleting chemical (ODC) emissions. Sandia, the Government Electronics Group of Motorola, and Los Alamos National Laboratory entered into a cooperative research and development agreement (CRADA) to evaluate the performance and reliability of a no-clean soldering process that eliminates the need for solvent cleaning. The program was funded by DOE's Office of Industrial Technologies through its Industrial Waste Reduction Program. A thorough testing and analysis program determined that the no-clean soldering process is capable of producing quality, reliable printed wiring boards (PWBs) that perform comparably to PWBs soldered with the already optimized rosin flux/solvent cleaning process. With US industry under mandates to eliminate all ODCs, mainly chlorofluorocarbons (CFCs), the no-clean soldering process represents an ideal solution because it completely eliminates the solvent cleaning step and its associated waste emissions, energy use, costs, and process turnaround time. Program findings have generated tremendous interest from industry and will be used to support changes in military specifications that require solvent cleaning. (6600)

Sandia led a team from the national laboratories and industry in developing, field demonstrating, and evaluating a Landfill Characterization System (LCS). The LCS represents an integrated systems approach to **characterizing contamination beneath landfills.** Twelve individual components of the LCS were field tested at Sandia's Chemical Waste Landfill, including smart sampling methods and downhole contaminant detection. Issues regarding technology compatibility and integration were addressed. Continued development of the LCS will include field demonstrations at Sandia and DoD sites. (6600)

DOE has developed the EnviroTRADE Information System to support its commitment to the **remediation of waste sites** throughout its complex by the year 2019. Environmental technologies that will facilitate the remediation of existing problems and minimize future waste streams must be identified and developed. The search is also under way for international technologies that can improve cleanup of US sites over current domestic technologies, while avoiding many of the R&D costs associated with the development of new technologies. EnviroTRADE contains profiles of international environmental problems and environmental technologies. Users

Environment, Safety, & Health

Sandia has established a process for continuous improvement of the ***Environment, Safety, and Health (ES&H) Manual*** and its supplements using customer feedback and teaming among ES&H support organizations and line organizations. Focus groups representing all Sandia organizations provided design requirements for the manual content, format, style, and update process that are being used to guide revisions. Each chapter, section, or supplement has an assigned owner who is responsible for its technical content. Line input and review is coordinated by a member from the Line Implementation Working Group (LIWG). Updates may occur by chapter, section, or page, or be accomplished through an interim change. As revisions occur, the *ES&H Manual* and its supplements are being improved to meet customer demand that the manual be the place to find out how to comply with ES&H requirements established by laws, regulations, DOE orders, and SNL best-management practices. (7000)

The final site-wide **Environmental Impact Statement** (EIS) for Sandia/California was released by then-DOE Secretary James Watkins Aug. 6, 1992. The document analyzes operations at both Sandia/California and Lawrence Livermore National Lab. This is the first DOE site-wide EIS completed under the Secretary of Energy's new policy for preparing and updating site-wide EISs for DOE facilities. The Tiger Team assessment of both laboratories recommended that the 1982 site-wide EIS be updated. The EIS evaluates the environmental impacts of DOE's proposed action of continuing operations of the site by a contractor. The five-volume set includes a comprehensive analysis and discussion of the environmental status of the site as well as the public's and regulators' comments on the draft EIS/Environmental Impact Report and the laboratories' and DOE's responses to those comments. (8600)

Energy and Environment

are able to identify matches between worldwide problems and available or emerging technologies. The system is easy to use because it provides the user with "point and click" menus and is based on visually oriented information such as menus, maps, and photographs or diagrams of environmental sites and technologies, by incorporating the capabilities of a geographical information system application toolbox. The mature EnviroTRADE system will be maintained on a file server at Sandia, and the information will be accessible to users with workstations and personal computing systems. (6900)

Sandia has taken a leading role in DOE's Early Site Permit (ESP) Demonstration Program, working with three utility companies to **ensure that nuclear power remains a viable energy option** to meet increasing US demand for electricity. During FY92, Sandia worked with Commonwealth Research Corporation, Public Service Corporation of New Jersey, and Southern Electric International on technical and regulatory evaluations for an ESP application to the Nuclear Regulatory Commission for siting requirements for the next generation of advanced light water reactors. Their recommendations were presented to the industry in a public conference late last year. Early site permits are expected to contribute to regulatory stability for future nuclear plant orders by addressing site-related issues prior to an organization's commitment to build a plant. The ESP program will consist of three phases: technical and regulatory analysis, applicant selection and planning for the third phase, and site selection and site specific activities. Adoption of the ESP program would avoid costly delays because design, safety, and siting issues would be resolved before a company began construction of a plant. (6400)

Sandia has designed, built, and tested an **airborne air sampling system** designated the Air Sampling Test Bed (ASTB) in a program funded jointly by the Air Force and DOE. This system rapidly collects large-volume air samples, a method referred to as "grab" sampling. The ASTB is intended to collect samples from an effluent plume located in a small, well-defined target air mass. Following collection, particles and gases in the sample are transferred to an assortment of filter, solid sorbent, and evacuated canister sampling media for post-flight analysis. The ASTB has been tested during joint DOE/USAF flights using two Air Force cargo aircraft modified to carry the system. As a test bed, the system can be used to develop proliferation detection and treaty verification techniques and systems. (5900/8100/6600)

Sandia, in collaboration with the Gas Research Institute, has established a Burner Engineering Research Laboratory (BERL) at Sandia's Combustion Research Facility. The BERL is a highly flexible facility for studying **natural gas combustion** in burners from 0.1 to 3 million Btu per hour. With access to a comprehensive range of state-of-the-art laser diagnostics through Sandia, the facility is ideally suited to fundamental analyses of practical problems on real burners. The facility is available to industrial equipment developers, burner manufacturers, gas utilities, and regulatory agencies needing fundamental information generated in industrial-scale combustion equipment. (8300)

The ordered intermetallic compound NiAl is currently under development for **high-temperature structural applications**. While these alloys are attractive for their strength, density, and thermal conductivity, a serious limitation to their use is brittleness at lower temperatures. In collaboration with the Air Force Wright Laboratory, we have used the high-resolution transmission electron microscope at Sandia to determine whether the source of this low-temperature brittleness is actually due to the core structure of the dislocations (basic defects that determine the mechanical properties of all metals) in the alloy. The movement of dislocations is the primary mode of plastic deformation in the alloy. However, until this study, no information concerning the core structure of dislocations in NiAl had been resolved. Our observations show that the core of a specific dislocation in NiAl is non-planar on the scale of about one nanometer. Consequently, simple movement of this dislocation is not possible, which is a likely explanation for the low-temperature brittleness of the alloy. At higher temperatures, we postulate, the non-planar core can move via a diffusion-controlled mechanism. This could explain the observed ductile-to-brittle transition, high yield strengths, and strong strain-rate and temperature sensitivities observed at higher temperatures in NiAl. This research was judged to be the winner of the "Outstanding Scientific Accomplishment" in the Metallurgy and Ceramics category of DOE's 1992 Materials Science Research Competition. (8700)

Nuclear Weapons

An **Automated Weapon Disassembly** system has been developed by the Intelligent Systems and Robotics Center at Sandia and the Explosives Technology Division at Pantex. This system uses a robot to perform weapon disassembly and packaging operations currently done manually at Pantex. The steps in the manual process that expose operators to higher radiation levels have been automated. Because the system is intended for use on a weapon subassembly containing both nuclear and explosive materials, mechanical protection and electrical isolation features have been included to provide nuclear explosive safety. The system for packaging will be delivered to Pantex, while additional development will continue at Sandia. (1600)

The development of a low-power **optical ordnance subsystem**, referred to as a Laser Diode Ignition (LDI), is being pursued at Sandia. This optical subsystem offers a replacement option for "hot-wire" explosive subsystems, which will further reduce the possibility of unintended ignition from sources such as electrostatic discharges. This enhanced safety characteristic is due to the removal of the bridgewire from the explosive device. This subsystem requires the same electrical input and delivers the same explosive output as the existing hot-wire subsystem, making it a "transparent replacement" within the weapon system. Feasibility of this technology has been demonstrated, and LDI is in full-scale engineering development in the Stockpile Transition Enabling Program. (2500)

Recent arms-control agreements have contributed to the complexity of dismantlement work. This includes the volume and types of weapons being dismantled, as well as the more stringent environmental, safety, and health requirements. An essential part of the **dismantlement program** includes part identification and material characterization for proper disposition and for waste minimization. The Stockpile Dismantlement Database was developed to provide an information base and data entry application to support part characterization work throughout the nuclear weapons complex. Both Sandia and AlliedSignal/Kansas City Plant will use the Stockpile Dismantlement Database for on-line data entry. The computer hardware and software are installed and operating at both facilities. (2800)

Phase I and Phase II Studies Dept. 5371 has developed an exploratory **penetrator program** with a strong system focus. A high-performance penetrator has been designed to reach and destroy deeply buried targets from velocities achievable from currently available delivery systems. Several quarter-scale gas gun tests were conducted to explore the design space and to confirm survivability of the baseline penetrator geometry. Results indicate that the design performed as predicted. (5300)

The MultiApplication Surety Technology 1 (MAST 1) project is a joint Sandia, Los Alamos, and DOE nuclear warhead engineering development effort. It was started in FY92, evolving from the canceled W91 Phase 3. MAST 1 is focused on developing a family of warhead designs to provide the latest available **nuclear surety technology** for the enduring stockpile. This family of warheads uses a common set of electrical system components and nuclear explosive package designed to survive laydown bomb and missile environments. The MAST 1 project stresses reduced time and cost, and improved quality through implementation of concurrent engineering practices, component product realization teams, and quality function deployment tools. During 1992, the MAST 1 project concentrated on a point design for a B61 diameter laydown bomb application. The MAST 1 program also approved a comprehensive ES&H plan that provides a documented process to develop components. Starting in 1992, the new DOE Production Capability Assurance Program (PCAP) is using the development of MAST 1 components to maintain critical manufacturing capabilities at the production agencies. (5100)

Sandia organized a **nuclear weapon dismantlement** program with the mission of assisting DOE in downsizing the stockpile. A program manager was named to coordinate the Labs-wide effort, and a field office was established at Pantex to facilitate our increasing involvement with their activities. The major thrust of the program is to apply our existing technology to solve problems arising from the increasing quantity of returned weapons to be disassembled for reuse, staging, or disposal. A joint Department of Defense/DOE dismantlement prioritization report was published; Sandia-initiated

Air Force weapons specialists try a new procedure in assembling a W61 (an earth penetrator weapon) as military liaison writer Ellen Edge, extreme left, documents the step-by-step process.

Nuclear Weapons

dismantlement policies were approved at DOE headquarters; software has been written for a staging model to describe the location of weapons and weapon material at Pantex; a robotic design for remotely storing, retrieving, and monitoring weapon pits (triggers) in Pantex igloos was generated; a method for sanitizing Kevlar/nylon parachutes to allow commercial recycling of the material was developed; and quality evaluations of the B57, W48, W68, and W70 disassembly processes were performed. Many other activities are scheduled for completion in FY93. (5400)

Sandia, working with Lawrence Livermore National Laboratory (LLNL), is studying the application of paste extrudable explosives (PEX) for application to nuclear system components (the nuclear assembly main charge) as well as other weapon components (firing systems and the booster). PEX offers a fundamental advancement in **nuclear weapon surety** by storing the explosive material away from critical features such as the fissile material or other potentially sensitive areas. Three surety validation test series were conducted in FY92. The first series consisted of thermal exposure tests where the PEX, in a composite storage vessel, was subjected to a thermal environment where, over the space of a few days, the PEX temperature was raised from ambient to the PEX decomposition temperature (approximately 300 degrees F). These tests validated that PEX will decompose and not detonate in this environment. The second series consisted of initial standoff tests, which showed that the PEX, when detonated in its storage vessel near a properly designed nuclear package, will not reduce the special nuclear material to an aerosol form. The last test was a JP5 fuel fire test. A PEX charge, in its composite storage vessel, was subjected to a military specification fuel fire and demonstrated that the PEX would decompose and not detonate in this environment. These validation tests were conducted jointly with LLNL, which formulated PEX. (5300/8700)

The Military Liaison (ML) departments in Defense Programs Operations Center 5500 serve as DOE's interface to military operational units. ML provides training and training videos, weapon maintenance technical publications, and field engineering support to its DOE and military customers in support of the **nuclear weapons stockpile**. During FY92, approximately 1,000 students — military, DOE, and Sandia personnel — were trained in more than 60 classes that focused on nuclear weapon activities (see photo, page three). ML produced 25 new videotapes and supported more than 180 different technical manuals (more than 17,000 pages) related to nuclear weapon activities. ML accomplished two major overseas weapon alterations and developed several special repair procedures in record time. An Unsatisfactory Report (UR) data base was established to track URs received each month. These data provide information about problems, causes, and impact on weapons systems. (5500)

Over the past year, significant progress has been made toward demonstrating practicality of an optical firing system architecture to improve **nuclear weapon safety** assurance. Under the Direct Optical Initiation (DOI) project, laser-based firing systems are being developed as an alternative to electrical firing systems. A laser-based firing system uses optical power transported over silica fibers to initiate detonation. Miniaturized rod lasers have been developed and demonstrated to survive weapon mechanical and thermal environments. A rugged laser has been incorporated into a functional prototype firing system consisting of optical stronglink switches, a laser-to-fiber coupling assembly, high-power fiber connectors, and a fiber feedthrough for an exclusion region barrier. The prototype system was used successfully to demonstrate the capability of firing multiple optical slapper detonators with sufficient performance and timing. Design of the next generation optical firing hardware is under way in support of the development of an integrated, rugged optical firing system for weapon system-level testing. (5100/2500/1200/2600/1100)

Sandia is completing production of a **tritium reservoir shipping container system** for DOE. The system includes two different containers (H1616-1 and 1616-2), a container leak tester, an adapter for manual handling, and an aircraft shipping pallet. The containers have been approved by DOE for offsite shipments. To qualify for offsite shipments, the containers were required to pass tests replicating all hypothetical accident conditions stipulated in Title 10, Part 71 of the Code of Federal Regulations. The design, development testing, and production of the system were handled exclusively by Sandia using a quality assurance program based on American Society of Mechanical Engineers Nuclear Quality Assurance. Sandia also wrote and published the user manuals for the system and furnished training hardware to the Department of Defense. Production of the 2,250 containers, 150 leak testers, 150 handling adapters, and 40 aircraft pallets required by the DOE was accomplished through contracts with private industry. (5100/5500/2400/3700/300)

Tritium reservoir shipping containers like these H1616-1 models produced by Sandia have been approved by DOE for offsite shipments. The entire package includes the container, a container leak tester, an adapter for manual handling, and an aircraft shipping pallet.

The aging **nuclear weapons production complex** is a widely distributed, environmentally outdated, expensive suite of production sites built to meet the peak Cold War production requirement. As the nuclear weapons stockpile and production requirements decrease, the production element of the nation's nuclear deterrent must consolidate to a smaller, less costly production complex (called Complex 21) while maintaining its technical competence. DOE is currently planning the consolidation of the non-nuclear component of the complex. As part of the planning, Sandia has been given responsibility for prototyping and small-lot fabrication of neutron generators, code activated processor assemblies, and thermal batteries. Conceptual design studies have been prepared by Sandia to examine the feasibility of producing these components at the Labs. DOE has developed the lead laboratory concept in response to the recognition that the smaller complex will not be able to afford the technical overhead costs borne by the current production plants. Sandia, Lawrence Livermore, and Los Alamos national labs, as lead laboratories, will be responsible for production process development and production support for Complex 21. (5400)

Phase 1 & Phase 2 Dept. 5161 has continued to maintain the capability to conduct joint studies for conceptual and preliminary **designs for nuclear weapon systems**. These studies take into account dealing with a new world order and an uncertain future, avoiding technological surprise, emphasizing nuclear safety and security, and living with new realities concerning testing and budgeting. We are developing new design methods for limited technology demonstration programs and for rapid prototyping. Our new programs have been for both DoD and DOE requesters. In 1992, we completed three Phase 1 studies for the Air Force and initiated two new Phase 1 studies for the Deputy Assistant Secretary for Military Application/DOE, and new Phase 1 and Phase 2 studies for the Department of Defense (DoD). We also support a number of other special non-phased studies of interest to DoD. (5100)

The Fail Safe and Risk Reduction (FARR) Study was conducted by the Department of Defense to review the **nuclear command and control system** and identify risk reduction measures aimed at preventing nuclear war that could be caused by misinterpretation, miscalculation, or accident. In support of this effort, Nuclear Energy Technology Center 6400 employees provided an end-to-end assessment of the system from early warning sensors to the weapon platform interface. From this understanding, a comprehensive logic model was developed, forming the basis for a thorough, documented evaluation. Former US Ambassador to the UN Jeane Kirkpatrick, who directed the study, and members of her advisory committee were briefed on the results. (6400)

Increasingly stringent environmental regulations may eliminate current disposal options for **non-nuclear components of nuclear weapons**. This will require the development of advanced treatment technologies. Four weapon components were successfully treated using stream reforming, vitrification, and acid digestion treatment technologies. The components treated included a fireset, a radar, a filter pack, and a pre-flight control unit. These units were selected because they represent a wide variety of the material types found in weapon components that must be disposed of properly. These advanced treatment demonstrations showed that the hazardous materials in these components can be immobilized or recycled. Chemical analysis indicated that precious metals recovery from weapons components might be as high as $8,000 per ton, which could help pay for these treatment processes. Sandia is involved in working with industry to further refine and demonstrate advanced treatment technologies. (6600)

Pulsed Power Development

An international research effort led by Sandia scientists succeeded in demonstrating control over the electron-ion instabilities causing beam divergence of intense ion beams for **inertial confinement fusion**. The key was to minimize the amount of electron charge in the accelerating gap. Four techniques were identified and explored computationally with Sandia's QUICKSILVER code, tested in small-scale experiments at various laboratories, and tested further on Particle Beam Fusion Accelerator II (PBFA II) at Sandia. All four approaches work. Two have been implemented on PBFA II to cut the beam divergence in half. Although much work is required to incorporate these discoveries into a reliable production capability for ion-beam-driven applications, the physics is favorable. After 15 years of work, the low-cost and high-energy technology of intense ion beams is being engineered into new capabilities for Defense Programs, such as PBFA II and the Laboratory Microfusion Facility, to ameliorate the impact of the expected loss of underground testing. (1200)

Other Defense-Related Work

Early in 1992, Sandia began designing the H1501B **Transportation Accident Resistant Container** (TARC), adapters for the B57 and B61 bombs, and strongbacks for loading and unloading the containers. This program required an accelerated schedule, so a concurrent engineering team, including DOE and AlliedSignal, was formed. Because design and production activities progressed in parallel and close communication among TARC team members was emphasized, the first production hardware was available in one-third of the time normally required. Much of the hardware has already been tested — vibration, impact, and fire tests show that it meets our requirements. (5300)

The Sandia Interactive Force Tracking System, developed for and funded by the Joint US European Command (EUCOM), was prototyped during Desert Storm and is currently being used at EUCOM in operations support. This system provides an integrated view, including maps and collateral imagery, of the **status and location of units** deploying from the US to and through Europe, Africa, and the Middle East. Under Sandia's technical direction, the system brought together the expertise of military and contractor sources to provide EUCOM a unique integrated view of information from the Joint Command strategic systems and in-theater logistic systems supported by the specific military services. Sandia is currently supporting ongoing system development. (5900)

A new program, sponsored by the Strategic Defense Initiative Organization, was initiated in March 1992 to purchase, modify, and launch a Russian Topaz II **space nuclear power system** by the end of 1995 or early 1996. This program is being carried out by the New Mexico Alliance (Sandia, Phillips Lab, Los Alamos, and UNM). Sandia has the lead responsibility for assessing the safety of the system. A preliminary safety assessment (PSA) of the Topaz II system was performed and documented. The PSA determined that the system could be launched from the US if "minor" modifications are made. Specifically, two subsystems may have to be added: (1) one to prevent criticality excursions during a water flooding accident, and (2) a reentry heat shield to prevent reactor break-up during a reentry accident. In addition to safety responsibilities, we are also responsible for the design of the reentry shield, for which a conceptual design has been developed. A thermionic system evaluation test facility for performing electrical tests of Topaz II was completed in November 1992. (6400)

Sandia evaluated the effectiveness of US **conventional weapons** against important fixed hard targets. This study was conducted for the Office of Munitions, Office of The Secretary of Defense (OSD). The work provides insights into the capabilities of current and developmental hard-target weapons and identifies potential technology opportunities to address shortcomings. Target types include hardened command posts, hardened aircraft shelters, runways, bridges, tunnels, and caves. Regions of interest include Southwest Asia, Korea, and Europe. Sandia's assessments are incorporated into the annual Conventional Munitions Master Plan, which reflects OSD conventional munitions development and acquisition policy. (4100)

A discretely unique series of dynamic mass properties measurements was performed by the Geodynamic Aerospace Mass Properties Facility of the Sandia/California Environmental Test Department for Los Alamos National Laboratory (LANL), in conjunction with Sandia/New Mexico and AeroAstro Co. The project goal was to make a LANL $25 million satellite for the **ALEXIS (Array of Low Energy X-Ray Imaging Sensors) program** a stable platform for experiments in orbit (see photo, page one). The moments and products of inertia of the satellite were measured and the products of inertia minimized through multi-plane dynamic balancing, first in air and then in helium, to deduce the values under the vacuum conditions of outer space. A special helium chamber was constructed to enclose both the measurement equipment and the satellite in a helium environment, a first for Sandia/California. The necessary safeguards and procedures associated with the helium working environment, as well as with handling a very expensive test item, were addressed in a newly implemented Conduct of Operations process at Sandia/California. (8200)

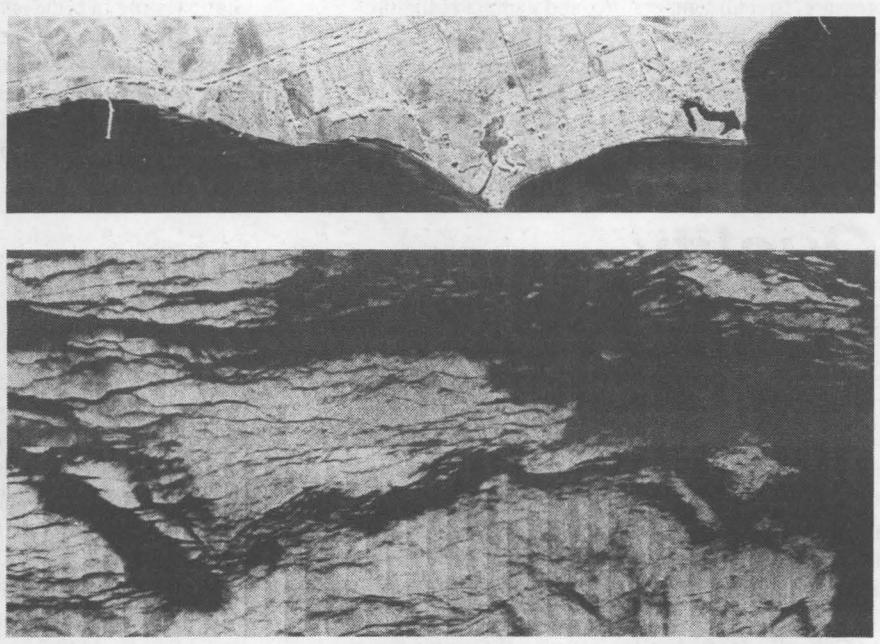
In February 1991, the cruiser *USS Princeton* was damaged by a mine in the Persian Gulf. As an aid to future design of Navy ships, Sandia was asked by the Naval Sea Systems Command to determine the response of the *USS Princeton* to **underwater explosives.** The technique utilized at Sandia included using the doubly asymptotic approximation technique within a structural finite element code. This methodology allows the modeling of fluid effects on a structure without the inclusion of a fluid element mesh, hence reducing the amount of computational resources needed. The calculated response (strain and deflection) compared well with the actual ship response. The sponsor indicated this was the first time a structural dynamic response was calculated for a complete ship. (8700)

Sandia has provided dynamic structural response calculations for **artillery projectiles** subjected to base pressure oscillations to help the US Army's Advanced Field Artillery Systems identify potential problems associated with pressure oscillations that occur in regenerative liquid propellant guns. Structural analysis results for the M864 projectile provide explanations for mechanical fuse failures observed in liquid propellant (LP) gun compatibility flight tests at Yuma Proving Ground. We are continuing to work with the Army on compatibility of the LP gun with current and future nonnuclear munition systems. (8700)

Sandia's warfare simulation model, SCABBARD, was used to assess the combat value of the cannon-and-rocket-delivered SADARM (Sense and Destroy Armor) **"smart" munition.** By comparing simulated battle results obtained with SADARM to the corresponding results obtained with other conventional "dumb" alternatives, it was found that SADARM's deployment resulted in an increased number of enemy vehicles destroyed, reduction of "friendly" casualties, and reduced time and tonnage of ordnance required to defeat the enemy. This work — part of a multi-year program to appraise via simulation the combat effectiveness of developmental and inventoried munitions systems — is supported by the Office of Munitions and the Office of the Undersecretary of Defense for Acquisition under the Joint Department of Defense/DOE Munitions Technology Development Program. (8100)

Jeff Morgan (2664) holds part of a downhole seismic sensor, developed at Sandia, like those that can be used to detect underground weapon tests.

A team of Sandia scientists and engineers successfully conducted multiple **synthetic aperture radar** (SAR) imaging experiments and performed several automatic target recognition (ATR) demonstrations. Key technical advances were made in SAR image formation, motion compensation, data collection and recording, ATR algorithms, and high-performance embedded software and microelectronic hardware. Working with the Air Force's Wright Laboratory Aeronautical Systems Division, new imaging capabilities were developed, resulting in more than an order-of-magnitude increase in data collection efficiencies. New ATR algorithms were investigated, and a novel modular SAR/ATR testbed design was developed. Working with the Coast Guard, the team is evaluating sensor technologies that could significantly enhance oil-spill remote-sensing capabilities by the mid-1990s. Finally, as part of DOE's exploratory development activities, a motion compensation and differential navigation subsystem was flight tested aboard Sandia's Twin Otter testbed aircraft. It is capable of a high level of accuracy and precision in locating, stabilizing, and pointing the antenna. Various defense and environmental-related analyses, data collections, and experiments were conducted under other projects. These sponsors included DOE, the Navy, and other Department of Defense organizations. (9100/2300/2700/2800)



Sandia's synthetic aperture radar (SAR) recently imaged naturally occurring oil seeps and coastline near Santa Barbara, Calif. The coastal image, top, shows Goleta Point and Coal Oil Point, a lagoon (middle right), and two major fishing piers (middle left and upper right). The lower image shows open ocean near the seep. Ocean areas covered by the slick appear dark, indicating reduced radar return from the oil-covered surface; brighter areas represent larger returns from wind-driven surface waves.

Sandia, the Air Force Technical Applications Center (AFTAC), the Defense Advanced Research Projects Agency (DARPA), and selected commercial companies have teamed from initial design phase through test and production to field a proven advanced seismic system to meet national treaty verification requirements. Sandia has integrated, tested, and delivered 12 **seismic instrumentation systems** to AFTAC, the program manager. These systems were designed to be used by the On-Site Inspection Agency (OSIA) in accordance with the protocol of the Threshold Test Ban Treaty (TTBT), a bilateral treaty between the US and the former Soviet Union that establishes rights and responsibilities with respect to conducting and monitoring underground nuclear tests. Under the treaty provisions, these systems will be operated by AFTAC at three designated sites in the former Soviet Union when an underground nuclear test in excess of 50 kilotons is conducted. The system, which consists of three elements — a borehole seismometer system, a vault

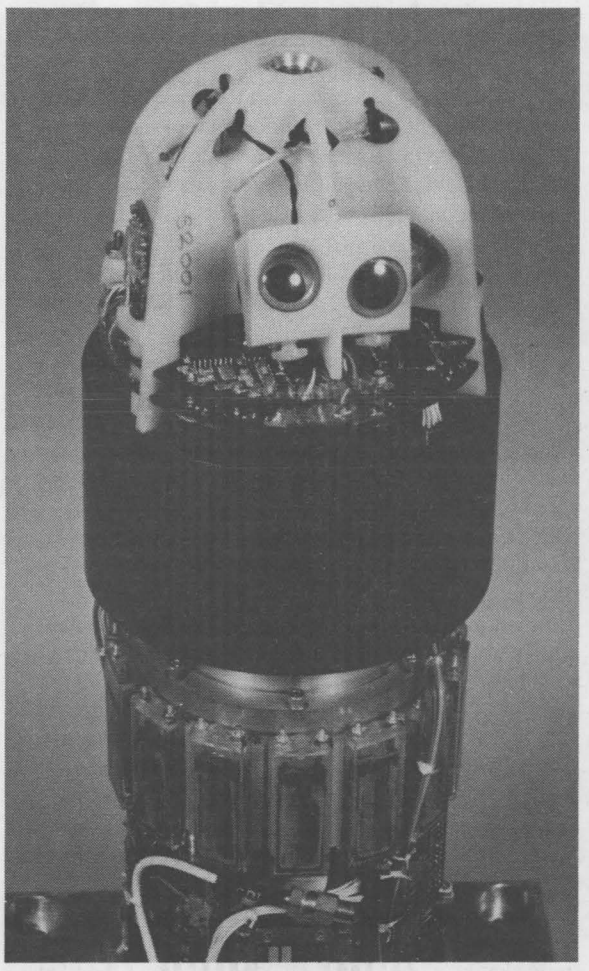
Other Defense-Related Work

seismometer system, and a data recording system — is designed to detect, display, analyze, record, and archive seismic signals emanating from the detonation to verify that the yield is not in excess of the treaty limit of 150 kilotons. The borehole seismometer system was an adaptation of a system previously developed by Sandia under DOE sponsorship. The other systems were developed under DARPA sponsorship. The system is now available to be deployed, should Russia lift its moratorium and resume testing. It could also be reapplied to monitor future test limitation agreements or proliferation-related testing. (9200)

Sandia developed a prototype transient spectrometer for analyzing the **spectrum of short-lived optical signals**. This rugged, field-deployable system combines a high-speed optical sensor array with embedded digital signal processing to provide a real-time collection, analysis, and display capability. When used in conjunction with a high-speed radiometer, the system provides a high degree of false-alarm rejection, allowing unattended operation even in bright background environments. The technology developed for this instrument is being incorporated in sensor designs for nonproliferation and environmental monitoring applications. (9200)

Sandia has delivered a space-qualified laser sensor to the Air Force Phillips Laboratory for integration with the Technology for Autonomous Operational Survivability (TAOS) satellite. The sensor, referred to as LS1, detects and characterizes **laser irradiation of satellites** in low Earth orbit. An innovative configuration of diffraction gratings, sensor arrays, and analog and digital signal processing is utilized to determine wavelength, angle of arrival, time of arrival, and energy of an incident beam. An array of specially designed parallel-processor computers allows for flexible, high-speed signal processing. This system will be used in experiments to verify laser detection and characterization as required for military space applications. (9200)

Sandia successfully demonstrated the deployment of **kinetic energy penetrators** (KEPs) from a simulated reentry vehicle traveling at 4,800 feet/second (Mach 4.45). The cylindrical KEPs were deployed at the Sled Track Facility against representative military targets such as rocket boosters and steel deck plates. The Defense Advanced Research Projects Agency sponsored this test, which establishes the feasibility of non-nuclear, hypersonic lethality. This precision-strike technology has important implications for missions such as a quick preemptive attack on a particularly menacing military target perceived as an imminent threat. (9800)



Major strides were achieved in miniaturizing sensors and transmitters on the way to development of this very Light-Weight Instrumentation System (LWIS) for application on lightweight space target vehicles. It was developed by Sandia under the sponsorship of the Army Space and Strategic Defense Command.

The Countermeasures Demonstration Experiment (CDX) was performed for the Strategic Defense Initiative Organization (SDIO). The CDX was a full-scale flight test to demonstrate the performance of several potential countermeasures an adversary could deploy against the **global-protection-against-limited-strike (GPALS) defense systems**. The experiments that were conceived, designed, developed, and tested by Sandia consisted of a device for deploying lightweight inflatable decoys, an optical/radar masker, and an endo-atmosphere optical decoy. A fourth experiment, electro-optic chaff designed by the United Kingdom, was tested as part of a cooperative test program. The information obtained from the CDX will be useful in developing sensors for the GPALS systems and improving their robustness. The test performance was presented up through the Director of SDIO. (9800)

Under sponsorship of the Army Space and Strategic Defense Command, Sandia has developed a very Light-Weight Instrumentation System (LWIS) for application on **lightweight space target vehicles** that is capable of autonomously measuring vehicle attitude, dynamics, longitudinal velocity change, body dynamics, and 36 temperature channels. The entire LWIS system weighs approximately one kilogram when complete with a three-axis magnetometer, three axes of body rate information, two pyroelectric earth horizon sensors, 36 thermal sensors, signal- and power-conditioning electronics, data encoders, encryption electronics, batteries, and transmitter. To achieve this capability, major strides were achieved in miniaturizing sensors and transmitters. This highly capable sensor package has many potential future target applications and may have emerging application to nuclear weapons joint flight tests. The miniature rate sensors, developed by a small company, are based on unique new technology that became feasible with the help of Sandia capabilities. Many potential commercial applications for the sensors have been identified. (9800/2600/2300)

Testing

Hunters Trophy, a Defense Nuclear Agency (DNA)-sponsored **nuclear radiation effects underground test** (UGT), was detonated at the Nevada Test Site Sept. 18, 1992. Our primary experiments were stockpile reliability and correlation studies of UGT versus aboveground simulation. The need for this information has increased in the era of UGT limitations. Various sensors were fielded, with signal levels from a few millivolts to more than 1,000 volts and time durations from 50 nanoseconds to eight minutes. Low-frequency digitized and high-frequency analog data were transmitted to our surface recording facility, 7 kilometers away, over fiber-optic links. Under DNA contracts, we performed containment and radiation diagnostic experiments and provided multiplexed high-frequency recording and data processing for several DNA experimenters. While a few signals were lost due to the extremely hostile environment, we successfully recorded all 388 data channels. (1200/2500/7700/9300)

Electromagnetic Test & Analysis Dept. 2753 has developed two **electrostatic discharge (ESD) simulators** that are currently being used to evaluate the response of electronic and explosive devices to the influence of ESD environments. One simulator is primarily intended to replicate the electrostatic discharge that a human can deliver. The simulator can produce a severe version of this threat by using the upper and lower bounds of the environment parameters: voltage, capacitance, resistance, and inductance. The second simulator is an expanded version, operable to 50 kilovolts, that can produce a variety of ESD threats, including those associated with the human body and charged devices. Both simulators are simple in design, and use off-the-shelf components and similar test fixtures. The simulators rely on coaxial pulse-forming networks and gas-filled relays to produce pulse rise times as short as a few hundred picoseconds. The basic simulator design is being used by other DOE organizations and has been described at symposia and in technical publications, resulting in requests for additional information by government and commercial organizations. (2700)

Diamond Fortune, a Defense Nuclear Agency (DNA)-sponsored **underground nuclear test**, was conducted at the Nevada Test Site April 30, 1992. This test created an aboveground effects test environment to study airblast by detonating a nuclear device within an 11-meter-radius hemispherical cavity. Under DNA contracts, we provided a variety of sensors and measurements of airblast, ground shock, cavity temperature and pressure, fireball temperature, and gamma radiation time histories. In a joint effort with Lawrence Livermore National Laboratory and DNA, we engineered, built, instrumented, and recorded data on proposed designs for reusable and low-cost underground nuclear explosion chambers. Significant new information important to understanding surface bursts was obtained on close-in airblast phenomena, containment, and response of materials. In the hostile environment of this nuclear test, we successfully recorded 249 of the 264 data channels fielded. (9300)

In response to several multimillion-dollar brine pipeline failures in the **Strategic Petroleum Reserve** (SPR) program, Sandia has developed and constructed a unique corrosion test facility at the Big Hill SPR site in Texas. This facility is being used to evaluate the performance of 16 different cement-based and polymer-based steel pipe-liner materials for corrosion control. The test program allows for dynamic testing in a flow loop where corrosion/erosion processes can be monitored. Static testing in brine is also possible. Sequential and cumulative test samples are examined for post-test mechanical and chemical alteration. Results from experiments will be used to optimize the longevity and chemical resistance of pipeline/liner systems for brine service within the SPR and the petroleum industry. (6100)

Quality

The Corporate Quality Excellence Program was established in Quality Improvement/Primary Standards Center 4300 in the spring of 1992. Composed of both existing and new activities, it had several significant accomplishments. It supported preparation, submission, and follow-up of the AT&T Chairman's Quality Award application. This included formation of a process management team to respond to feedback from the application; the team developed seven recommendations for continuing Sandia's quality journey. The **Sandia Quality Council** accepted and is pursuing these recommendations. Sandia received a score of 429 points out of a possible 1,000, significantly better than most organizations achieve on a first application and close to the 1992 AT&T average of 465 points. The program sponsored the first New Mexico Small Business Quality Forum with New Mexico State University in June 1992, and it was rated a success by the more than 200 persons attending. It also was instrumental in establishing the New Mexico State Quality Award. The program also provided daily communications to the Laboratories via Radio Sandia. (4300)

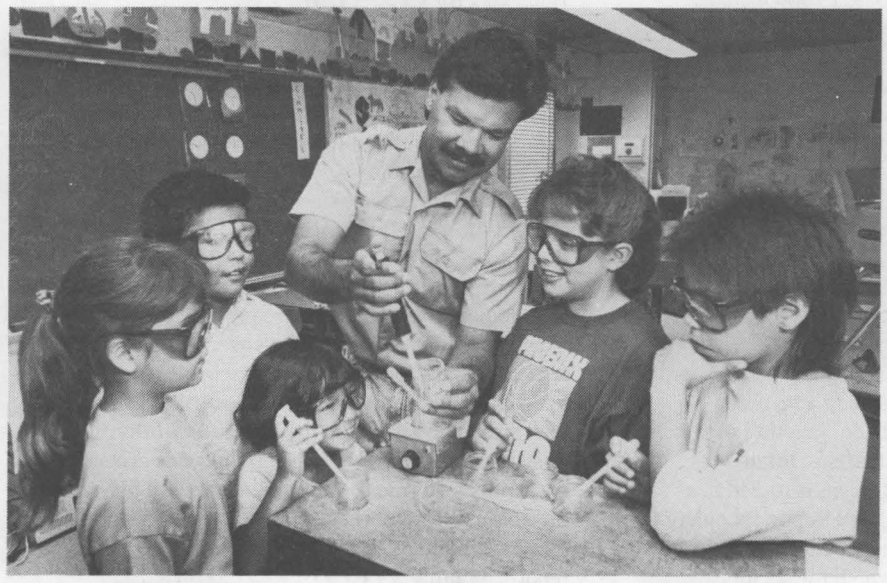
Education Outreach

A new 45,000-square-foot **materials R&D laboratory** located in the University of New Mexico research park was dedicated Aug. 27, 1992. The Advanced Materials Laboratory (AML) is a collaborative venture involving Sandia, UNM, and Los Alamos National Laboratory. Staff from the three institutions are working on projects that emphasize university and industry interactions. Three small companies currently have space in the laboratory for collaborative projects with AML staff. Vice President Al Gore said during a campaign visit to the AML that he views it as a model for how federal laboratories should join with universities to work with the private sector. (1700)

Sandia's Educational Outreach organization has established its **Science Advisors (SCIAD) Project** in 200 participating schools. Sandia provides each of these schools with an engineer or scientist, for up to four hours a week, to serve as a resource to enhance elementary and middle school teachers' knowledge and comfort with math and science. Sandia has replicated this model in southwest New Mexico and West Texas. The Southwest New Mexico SCIAD Program has 38 schools; the West Texas program is in the pilot stage and includes 11 schools. SCIADs for these programs are recruited from local industry. Sandia provided the model and the training to implement these programs. A Sandia representative serves on the advisory board for each project and serves as a liaison between these and Sandia's SCIAD project. (35)

Sandia, with support from DOE, is helping the University of Turabo in Puerto Rico develop a **new engineering school**. Since 1989, the dean of the engineering school has been a Sandian, and this is expected to continue until 1994. The engineering school offers a bachelor of science (BS) degree in mechanical and manufacturing engineering and will be offering a BS in electrical engineering in 1993. In the third year of the academic program, the new engineering building was completed, and in recognition of the contributions from Sandia, it will be named the "Sandia National Laboratories Engineering Building." About 210 students are enrolled in the engineering program. (35)

The first **workshop for teachers** in the Math Through Applications program was held in the summer of 1992. The project, a collaboration including Sandia, the Institute for Research on Learning in Palo Alto, and Stanford University, is jointly funded by the National Science Foundation and DOE. Aimed at sixth through ninth graders in inner-city schools, the project emphasizes real-world problems. Computing technology ranging from hand-held graphics calculators to spreadsheets to high-level languages is applied to open-ended problem solving. (8100)



Larry Salgado (9701), a Sandia Science Advisor, performs "fun science" for children at an elementary school on Kirtland AFB in Albuquerque.

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Sandia established a Labs-wide **Software Management Program** (SMP) to ensure a consistent approach to the management of all software assets acquired, developed, supported, and used. The SMP encourages organizations with software responsibility to establish organization-specific, results-oriented software management plans that promote improvement and incorporate concepts of quality assurance and quality control. Each vice president was invited to nominate two representatives to be members of a quality improvement team that serves as the technical advisory group to Sandia's upper management for the effective management of software. The team has presented an implementation plan to DOE's Albuquerque Field Office and is actively pursuing two other work items: establishment of a Software Management Policy via a Sandia Laboratories Instruction (SLI 1011), and establishing contact and cooperation with other software-related initiatives. (300)

On June 24, 1992, the Supercomputer Consolidation Project accomplished a major milestone by sending data between our New Mexico and California sites on our new **DS3 (45Mbs) intersite link**. This link uses the emerging Asynchronous Transfer Mode and Synchronous Optical Network standards that are being developed for gigabit wide-area networks (WANs). These standards will scale to the gigabit network speeds required for future remote access to supercomputer and massively parallel computer resources. We worked closely with several key networking vendors, using Beta and pre-release equipment, to implement this link. Our success in this cooperative effort has resulted in national exposure for our WAN capabilities. (1900)

Sandia and AlliedSignal completed an 18-month process to select a new generation of standard software tools for **mechanical design and manufacturing automation**. This effort was driven by the need of mechanical engineers, at both Sandia and AlliedSignal, to become more productive through use of advanced integrated mechanical computer-aided design, manufacturing, and engineering tools. This system will become the standard for Labs-wide mechanical design, replacing existing systems and associated tools. This project — called ACCORD — included Sandia representatives from organizations 367, 1500, 2500, 2600, 2800, 5100, 5300, 7200, 7400, 8200, and 9200. Capabilities of the system include state-of-the-art technology for solids modeling, engineering analysis, engineering drawings, numerical control, inspection, process planning, product data management, and engineering documentation. Use of the ACCORD system has already benefited projects such as Direct Optical Initiation, Integrated Manufacturing and Design Initiative, and the Multiapplication Surety Technologies Firing Set. Organization 2800 is leading the Labs-wide implementation of ACCORD. As of September 1992, 100 systems had been installed at Sandia. (2600/2800/5100)

The development of the DS3 Telecommunication Delay and Error Simulator (DS3 is the signal standard for long-haul, **high-speed computer communications**) makes it possible to test ideas for improving long-distance communications by interconnecting two sets of local computer equipment as though they were far apart. It can simulate the delay and error characteristics of an intercity communication channel up to 5,000 miles long. The Sandia system transmits at 44.73 megabits per second, can inject errors into transmissions, features a 10-turn dial for selecting the desired amount of delay time up to a maximum of 90 milliseconds, is more compact than other simulators, and costs less than half as much as existing devices. Sandia is now working to transfer the technology to commercial manufacturers. (1900)

TLC (Total Life Concept) program participants have become healthier over the past five years, according to a recent evaluation of data from 1988 and 1992 **health risk appraisals** completed by 269 Sandians. Data provided by a private health group indicate that Sandians enjoy better health than that of the reference group. (The reference group is a subgroup of the national population which has been matched to the Sandia group's average age, sex, and race characteristics.) These findings are part of the comprehensive evaluation efforts ongoing in TLC since March 1992. Significantly more Sandians participated in TLC activities in FY92 — 2,400 employees as compared with a maximum of 1,300 in previous years. Data indicate that people who participated in the TLC five-year follow-up study are less likely to file a medical expense claim than Sandians in general. (7030)

Catalog information for In-Hours Technical Education Courses and Out-of-Hours Programs were made available through Sandia Line. Employees who have access to a telephone and are able to receive a fax can now have **immediate access to education and training information**. During the first three months of operation, more that 6,000 Sandians accessed Sandia Line. One result of the change from issuing printed catalogs to listing courses on Sandia Line has been a direct cost saving of $24,000. Also, the first *Education for Quality Improvement Catalog* was published and distributed. Quality courses are now available on a just-in-time basis for teams and individuals. (7500)

The Facilities Development Center played a significant role in several major Labs-wide initiatives. Information Systems Dept. 7925 successfully implemented an automated download of corporate data from the Service Center Information System on the IBM to the Facilities VAX system. In addition, the phased implementation of the **Asbestos Control System**, which will manage large volumes of asbestos data for all sites, is under way. This system improves data integrity, security, and reporting, as well as facilitates effective asbestos management and customer communications. The center has also made considerable progress toward updating its design and construction standards. Those standards have been changed to comply with all new ES&H requirements, not permit the use of asbestos, and improve the quality of construction. (7900)

During the past year, the Sandia/New Mexico Mail Team has registered notable improvements in overall customer service. Since May 1992, the average time required for **delivery of incoming mail** items (including properly and improperly addressed mail) has been reduced considerably to 6 hours and 10 minutes. During the same period, the percent of mail sorted and staged for same-day delivery has risen from 20 percent to 100 percent. The Mail Center processes approximately 10 million items of mail per month, of which 72 percent is incoming third- or fourth-class or bulk mail. Mail Center employees are now concentrating on improving delivery of the 58 percent of incoming mail that is not properly addressed and already has been in transit an average three to four days by the time the US Postal Service delivers it to Sandia. (7600)

The Packaging and Transportation Safety Council (P&TSC) was chartered and began activities to improve P&T safety. The P&TSC Compliance Appraisal Team (CAT) established an Appraisal Guide for conducting internal appraisals of **packaging and transportation operations** across all Sandia locations. The team includes representatives from throughout Sandia. Three appraisals were conducted in FY92, and the work of the team was praised by DOE's Kirtland Area Office. Also, a Quality

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Assurance Management Plan was completed that incorporates the assurance guidelines required by DOE Order 5700.6C for packaging and transportation. (7600)

A 20-member Labs-wide team consisting of represented employees and members of management has developed a **performance management system** for represented Sandians. The team was formed to address dissatisfaction with the current performance appraisal system by management and unions and problems pointed out during the 1991 Sandians' Perspective survey. The team was formed in January 1992 and presented its proposal in July to Division 7000 management, which enthusiastically approved and cited it as "the best example of union/management ownership, partnership, and trust that has occurred at Sandia." The new performance management system will encourage open communication between employees and their managers; ensure that employees clearly understand their specific job responsibilities and performance expectations; encourage employees to continually strive to improve their job knowledge, skills, and abilities; and provide the basis for promotional consideration, career planning, and other developmental areas. (7500)

President Al Narath presented his reasons for optimism about the Laboratories' future in a series of September employee meetings. In conjunction with these meetings, a **statement of strategic intent** was released as evidence that this optimism is rooted in a broad mission base of continuing and important emerging responsibilities. The Statement of Strategic Intent provides the framework within which the sectors are empowered to plan and execute their programs. The statement represents completion of another milestone in Sandia's initiative to improve management responsiveness to changing conditions. (1)

Determined to adapt to changing national needs, Sandia carried out a **major internal restructuring** in early 1992. With a goal to build a more customer-oriented, improvement-oriented, project-driven, and responsive organization, vice presidents were asked to redesign their organizations. Part of the redeployment plan was to remove one level of management, reducing the levels from seven to six. At the same time, a program management structure was established with projects and programs reporting to sector managers regardless of their organizational location. These actions have moved the Labs from a functional orientation to a project focus, with improved capability for cooperation and teaming to meet customer requirements. (1)

The Audit Services Center developed and implemented the most aggressive and **comprehensive audit plan** in Sandia's history. The plan, known as the Integrated Audit Plan, calls for finishing backlogged audits on contract costs totaling more than $400 million and completing a review of the internal audit universe (anything that can, by DOE regulation, be audited by internal auditors). The plan responds to Sandia's management and the Board of Directors Audit Committee's request that the transition to the new management and operating contractor minimize risk to DOE, AT&T, Sandia, and the new contractor. The plan combines a more sophisticated risk analysis with a mix of permanent and temporary Sandians and contract personnel. A new, more aggressive risk analysis was developed combining government and private audit techniques. In addition to traditional Sandia methods, resources were mustered from AT&T, contracted services, and temporary employment. The major accomplishment of developing and implementing the plan is that it ensures a significantly easier task of carrying out the plan, which is the task for FY93. (120)

The first phase of the new Service Center Information System (SCIS) was begun in October by Organizations 100 and 7300. SCIS provides **financial information for management** of Sandia service centers and for their customers. The system allows each service center, as a separate business segment, to manage its costs at the activity and service order level and bill customers weekly. One of the main features of the new system is support for "internal contracting," a major requirement for more effective project management. This assures the customer that costs will not exceed the agreement, and assures the service center that funds are available to perform the work. A query and file download system available on the Laboratory Information System (LIS) computer will show service order detail costs plus "internal commitments" weekly for most of the 36 service centers established for FY93. In addition, billings will be reflected in the customer's Cost Budget reports monthly for FY93. (100/7300)

The Management Integration and Implementation Project (IP) developed a process for assimilating the management requirements from DOE's orders on **Quality Assurance (QA) and Conduct of Operations (COO)**. Managers at all Sandia sites determined how well they were meeting the 61 integrated requirements and developed plans for achieving full compliance. In June, the first summary report of these initial plans was delivered to DOE. The Albuquerque Field Office assessed our implementation of IP in early September, and although the assessment highlighted some problems discovered in the first phase, it also noted that the process is still in its fledgling stages. DOE concurred with the IP approach of combining COO and QA into one management process, which is unique among DOE facilities. (7000)

In response to Sandia's need for accurate and timely employee location information, an **On-Line Telephone Directory System** was implemented on the Laboratory Information Systems computer. Center and executive secretaries are now using this new system to update employee and on-site contractor location and phone information, job function, organization function, and other data used to support production of the printed *Sandia Directory*. The new system gives the secretaries the capability to make updates and corrections and look at the results immediately on a screen or on paper. The use of a centralized system and the transfer of input responsibility to line secretaries should improve both quality and timeliness of directory data. (7300/7100)

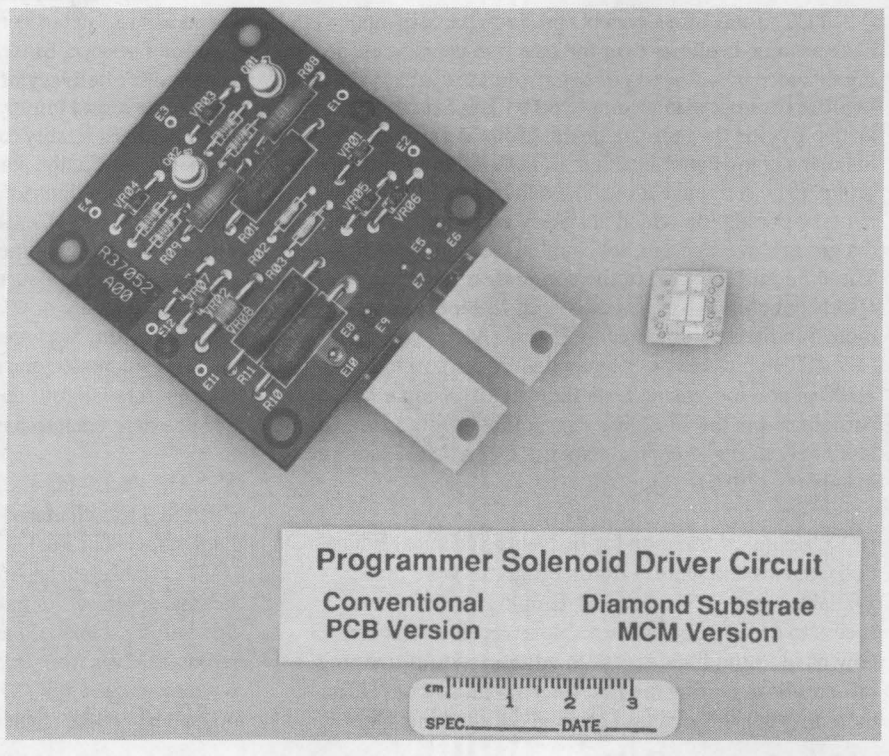
Quick Pay, an invoiceless **payment-processing pilot project**, was designed and put into effect at Sandia as a result of the joint effort of Orgs. 100, 7200, 7300, 7600, 8500. Quick Pay allows Sandia to make payment upon receipt of materials without having the supplier submit an invoice. This project has reduced administrative costs for Sandia and participating suppliers, improving the number of "quick pay" discounts that Sandia gets. The Quick Pay pilot project has laid the foundation for continued expansion of invoiceless payment processing at Sandia. (100/7200/7300/7600/8500)

Art Dept. 7155 completed a **graphic computing system** capable of creating three-dimensional photo-realistic animations of mechanical subjects and scientific phenomena. The system can accept 3-D geometric data from computer-aided design systems or real-time motion data to create visual models. Models and animations can be produced directly as broadcast-quality video, laser discs, viewgraphs, and prints for use in presentations. The system has supported several corporate center projects, including a fireset design for Firing Set & Contact Fuze Dept. 2571, a conceptual satellite scenario for Satellite Systems Engineering Dept. 9211, and reconnaissance and assessment for Sensors & Discrimination Systems Evaluation Dept. 9818. Animation of complex subjects provides a competitive advantage by presenting full-motion visual demonstration to sponsors supplying funding. (7100)

Sandia hosted both President George Bush and then-presidential candidate Bill Clinton in historic visits in September. These unique opportunities, made possible by an extraordinary Labs-wide effort and coordinated by the Protocol Office in 4500, showcased DOE's and Sandia's potential for addressing **national technology needs**. Other highlights from a busy year included hosting the Safety, Security, and Dismantlement Conference, which included 12 technical experts from the former Soviet Union, 15 US government representatives, and numerous participants from Sandia and Los Alamos. The Protocol Office also planned and handled logistics for DOE's Preproposal Conference for potential Sandia management and operating contractors. In addition, the office arranged 123 high-level individual and group visitor events such as board of directors' meetings and joint laboratory meetings. (1/4500)

Three **periodical technology bulletins**, *Manufacturing Technology, Energy and Environment,* and *Testing Technology,* produced by the corporate publications group, hit their stride with about 35,000 copies published in the last quarter. Two new bulletins were launched: *Defense Programs* and the *Sandia Management Bulletin*. The *Sandia Management Bulletin* is published three times a week to summarize current events worldwide. The first new Laboratories capabilities brochure in five years was completed. More than 100 Sandians were interviewed by the strategic planning group for a major initiative, the Vision Project. Results were used by President Al Narath to promulgate a statement of Sandia's strategic intent. The most comprehensive Institutional Plan (an annual 5-year plan) ever produced was delivered to DOE. The *Summary Description of Facilities and Operations* helped DOE construct its Request for Proposals for a new Sandia management and operating contractor. (4500)

The Public Relations Department arranged visits for three film crews from CNN (Cable News Network) during the year, resulting in segments featuring our work on parachutes, the solar Design Assistance Center, advanced sensors, robotic vehicles, and space nuclear propulsion. Each of the programs was aired numerous times, resulting in a **viewership by a large national audience**. In June, Sandia hosted a press conference announcing a non-invasive glucose sensor (see photo, page ten) developed in conjunction with the University of New Mexico. The press conference, an accompanying written press release, and a video news release resulted in coverage by three local television stations and articles published in *Time, The Wall Street Journal, The New York Times,* and more than 60 other newspapers and magazines worldwide. (7100)

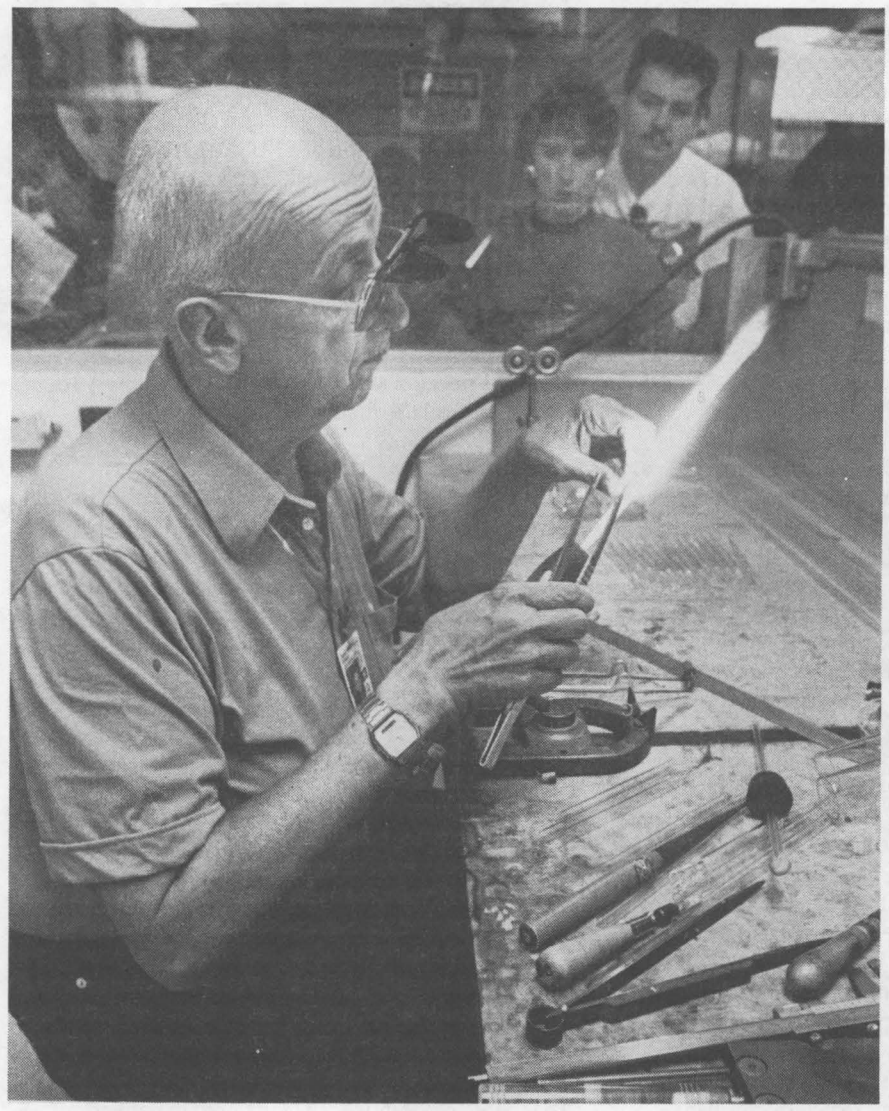


Power electronic circuits like the small one in this photo (right) are fabricated on diamond substrates and are about one-tenth the size of the conventional one on the left. Sandia fabricated the prototypes of these weapon programmer power electronic circuits.

Components/Materials and Processes

A Sandia-developed SA3300 **microprocessor**, the arithmetic unit of a microcomputer that does all the logical manipulations, is used in the camera of the Mars Observer satellite launched in September 1992 for an expected arrival at Mars in August 1993. The same microprocessors, along with timing control units and interrupt control units, have also been delivered for the International Solar-Terrestrial Physics (ISTP) program, with multiple launches to begin in mid-1993. The integrated circuits were developed to emulate commercial devices under an agreement with National Semiconductor Corp. These parts were fabricated by AT&T in a special process, developed jointly with Sandia, and can withstand the severe radiation environments of space. Reimbursable funding for these deliveries came from Caltech for Mars Observer, and from NASA/Goddard for ISTP. (2200)

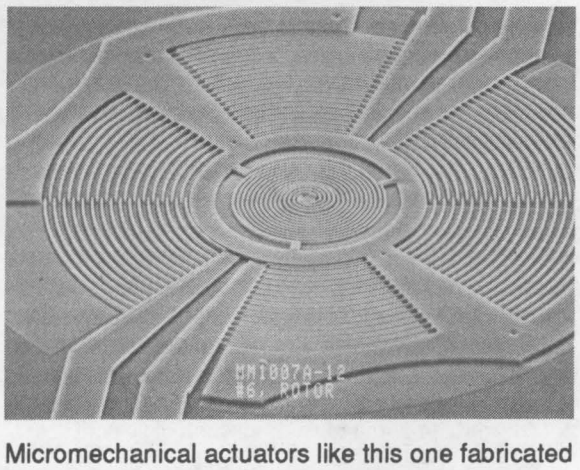
In 1990, the Pinellas Plant and Sandia were threatened with a production shutdown because the sealing glass required for a critical component could not be commercially manufactured. Commercial material failed to meet thermophysical property and internal defect specifications. Working with personnel and financial support from the Martin Marietta Specialty Components Plant, Pinellas and Sandia formed a Glass Team to develop and qualify a process at Sandia to produce the glass using **platinum-rhodium crucible melting technology**. Together we selected a producible composition; developed heating, mixing, and fining techniques; machined and etched preforms; drew the glass into rod form; and then tested and inspected the glass for production use. We wrote a process manual, developed a quality plan, and complied with Quality Criteria requirements. The Sandia-made material has met all weapon component specifications. (2400/8400/1800)



Don Oatley (2476) of Sandia's Glass Lab demonstrates for visitors to the Labs the craft of drawing glass into rods, a process used in producing material needed to avert a production halt because the glass could not be acquired commercially.

A micromechanical actuator fabricated from polysilicon in the Microelectronics Development Laboratory has been successfully tested and is being considered for use as the power source for a class of safety mechanisms used in nuclear and conventional weapons. These devices would constitute the first application of **microfabricated mechanisms for weapon safety systems**. The motivation for using these types of devices over existing devices comes from expected increases in ruggedness and reliability due to their small size and batch-fabricated nature. This, coupled with expected order-of-magnitude decreases in cost and size, makes these devices potentially useful for weapon applications. (2600/1300)

We successfully joined concentric cylinders of 15-5pH stainless steel and 6061T6 aluminum with thick nickel electroplating for the Short-Range Attack Missile-A program. This process, referred to as **electrochemical joining**, allowed us to provide a joint on the 381-mm-diameter cylinders that is stronger than the weaker material (6061T6). The principal advantage of the electrochemical joining process is that it is done at low temperature (26-49 degrees C). This is low enough to eliminate shrinkage stresses and the distortions that normally accompany high-temperature joining, as well as the degradation that often results at higher temperature from re-crystallization and grain growth to the component material. Tensile testing of the electrochemical joint resulted in failure of the aluminum with no degradation of the electroplated nickel joint. Cost analysis of the electrochemical joining process demonstrated that it is a viable process that should be considered when joining materials that are difficult to join together or that cannot be joined by any other known procedure. (8700)



Micromechanical actuators like this one fabricated from polysilicon in the Microelectronics Development Laboratory for weapons applications are expected to be more rugged and reliable than those in current use.

The Warren F. Savage Award of the American Welding Society was awarded to Steve Goods and Clarence Karfs (both 8714) in March 1992 for their paper "Helium-Induced Weld Cracking in Low Heat Input GMA Weld Overlays." This award is given to an article (published in the Research Supplement of *Welding Journal* in 1991) for the "greatest contribution to the understanding of **welding metallurgy**." Their research, part of a joint activity involving Sandia, the Savannah River Site, and Westinghouse Science and Technology Center, was directed toward developing repair technologies for radiation-damaged structural alloys. Their work showed that irradiation-induced helium can significantly degrade weldability in these materials. The results of this research program demonstrated that the effects of this entrapped helium can be minimized and that satisfactory repair welds can be fabricated by controlling heat input and weld penetration. (8700)

We have fabricated the initial prototypes of **weapon programmer power electronic circuits** on diamond substrates using advanced hybrid technologies (see photo, page eight). These power electronic multi-chip module circuits include power transistors, diodes, and built-in-place power resistors, and can be packaged in one-tenth the volume of conventionally built versions. In addition, the diamond substrate versions have increased thermal performance and do not require heat-sinking to the weapon programmer case, an important feature in new modular designs. (8100/1300/2300/2400)

Arms Control Verification

A technique that may be applied to the Strategic Arms Reduction Treaty (START) verification task of **warhead counting** was developed at Sandia with funding from DOE's Office of Arms Control. This procedure of Radiation Pattern Identification (RAPID), was demonstrated at Warren AFB using an actual Peacekeeper missile system. RAPID incorporates both gamma-ray and neutron sensors to produce radiation intensity patterns that indicate the number and positions of warheads on the missile. Employing the RAPID technique, warhead-counting inspections can be conducted in only a few hours at a launch site without removing the missile or its shroud. (5900)

Sandia is applying **synthetic aperture radar** (SAR) expertise in support of two treaty verification-nonproliferation projects: the Airborne Multisensor Pod System (AMPS) and SAR for Open Skies (SAROS). AMPS is sponsored by the DOE Office of Arms Control and Nonproliferation and is a multi-organizational effort to develop an airborne multiple-sensor R&D data collection platform and develop techniques to process multi-sensor data sets. Sandia is teamed with EG&G Remote Sensing Laboratory, Naval Air Warfare Center (NAWC), and other contractors to develop the sensor suites. Sandia is now integrating an SAR system, originally developed for another customer, into a pod. This pod and another carrying EG&G-supplied electro-optical sensors will be flown on an NAWC P-3 aircraft. Sandia has also developed an algorithm to search magnitude-detected SAR imagery for airfields. This automatic search technique will allow the analyst to examine activities in and around airfields without having to look at every image. SAROS is sponsored by the Defense Nuclear Agency/Arms Control and Test Limitations. Under the Open Skies Treaty, a signatory may inspect other signatories using various airborne sensors, including SAR. The SAR must use exportable technology and have a ground resolution of no better than three meters. Sandia has been assigned the responsibility of teaming with private industry to develop and integrate two prototype SAR systems for this application. The prototypes and documentation will be provided to the Air Force for use by FY95. Sandia also continues to provide SAR technical support for the US Open Skies negotiating team in Vienna under the sponsorship of the DOE Office of Arms Control and Nonproliferation. (9200/9100/2300/2600/2700/1500/5900/9500)

Supporting Technologies

As Sandia's surety departments plan for the future, knowledge of the past is becoming more important to them as a means of obtaining information from each new experiment and avoiding experiments that yield no new information. In discussions of future experiments to address effectiveness of weapon use control features, the phrase "I think that experiment has already been done" is heard frequently. Funding from the Sandia Surety Guild is promoting the **collection and cataloging** of significant adversary experiments and related documentation associated with the effectiveness of nuclear weapon use control features. This catalog will, in turn, promote more effective planning of experiments. An additional planned outcome of this effort is identification and storage of appropriate documents as a permanent collection in a centralized location. This will help ensure that important information from organizations that have knowledge or documentation of past use control effectiveness experiments will be included in this process. (300/5300/5900)

Sandia researchers have made a significant breakthrough in the effort to make more efficient use of **massively parallel supercomputers**. A fundamental challenge in parallel computing is the decomposition of a problem into equally sized sub-problems that are assigned to processors in a way that minimizes interprocessor communication. Sandia researchers have discovered an important new result in the area of mathematics known as spectral graph theory that has led to an improved method for computing these decompositions. The theoretical advances have been incorporated in a new computer code that produces nearly optimal decompositions, a 30-to-50-percent improvement over the previous best method. Decompositions also can be performed three times faster and with greater robustness and generality. The advancement will result in larger, faster simulations of problems from structural mechanics, radiation transport, fluid flow, and many other applications. (1400)

Several new **ion beam analysis** (IBA) techniques were invented and applied to materials R&D efforts. They include perfection of a time-of-flight adaptation of our patented heavy ion backscattering spectrometry (HIBS) ultra-sensitive technique for measuring trace levels of metal impurities on silicon wafers. Micro-monolayer sensitivities, already projected to be required for future integrated circuit (IC) manufacture, have been demonstrated. The nuclear microprobe-based single event upset (SEU) imaging system was broadened to also supply submicron images of charge generation and collection in complementary metal oxide semiconductor ICs. This new application of SEU imaging is important in understanding and decreasing upset susceptibility, and represents a promising new diagnostic tool for 21st century IC fabrication. Finally, hydrogen profiles of plasma-exposed tokamak components collected on our R&D 100 award-winning external (i.e. in the air) IBA system are being used to define the thermonuclear discharge scenario for the tokamak fusion test reactor device at Princeton and to assess tritium inventory for the international thermonuclear engineering reactor concept. (1100)

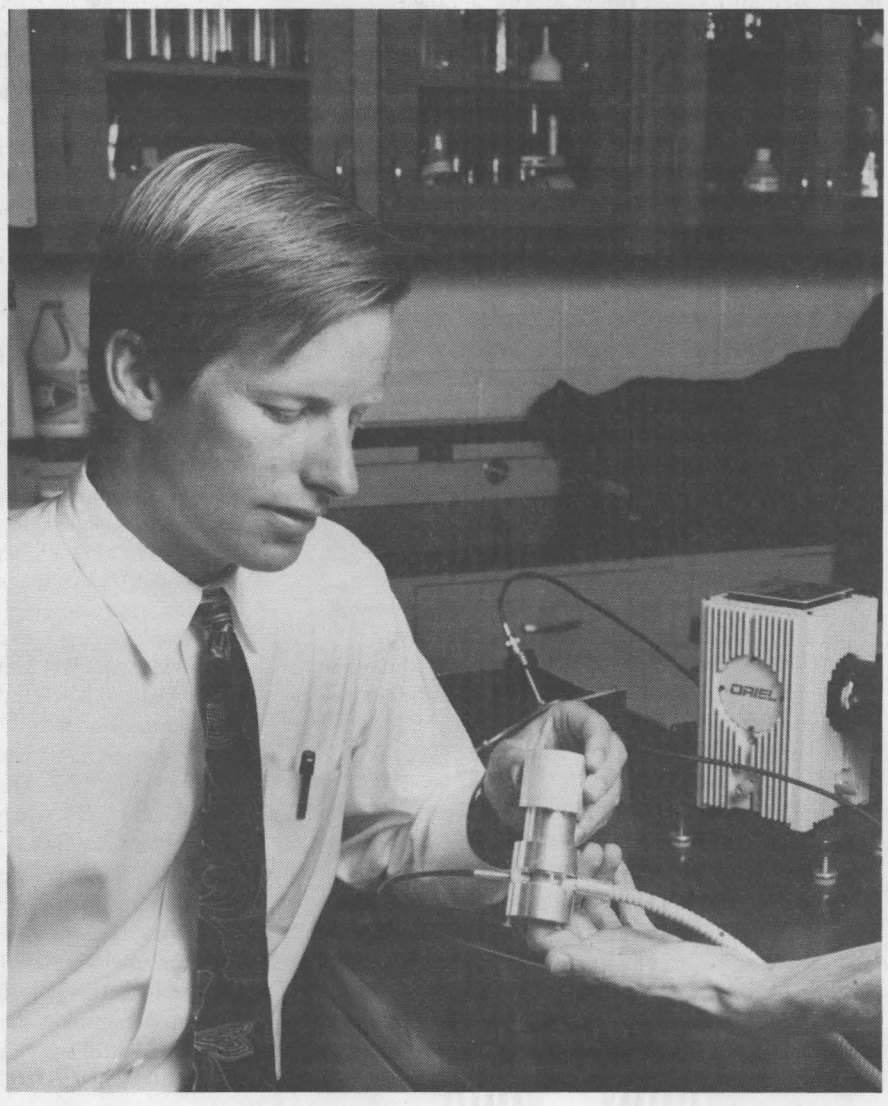
A device has been developed by Sandia and the University of New Mexico School of Medicine that will provide non-invasive measurement of the concentration of glucose in blood. This device could eliminate the current requirement for 2.5 million diabetics in the US to **test for blood glucose levels** by pricking a finger several times a day. The device utilizes near-infrared light and chemometric techniques that were originally developed at Sandia to monitor the evolution of gases from aging explosives. Tests on approximately 100 diabetic and non-diabetic patients of various ages and ethnicities have shown the ability to measure, non-invasively, the concentration of glucose in blood with precisions approaching that of the chemical techniques used in home monitoring units that require finger pricking. (1800)

A multi-department effort has contributed to bring FASTCAST capabilities along to assist with **rapid prototyping** of investment castings. Although not fully implemented to include computational simulation, FASTCAST capabilities are being used to deliver investment cast hardware in as little as four weeks. Several technologies, such as rapid mesh generation developed by Department 2814 and computational simulation of the casting process performed by Department 1511, are being integrated into a single package to allow for a complete optimized casting design to be transferred to hardware for rapid prototyping. The capabilities in rapid prototyping include stereolithography to produce plastic parts for design validation and selective laser sintering (SLS) that allows Department 2484 to produce an investment cast wax pattern. Both of these processes use a computer-aided design solid model as input and produce the part directly from the electronic design. Once a prototype wax pattern has been produced by SLS, standard investment casting processes are used to produce the part. Capabilities to speed these traditional molding and casting processes are also being developed. (1500/1800/2400/2800)

We have developed a modular **icon-based control architecture** for tele-robotic systems. SMART (Sequential Modular Architecture for Robotics and Tele-operation) is part of a technology strategy to make intelligent systems more accessible to users. Using graphical icons, the user connects modules controlling the individual hardware components — robots, input devices, and sensors — to modules describing the world model (kinematics, obstacles, and work space constraints) to create a functioning system. SMART allows each module to be designed and debugged independently and then to be automatically integrated into a system. Thus, greater complexity, flexibility, and reliability can be achieved with far less development time. (1600)

Sandia conducted a unique research program that combined the strengths of both computational and experimental **aerodynamic simulation**. This program, called the Joint Computational/Experimental Aerodynamics Program, was a synergistic team effort that enables us to identify, and then improve, aspects of both simulation approaches. The research, conducted on a hypersonic maneuvering reentry vehicle, distinguished between errors associated with mathematical modeling of the fluid physics, numerical accuracy for the given mathematical model, and experimental data uncertainty. The research was conducted in the Sandia Mach 8 Hypersonic Wind Tunnel and used advanced instrumentation and diagnostic techniques, including shear-stress-sensitive liquid crystals to detect boundary layer transition. Internationally respected experts have recommended this work as a model for computational fluid dynamics code verification and validation. (1500)

Vertical-cavity surface-emitting lasers (VCSELs) have the potential to play the same role in the **miniaturization of lasers** as integrated circuit technology played in the miniaturization of transistors. Sandia has made two advances that overcome major obstacles in fabricating high-efficiency VCSEL devices reliably. The first advance is an on-line reflectance-based process monitor that enables precise corrections during growth of the device. The second advance is development of compositionally graded mirrors that lower device resistance by more than an order of magnitude relative to conventional semiconductor mirror stacks. These advances should lead the way to the commercial realization of practical VCSEL-based photonic systems. (1100/1300)



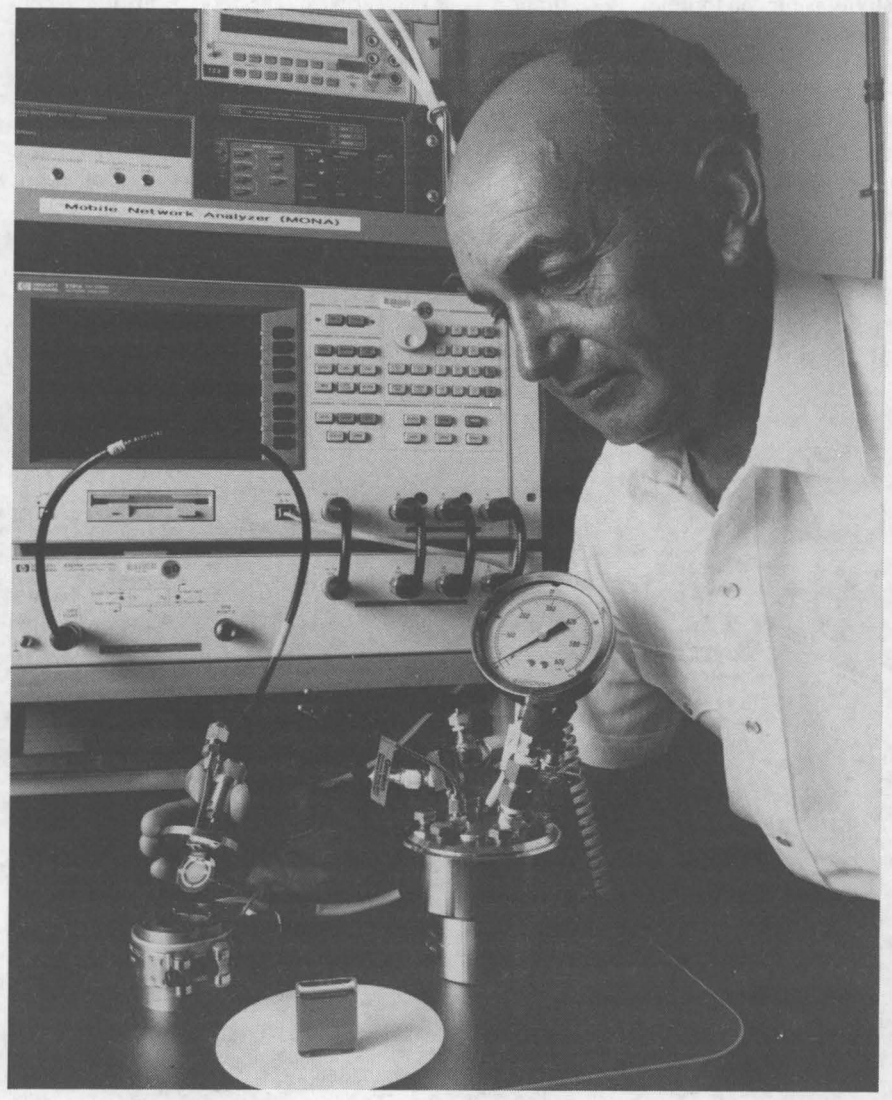
Sandia post-doctoral fellow and University of New Mexico School of Medicine resident Dr. Ries Robinson demonstrates a new non-invasive glucose sensor that could end the need for diabetics to prick their fingers daily to draw blood to monitor their glucose levels.

Massively parallel computational fluid dynamics (CFD) codes produce numerical solutions that are best analyzed using scientific visualization. Sandia researchers have developed a technique enabling **parallel visualization of solutions** while the simulation is in progress. Previously, visualization was done as a post-processing step requiring many gigabits of disk space to store the volumes associated with a time series. To eliminate the serial bottleneck associated with file input/output, volume data can be rendered by running a CFD simulation and an isosurface (three-dimensional surface contour) code heterogeneously on different subsets of processors on a massively parallel computer. Volume data consisting of triangle lists can be sent directly to a graphics workstation across an Ethernet connection. In this approach, the workstation acts as a powerful processor tied directly to the parallel computer. Graphics software running on the workstation receives the isosurface description and creates a window in which the volumes are rendered. A spaceball can be used to control the view point, thus enabling the user to selectively interact with the simulation domain. The new technique eliminates the need for file storage while providing fast production of scientific animations. (1400)

Advanced sensor technologies recently invented at Sandia are now being applied to important problems

Supporting Technologies

in the national interest. A new, wide-range, robust hydrogen gas microsensor has been developed using a combination of thin-film catalytic metals and silicon microelectronics. This microsensor can measure hydrogen content from 1 ppm to pure hydrogen and can operate in a wide variety of environments including cold gas flows and vacuums. The multidisciplinary sensor team designed and fabricated first prototypes in the Microelectronics Development Laboratory for customers at NASA Stennis and for DOE's Office of Technology Development. Using a related technology, a mass sensor system was recently developed for the Air Force's Advanced Jet Fuels Program to monitor the real-time decomposition of aviation fuel at elevated temperatures. This Quartz Crystal Microbalance (QCM) sensor, developed in conjunction with Process Research Dept. 6212, can measure solid deposition rates of a few atomic layers per minute, permitting real-time, quantitative evaluation of jet fuel degradation during aircraft operations. (1300/6200)



The Quartz Crystal Microbalance Jet Fuel Degradation Monitor, operated here by Leonard Casaus (1315), permits real-time measurement of aviation fuel as it decomposes at elevated temperatures.

Sandia continued to support national standards to facilitate access to product data. Six Sandians served in leadership positions in national organizations developing standards for **product data exchange**. Members of Sandia's Advanced Engineering/Manufacturing Technologies Dept. 2861 were instrumental in the publication of an update to the Initial Graphics Exchange Specification (IGES). This new version of IGES introduces a boundary representation (B-Rep) scheme for the exchange of manifold solid objects. Increased emphasis on solid descriptions, such as B-Rep, for products makes it increasingly important to have a system-independent format for product data exchanges between dissimilar Computer-Aided Design and Engineering systems. This same department is participating in a follow-on effort to IGES, product data exchange using STEP (Standard for the Exchange of Product Model Data). STEP is an emerging international standard that will provide the system-independent means for sharing product data throughout the life cycle of a product. The technologies and standards to be derived from this follow-on effort are viewed as a cornerstone to the Concurrent Engineering and Agile Manufacturing environments required by US industry. Emphasis is now being placed on the application of these emerging standards at Sandia. (2800)

In June 1992, DOE announced a national **Center for Advanced Manufacturing Technologies**, established at Sandia/New Mexico to maximize the value of Sandia's technology base to the manufacturing needs of the DOE Nuclear Weapons Complex (NWC), other government agencies, and US industry. The center's mission is to provide leadership with our partners in engineering integrated solutions to problems of national competitiveness in defense and economic security. It will coordinate the broad range of advanced technologies developed within Sandia's defense, energy, and environmental programs to help make the NWC a model for the product realization process and to help US industry improve its manufacturing processes and become more competitive in international markets. Partnerships with government agencies, universities, industry, and other government laboratories will be pursued to ensure maximum value. (2900)

A key milestone in the DOE **reactor laser program** FALCON (fission-activated laser concept) was the successful completion of the flowing laser scaling experiment in the Annular Core Research Reactor (ACRR). This experiment demonstrated significant power extraction from a multichannel experiment simulating conditions in a large reactor laser system. It was the second in a series of ACRR tests designed to confirm the capability of this technology to scale to megawatt-class power levels with high beam quality. (6500)

Sandia has patented a new quantitative method for determining the total **heat flux from cryogenic objects.** This invention detects the temperature change across a superfluid helium boundary layer that results when heat is transported across it. This superfluid boundary was discovered only recently. The technique has been used to determine the very small amount of total power dissipated in an array of superconducting junctions. This invention may be applied as a safe and efficient new method of tritium assay in support of weapons programs and may also prove useful as a diagnostic tool for improving the design of sensor arrays used in space-based applications. (4300)

In response to a request from New Mexico officials, a Sandia team started testing a concept for **voting by telephone.** The team consisted of personnel from Organizations 9500, 7300, and 5900. The Center for Nuclear Security Systems 9500 led the project and developed some of the security techniques necessary to demonstrate the voting-by-phone concept. Laboratory Information Systems Center 7300 integrated the system, connected the phone system to a data base, and employed advanced functionality and security features. The system was tested in four Albuquerque high schools the week before the November 1992 election. The test proved that the concept was viable and that the system was user friendly; 96 percent of the participants responded during the voting process that they would gladly use such a system in a real election. An arrangement could be developed among Sandia, the New Mexico Secretary of State's office, and some private firm (yet to be identified) that would be interested in developing a commercial version of a secure phone-voting system. (9500/7300/5900)

A new laboratory measurement technique that determines the surface impedance of materials at radio frequencies over the range 100 to 1,000 MHz has been developed. The technique simplifies **microwave characterization of state-of-the-art composite materials** used in many aerospace applications. Its important features are that it is useful for anisotropic or composite samples and that it represents the results expected in a free-space environment. The sample is placed in a radial transmission line because conventional coaxial transmission lines or waveguides cannot provide free-space excitation. Measurements are obtained using a network analyzer at a coaxial port on the radial line, and configuration effects are removed from the raw data using two different models to compute the surface impedance. Results from the two analysis approaches agree to within one percent. (2700/4300)

Safeguards and Security

Sandia developed and installed a new **vehicle tracking and display system** for DOE's Transportation Safeguards Division (TSD). The system uses satellite-based technology to transmit and receive text messages (in addition to the standard 10 codes), a capability essential to the communication of critical information but not available to TSD before this installation. A new command control console was delivered with user-friendly touch screens providing easy access to data bases containing pertinent information. Together with the data bases, high-resolution map displays overlaid with vehicle location and vehicle state-of-health provide all of the data required for TSD's mission of tracking and displaying DOE assets. (9500/9600)

Systems Engineering Depts. I 5362 and III 5365 joined with Process Development and Fabrication Dept. 8284 and Solid Mechanics Dept. 8741, AlliedSignal, and DOE to perform engineering evaluations and inspections on six Sandia-designed **weapon handling-gear systems.** The gear included shipping containers, bomb hand trucks, hoisting adaptors, and lifting slings. Evaluations included stress analysis, drawing reviews for proper material and weld callouts, mechanical tests to failure, and metallurgical examination of welds. Spot inspections were conducted on all hardware in the field, and one container (the H1408) received 100 percent visual inspection by Sandia's American Welding Society Certified Welding Inspectors (AWS CWI). The team also encouraged and assisted in implementing a plan to train and qualify AWS CWIs at AlliedSignal, manufacturer of most of the handling gear. Action plans are being formulated to address the quality concerns found during the inspections. (8200/8700/5300)

Sandia has a lead role in providing US assistance to the Russian Federation for its **nuclear weapon dis-**

Safeguards and Security

mantlement activities. This activity is funded through the Soviet Nuclear Threat Reduction Act of 1991 and currently includes seven projects: storage and transport containers for fissile material, safety and security modifications to Russian weapons transport rail cars, armor blankets to protect weapons from small arms fire, design assistance for a fissile material storage facility, equipment for use in emergency response in the event of an accident, assistance in developing a state material control and accountability system, and the purchase of Russian highly enriched uranium. These projects and other interactions with the republics of the former Soviet Union implement US initiatives to improve our nuclear weapon safety, security, and control practices and encourage environmentally responsible dismantlement. (5800)

The new **Security and Use Control Assessment** (SUCA) Dept. 334 was created during Sandia's restructuring to provide an independent assessment of security and use control equipment. SUCA is conducting a study of surety component evaluation and participating in a study to establish a historical catalog of experiments related to weapon use control effectiveness. SUCA is also exploring ways of formalizing an improved surety assurance process for Sandia, participating in updating the General Characteristics For Use Control, a DoD-owned requirements document, and is exploring use control assessment methodologies. (300)

The Portable Reconfigurable Line Sensor (PRLS), developed at Sandia for the Air Force, is a unique rapidly deployable self-protecting radar security sensor that requires no alignment or calibration.

Sandia has developed a prototype **robotic security system** for the Defense Nuclear Agency that is able to autonomously patrol an exterior site-security perimeter, detect intrusions, and remotely assess alarms. This is the first system of its kind developed for exterior use. After the robot is taught permissible paths in the site, the system is able to automatically respond to alarms generated by the fixed perimeter-security system under supervision from the operator. Benefits of the system include removing human guards from potentially dangerous situations and automating repetitive and boring patrol tasks. Unlike human guards, the system is constantly vigilant and increases uncertainty for the adversary. Sandia is working to transfer this technology to the Army for further development. (9600)

Sandia is transferring the Portable Reconfigurable Line Sensor (PRLS) technology to private industry. Developed at Sandia for the Air Force, the PRLS is a unique **self-protecting radar security sensor** that is rapidly deployable and requires no alignment or calibration. It is expected to have a wide variety of applications in the new field of rapidly deployable security systems. The developed technology is now being transferred to Racon, Inc., of Seattle, through an Air Force/Racon cooperative research and development agreement (CRADA). Through the CRADA, Sandia engineers are working with Racon engineers to develop a commercial version of the PRLS. Racon receives the benefit of Sandia security systems and radar development expertise, while Sandia engineers gain valuable exposure to important commercial manufacturing constraints and requirements. The Racon product should be available in 1993. (9500/2300)

Technology Transfer

SEMATECH and DOE established a national microelectronics Contamination Free Manufacturing (CFM) Research Center at Sandia in FY92 to develop **ultrapure processing technology** that will be needed by the year 2000 to enable production of gigabit integrated circuit devices for US manufacturers. The multi-million-dollar research center is based at Sandia's Microelectronics Development Lab (MDL) and draws on the technical breadth and depth in CFM-relevant research at Sandia. It will focus initially on developing "smart" high-sensitivity contamination detectors, advanced wafer-cleaning techniques, and mathematical models to describe and predict conditions that could result in particle formation during thin film deposition. It also will work on developing particle-proof wafer enclosures that could speed the transition of cleanroom design from the conventional ballroom style to "mini-environments" that would utilize cluster tools and robots. (1300)

In 1991, Signetics Company signed Sandia's first cooperative research and development agreement (CRADA), to assess and improve the **reliability of its advanced integrated circuits** (ICs). Through the agreement, funded equally by Signetics and DOE, Sandia's Microelectronics Quality/Reliability Center (MQRC) delivered a reliability assessment of a new Signetics production technology, benchmarking it against those of other manufacturers. The MQRC also transferred a series of Sandia IC test structures, performed a joint study of IC metallization reliability, and transferred Charge Induced Voltage Alteration (CIVA). CIVA is a new scanning electron microscope failure analysis technique developed to simply and economically locate open circuit faults, which is a serious problem throughout the microelectronics industry. Signetics has initiated the process to renew its CRADA for another year, continuing with six other firms in making use of the MQRC's unique capabilities in failure analysis and reliability assessment. (2200)

Congress, through the Federal Aviation Administration, has established a national **Aging Aircraft Program**, including a Sandia center — the Aging Aircraft Nondestructive Inspection Development and Demonstration Center. The center is focused on developing enhanced inspection techniques for the aging civil aviation fleet. Since its funding in August 1991, a group has been formed at Sandia to develop this center, housed in a hangar at Albuquerque International Airport. The Sandia center has acquired a Boeing 737, among other test specimens, to use in evaluating the cost effectiveness and reliability of the test program, and will report the results of its evaluation to industry. (2700)

From October 1991 through September 1992, Sandia obtained approval for **48 cooperative research and development agreements** (CRADAs) — more than any other defense program laboratory. At the end of FY92, 11 additional CRADAs were awaiting approval by the DOE Albuquerque Field Office, and 68 were in various stages of preparation or negotiation with partners. Some of the companies working with Sandia include Motorola, Signetics, Texas Instruments, National Semiconductor, Dow Corning, Cray Development, BPLW Architects and Engineers, Schumacher, United Technologies/Pratt & Whitney, and LSI Logic. In addition, Sandia's Technology Based Regional Economic Development (TRED) Program provided assistance to more than 100 small and medium-sized companies in FY92. Launched in October 1991, TRED offers tours of Sandia, technical workshops and seminars, and one-on-one interactions to promote the use of Sandia's unique capabilities and provide advice or technical assistance not readily available elsewhere. It is not intended to provide services or assistance obtainable from commercial companies. (4200)

Sandia, using computational simulation, continues to work with a number of industry partners to improve **chemical vapor deposition** (CVD) processes for both structural and microelectronics applications. The work considers both fluid flow and heat transport in CVD reactors as well as the process chemistry. With United Technologies, Sandia has optimized the design of a large-scale system to coat carbon-carbon composite structures with silicon nitride. With SVG/Thermco, we have helped to scale up an advanced diffusion furnace for semiconductor fabrication. A project with the Norton Company focuses on scale-up and cost reduction in the manufacture of synthetic diamond films for microelectronics packaging applications. With the 3M company, we are working to improve the synthesis and coating of alumina fibers for incorporation into metal-matrix structural composites. The structural projects are supported by the Defense Advanced Research Projects Agency and the microelectronics applications by SEMATECH. (8700/8300/1100/1500)

The application of standard techniques for **arc welding processes** does not provide the data required to construct and verify welding models. The intense luminance range of the arc exceeds the dynamic response of film emulsions and electronic sensors. A diagnostic imaging technique that uses laser illumination and narrow bandpass filters in conjunction with high-speed film and video systems has been developed that provides detailed experimental data for welding process modeling. The data include filler metal droplet size, mass of metal transferred, weld pool dynamics, arc reignition through a cathode spot, and the physics of the weld arc. (8200)

Sandia's decision to address escalating health care costs through the application of appropriate technology led to the definition of the **Biomedical Engineering Initiative**. This initiative is designed to address the development of appropriate technology with potential to reduce health care costs, increase cost effectiveness of health care delivery, and improve quality of life. Several Sandia projects have been funded internally. Some have already demonstrated potential for commercialization: non-invasive glucose sensor for diabetes control, pattern-recognition software for cancer detection in mammograms, and analysis of medical staple deformation for the design of suture staple guns. Other projects that are in the demonstration phase include an ultrasonic scanning system for prosthetic application, chemometrics-based optical-reflection fetal oximeter for applications in medical diagnostics, silicon-based sensors for accurately measuring radiation doses during radiation treatment, and X-ray tomographic microscopy for high-resolution 3-D bone imaging. (9900)