

Secretary's Task Force to Examine Future Roles of DOE Labs

Scientists, academicians, and industrial leaders will be part of a new task force created by Energy Secretary Hazel O'Leary recently to examine possible future roles of the DOE laboratories.

The task force's primary mission, she said, is to "take a hard look at what should be the alternative missions for the DOE national laboratories." O'Leary announced formation of the Task Force on Alternative Futures for the DOE National Laboratories during a Feb. 2 press conference in Washington.

"These labs have been engines for scientific and technological innovation in the past, generating new technologies and knowledge that have helped establish US scientific and technological pre-eminence," she said.

"With the end of the Cold War and growing concerns about global economic competition, now is the time to plan how the department's laboratories can best help meet the energy, environmental, economic, scientific, and defense needs of the future."

The 15-person task force will be headed by Robert Galvin, former CEO and current chairman of the executive committee of Motorola. Other members have not yet been selected, but will include several members of the Secretary's main advisory group (called the Secretary of Energy

Advisory Board, or SEAB), as well as "volunteer" experts from the scientific, academic, and business communities. The first meeting will convene next month, and the study will be completed by Feb. 5, 1995.

Sandia Among Top Subjects of Study

During its one-year review, the Secretary's task force will scrutinize DOE's nine large, "multiprogram" laboratories. With combined budgets of \$6 billion and total employment exceeding 50,000 people, said O'Leary, "these nine are our largest, most valuable national laboratories, at least within the realm of the Department of Energy."

The nine are Sandia, Los Alamos National Lab, Lawrence Livermore National Lab, Argonne National Lab, Brookhaven National Lab, Idaho National Engineering Lab, Lawrence Berkeley Lab, Oak Ridge National Lab, and Pacific Northwest Lab. The study will also review how the National Renewable Energy Lab in Golden, Colo., fits with the Department's renewable energy strategy.

As activities for the defense labs continue to shift away from new nuclear weapons R&D and toward proxy testing, stockpile safeguarding, and non-proliferation concerns, she said, the task force will pay particular attention to the roles of DOE's three major defense labs — Sandia, Los Alamos, and Lawrence Livermore.

"These laboratories may, and should, be looking for alternative missions," she said. "But I want to make clear that the national security requirements [of the labs] still exist."

The task force will begin by developing an understanding of the facilities, resources, capabili-

ties, core competencies, and missions of the laboratories — both as individual institutions and as a system. It will then examine alternative scenarios for redirecting the labs' scientific and engineering resources. (See "O'Leary's Objectives for Examining the Labs.")

Among the scenarios O'Leary cited: "possible redirection, restructuring, and/or closure of parts of the DOE laboratory system." The product of the review will be a list of recommendations citing specific alternatives for utilizing the DOE laboratories, which the Secretary pledged to act on.

She added that the DOE laboratories represent a major national resource, employing 19,000 scientists and engineers and 40 percent of the nation's

Among the scenarios O'Leary cited: "possible redirection, restructuring, and/or closure of parts of the DOE laboratory system."

high-energy physicists. "Over the lifetimes of these institutions," she said, "the American public has invested \$100 billion in these laboratories. If we were to seek today to replace the infrastructure [of these laboratories], . . . the replacement cost in capital equipment alone would be \$20 billion."

She also mentioned US industry's increased reliance on the DOE labs' facilities and expertise as an important factor in deciding how scientific and engineering resources will be allocated in the future. "More and more as the private sector folds down the amount of its budget that it can expend

(Continued on Page Four)

Features Continuous Feedback

Work Planning, Performance Get New Look

Sandia's new Performance Management system for planning, tracking, and assessing individual Sandians' effectiveness on the job was designed to "be a forward-looking tool to help strengthen communications among employees, managers, and customers, and to better align the work of the Labs with strategic business plans."

That's according to Margaret Harvey of Compensation and Job Evaluation Dept. 3545. She and Ed Cassidy (3545) were the project managers for development of the new system as it applies to all non-represented employees.

Even though the system is new to Sandia, it has been under development since at least 1990, when the Rewards and Recognition Project — reinforced soon afterward by results from the first "Sandians' Perspective" survey — indicated that Sandians were dissatisfied with the way their job performances were evaluated.


"The Sandians' Perspective survey showed we were significantly worse in our attitudes about our evaluation process than similar organizations were about theirs," says Margaret, "and that there was a special need for greater communication between employees and their managers. With such input, and given the Labs' evolving and growing post-Cold War work role — requiring greater sensitivity and responsiveness to customer needs —

(Continued on Page Four)

Special Section: Labs Accomplishments For Fiscal 1993

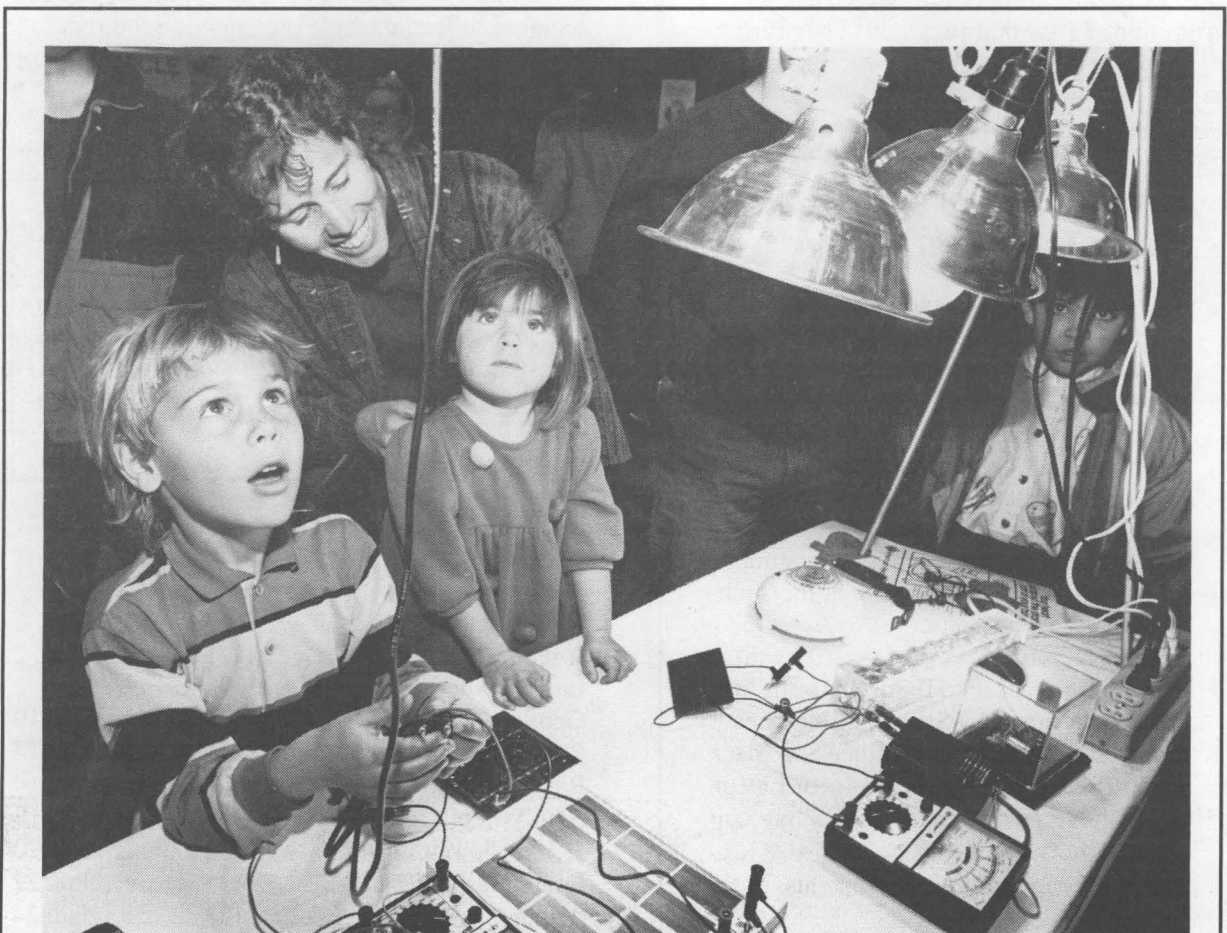


HAZEL O'LEARY



LAB NEWS

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DISCOVERING PHOTOVOLTAICS — Sandia's photovoltaic exhibit at the Discoverland exhibition last weekend caught the attention of Gavin (left) and Tegan Argo, along with their mom, Elaine. The KNME-TV event at the New Mexico State Fairgrounds gave children a chance to enjoy scientific exhibits, games, and entertainment. (Photo by Randy Montoya)

This & That

"A surprising number of first-rate achievements" - That's how Sandia VP Paul Robinson (4000) described the collection of Sandia achievements from FY93 in this issue after first seeing them. The special "Labs Accomplishments" section is published in the middle of this issue. Thanks to the many Sandians who submitted accomplishments (including those who didn't make the cut), to the VPs who reviewed and selected them, and to LAB NEWS Writer Howard Kercheval for coordinating this project with the help of several other LAB NEWS employees.

My old retired boss used to remind his faithful crew periodically that our main job is to keep our heads while others about us are losing theirs. It appears that Sandians are not only keeping their heads during these uncertain times, but are keeping mightily busy in the process.

Many Sandians like to save the Labs Accomplishments section to show VIP visitors, customers, and family members. We printed a few extras; call 844-7522 if you need one.

* * *

Can't argue with that! - I couldn't stifle a laugh when I read this heading on a recent Department of Energy news release: "Energy Department Says Texas Holds Wind Energy Potential." I lived in Texas for nearly four years, and I can say for sure that's true. There is a seemingly unlimited amount of wind energy potential there. If you don't believe it, just listen to a Texas politician for a few minutes.

* * *

Welcome, Ken! - I announced last month that Managing Editor Charles Shirley is transferring to another organization. We'll all miss him, but we have selected his replacement: Kendrick (Ken to his friends) Frazier, who has worked in Sandia's Media Relations office for 10 years. We'll tell you more about Ken in the next issue after he joins us and locates his desk and high-tech writing machine, but I'll tell you now that Ken is one fine writer and a great guy to boot. We welcome him.

* * *

Less takes longer! - This may not be entirely original, but President Al Narath drew a chuckle from Sandians at one of his recent quarterly briefings after he gave an extended answer to a question. Al then asked the audience, "Have you ever noticed that the less a speaker knows about something, the longer the answer is?"

* * *

I'm glad - how 'bout you? - Aren't you glad you can pick up at least one newspaper - the LAB NEWS - and know that you aren't going to see a single story about Michael Jackson or Tonya Harding?

* * *

Budget madness time - It's that time of year when the media start dissecting the next proposed federal budget, turning the pieces around (sometimes at very odd angles), and speculating about our future. Remember last spring when some wild stories were published that Sandia's FY94 budget would be way down and that we'd be cutting a thousand jobs? Thank goodness, the quality of the rumors and speculation is higher this year, but don't be surprised if you see misleading headlines just about any day this time of year. Keep in mind that many, many deliberations and much jockeying for position lie between here and the FY95 budget. We'll report anything meaningful when the budget fruit really starts to ripen. Let's hope it's no lemon! ●LP

Copies Available to Employees

Narath Testifies Before House Subcommittee

Sandia President and Lab Director Al Narath testified before a US House subcommittee on Feb. 3 about the evolving role of the DOE labs and how they can contribute to national security by working cooperatively with industry and universities. Al's testimony was presented to the House Committee on Energy and Commerce, Subcommittee on Energy and Power.

It was presented in support of the DOE National Competitiveness Technology Partnership Act, introduced as House Resolution 2875 by Congressman Bill Richardson of New Mexico. The act was originally introduced in the US Senate by New Mexico's Senators Jeff Bingaman and Pete Domenici, and was passed by the Senate in November 1993.

Because similar information was covered in last month's State-of-the-Labs interview with Al and Executive VP Jim Tegnalia, the LAB NEWS is not reporting the details of Al's testimony. However, we are making copies of the testimony available to interested Sandians.

Al emphasizes in the statement that "a comprehensive definition of national security must include national defense, energy security, environmental integrity, and economic vitality."

He goes on to explain that Sandia's strategy for technology transfer has "evolved from maximizing the number of small CRADAs [cooperative research and development agreements] to seeking large-scale alliances with industry and universities.

"In the last two years," he continues, "we have begun to focus on teamwork arrangements with clusters of companies and larger-scale alliances in which the capabilities of DOE laboratories, industry, and universities are combined to pursue broad, industry-driven precompetitive R&D agendas.

Al also explains his views about how federal R&D investments can yield their full potential.

Sandia/New Mexico employees who want a copy of Al's complete written testimony should mail or fax requests to the LAB NEWS, Mail Stop 0413, fax 844-0645 (no phone requests, please). Sandia/California employees should send requests to LAB NEWS Reporter Barry Schrader, Mail Stop 9111, fax 294-3524. ●

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MARTIN MARIETTA

VIP Visitors and Black Heritage Events Covered in March 4 Issue

Watch for coverage in the next issue of two events that occurred Wednesday, Feb. 16, after this issue went to press.

One is the visit by New Mexico's US Senators, Jeff Bingaman and Pete Domenici, along with the Director of the National Institute of Standards and Technology, Arati Prabhakar. We will also report about Senator Domenici's remarks during a colloquium he gave at the Technology Transfer Center.

LAB NEWS representatives also attended the Black History Month luncheon sponsored by Sandia's Black Leadership and Outreach Committee and Black Heritage Club. We'll have information about the festivities and about several Sandians who were recognized at the luncheon for outstanding achievements.



Video Conferencing Info by Fax

Sandia has new video conferencing facilities, with more coming (see "Video Links Help Sandia Researchers See Eye to Eye" on page three). Current location and scheduling information is available by fax from Sandia Line: Call (505) 845-6789, then dial 9-1246#.

Retiree Deaths

Paul Montano (83).....	4623	.....Jan. 2
Joseph Meland (63).....	2171	.....Jan. 2
Larry Horner (71).....	3921	.....Jan. 2
George Gleicher (77).....	4321	.....Jan. 10
Perfecto Romero (76).....	3615	.....Jan. 14
Raymond Butler (76).....	1642	.....Jan. 14
John Wimpling (75).....	3740	.....Jan. 19
Herbert Jewett (74).....	1482	.....Jan. 20
Frank Martin (72).....	3435	.....Jan. 22
Arthur Clark (75).....	8123	.....Jan. 24
Arthur Chacon (91).....	4573	.....Jan. 28

Sympathy

To Ann Marie Griego (7437) on the death of her father in New Orleans, Dec. 29.

'Dial Up' Video Conferencing**Video Links Help Sandia Researchers See Eye to Eye**

Sandia scientists can now meet face-to-face with colleagues anywhere around the world by simply walking to the nearest video conference room and turning on a TV set.

With the recent installation of high-technology video conferencing "teleports," employees Labs-wide can attend tele-seminars, work with project team members at another site, or hold multipoint meetings with external companies and agencies.

"Video conferencing is one piece of our customer-driven, integrated way of doing business," says Dona Crawford, director of Scientific Computing 1900. "The technology will couple computers, networking, information, and people based on



customer needs. Whether it involves linking one-to-one, one-to-many or many-to-many, our goal is to provide a seamless application that is painless for people to learn and use." Dona speaks from experience. She uses Sandia's video conferencing capabilities almost daily to hold meetings with department managers in both New Mexico and California.

"Video conferencing lets people communicate more effectively because it's possible to read body language much better than someone's voice over the phone," she says. "Moreover, we can't afford to move people, so we need to be able to move information. In fact, our goal at Sandia is to become a microcosm of what is happening in the national information superhighway, and to serve as a model for the nation. This will allow us to work easily with industry, or perhaps even implement new information technology for DOE and private industry."

Pete Dean, Manager of Networking and Communications Dept. 1951 and project leader for video conferencing, says, "Video conferencing played a vital role in the recent Supercomputer Consolidation

Project by allowing large numbers of staff to participate fully in the many meetings required for a project of that size."

Jim Berry (1951), the Sandia/California video conference engineer, predicts that the teleports will provide the Labs with substantial savings by giving people more time in their offices.

"Sandia purchased this advanced video conference installation to improve communications throughout the company," Jim says. "The teleports will let teams collaborate more efficiently by facilitating unclassified point-to-point and multipoint video conference meetings. In addition, we're making major equipment upgrades in our auditoriums. As a result, a popular tele-seminar presentation, such as a speech by a visiting dignitary, can be broadcast simultaneously to people in various teleport rooms. The compatible video conference technology is also available for the desktop."

Though users have to schedule time at the teleports (see end of article for information about locations and scheduling), there is not a charge for using them.

Dialing International Connections

"The new equipment gives us greater flexibility by allowing us to essentially dial a video conference connection" says Mark Schaefer (1955), the Sandia/New Mexico video conference engineer. "The equipment uses international standards



DEMONSTRATING VIDEOLINK capabilities between Sandia's two main sites are four team members "live in Livermore" and two on-screen from Albuquerque. Seen "live" (from left): Dot Harrell, Jim Berry (both 1951), Jay Petersen (8275), and Dona Crawford (1900). On screen: Mark Schaefer (left) and Dan Saladin (both 1955).

for videophone conferencing. When you include the public communication services available, these units can connect internationally to a large number of similarly equipped facilities."

Currently, there are three teleports at the New Mexico site, six at California and one at Sandia's Microelectronics office in San Jose, Calif. Seven additional teleports are to be installed this year at New Mexico and two at California. Manufactured by Picture Tel of Danvers, Mass., the system consists of a computer, television, camera, remote control, and multiple telephone connections.

"Teleports are the home entertainment centers of the future," Jim predicts. "The video conference industry has begun developing a television-top device to bring videophone technology to the home. One of our goals is to train users to set up and manage their own conferences. Another is to establish single-point-of-contact scheduling, intended to smooth the scheduling process. Although we are just beginning our training program, people have heard about the teleports by word-of-mouth and are already using the equipment."

Better Performance, One-Fourth the Cost

Though this generation of equipment is new at Sandia, video conferencing isn't. In 1988 Sandia installed its first video conference systems at a cost of \$200,000 each; today, new conference teleports cost about \$50,000 each.

Mark says, "The original installation involved Sandia/New Mexico, Sandia/California, and Allied-Signal in Kansas City. It served as the prototype for the current DOE Secure Video Conferencing Network (SVCN). The original facility is being updated as well. New equipment at the DOE SVCN sites will allow the system to operate more economically. The equipment modifications will allow communication at lower data rates with no loss in picture or sound quality. In addition, the DOE network is being modified to allow interoperability with other government video conference networks."

Jim adds that interest in teleports for internal conferencing purposes has been strong. "This initiative has received support because people see it as a way to avoid frequent traveling and to boost productivity," he says. "We definitely have a motivated community, and anticipate expanding the teleport capability as user demand increases."

Current location and scheduling information is available by fax from Sandia Line: Call (505) 845-6789, then dial 9-1246#. ●MSheehan

Supervisory Appointments

PATRICIA SMITH to Director of Human Resources and Business Operations Center 8500.

Pat joined Sandia in 1981 as a technical writer assigned to the Solar Department. Later she was matrixed to the Combustion Research Facility to coordinate high-visibility communications. In 1985, she was promoted to Supervisor of the Technical Publications Department.



PAT SMITH

During a two-month special assignment to Albuquerque in 1987, she worked with the Technical Information Department there. In December 1987 she became Manager of Personnel and Employee Resources Dept. 8522.

Other special projects/assignments in which she has been involved include chairing a task force to examine communications at the California site, coordinating the communications strategy for Sandia/California's Department of Labor audit, negotiating the 1990 labor contract with the International Association of Machinists & Aerospace Workers, participating on the Rewards and Recognition Committee, and co-training for the "Sandia Management Development Course," "Leadership Is Everybody's Business," and the Performance Management Workshop.

Pat began her career as an editor for American College Testing in Iowa City, Iowa. She has a bachelor's degree in English from Spalding University in Louisville, Ky, and a master's degree in technical writing from Rensselaer Polytechnic Institute.

BRUCE AFFELDT to Manager of Fabrication Dept. 8284.

Bruce joined Sandia at Livermore in 1962, working in the Ozalid Room (the name for Drawing and Reproduction at the time). After five years,



BRUCE AFFELDT

he moved to the Drafting Department and then to the Machine Shop as a programmer. He became a Technical Staff Associate in 1985. Bruce returned to Drafting for four years to assist with the installation of that organization's computer-aided drafting system.

He was promoted to Member of Technical Staff in 1989 and became acting Manager of the Fabrication Department in March 1993. Bruce has a Technician's Certificate in electronics from the Illinois Institute of Technology in Chicago.

(Continued from Page One)

Task Force

on research and development, it tends to be looking toward our laboratories to get that work done," she said. "The question quite naturally is how much of that work should the labs do?"

A major concern of hers will be to ensure that the "sea of basic and applied research doesn't dry up, so that we can win the next competition, which has nothing to do with war but something to do with industrial, or economic, survival," she said.

Mission Redirection Possible

O'Leary emphasized that although lab closures are an option, they are not a starting assumption of the task force. "Before we focus on closings we've got to figure out what [the labs] produce, by what measure, and at what cost. . . . Seems to me on the table ought to be what alternatives are there to ensure that meaningful work does take place."

"We welcome this review," said Labs President Al Narath in a *Sandia Bulletin* published Feb. 2. "It fits well with what we at Sandia have been doing in long-term strategic planning and preparing for future uncertainties. We feel we are well positioned for carrying on our important missions in national security, environmental integrity, energy, and in working with private industry to bolster US economic competitiveness. We have worked very hard to demonstrate excellence in all we do and in forging broad capabilities and interactions with industry in the important thrust areas of manufacturing technologies, electronics, and information science and technology. We think we are well positioned for the future."

Executive Staff Director Virgil Dugan (12100) says it is unlikely Sandia will be considered as a candidate for closure. "Sandia is in a somewhat positive position among DOE laboratories," he says. "Simultaneously we are accumulating new nuclear weapon manufacturing responsibilities, we are expanding the definitions by which we interact with industry, we have a progressive energy and environment program, and we have ongoing nuclear weapon stewardship responsibilities that demand our continued attention. I don't think closure is even thought about in terms of Sandia.

"One concern we do have, though, is a continuing decline in R&D funding from DOE's Office of Military Application. That is a potential threat to our ability to fulfill our basic mission."

About the task force's work, Virgil says, "The primary driver of this review is to reconfigure the laboratory system so it is more compatible with

O'Leary's Objectives for Examining the Labs

Secretary of Energy Hazel O'Leary released the following list of "Objectives" that will guide her Task Force on Alternative Futures for the DOE National Laboratories:

1. The Task Force should develop a clear understanding of the roles played by the DOE multiprogram laboratories in the research and technology development process. Specifically, the Task Force should examine the roles of the laboratories in meeting public missions, in serving as an R&D provider to other agencies and the private sector, and in working with academia to advance fundamental science. This examination should include an assessment of the contribution of the DOE laboratory system to the overall national investment in science and technology, and a comparison of the activities of the DOE laboratories to the R&D focus of other government agencies, academia, and the private sector.

2. The Task Force should become well versed with the nuclear weapons related research, development, testing, and evaluation (RDT&E) needs for the nation over the coming decade, and the options for satisfying these needs. Specifically, the Task Force should closely examine the strategic planning efforts currently under way within DOE Defense Programs, particularly those efforts aimed at shifting the nuclear weapons safeguards program from underground nuclear testing to science-based stockpile stewardship. It should also interact closely with the Department of Defense.

3. The Task Force should assess the role that the DOE multiprogram national laboratories have played in the advancement of basic research and the fundamental sciences. This

should include a review of the role played by the various DOE User Facilities, the computational science resources, and the advancement of the life sciences. Ways by which this role might be improved or strengthened should be identified.

4. The Task Force should examine the current configuration of nuclear weapons RDT&E activities among Los Alamos National Laboratory, [Lawrence] Livermore National Laboratory, and Sandia National Laboratories. This should include an assessment of the strategy behind the current configuration, which involves purposeful redundancy to promote competition and peer review. Alternatives to the existing configuration should be examined.

5. The Task Force should assess the role of the multiprogram laboratories in supporting economic competitiveness and contributing to the US industrial R&D base. This should include an examination of the opportunities and the mechanisms for the multiprogram laboratories — as a system — to contribute to large partnerships with the private sector as well as providing R&D assistance to small businesses.

6. With the current assessment of the roles and missions of the DOE multiprogram laboratories in mind, the Task Force should examine several options for the future of these institutions in terms of budgets, management, and mission assignments, including an analysis of possible costs and benefits of each alternative. As part of the examination of costs and benefits, the Task Force should assess the ability of R&D institutions such as the DOE laboratories to adapt to varying levels of change. This analysis should assist the Task Force in recommending implementation options.

national needs," he says. "This laboratory system was set up 50 years ago, and it is now time to re-evaluate. Just like industry, DOE needs to 're-engineer' itself to improve its effectiveness."

Strategic planning efforts by Sandia's management during the past few years will likely mesh with recommendations ultimately arrived at by the Secretary's task force, he believes. "We have worked hard to make our core competencies the foundation of Sandia's service to the nation," he says. "I am hopeful the task force will find that these same core competencies are valuable both to industry and other government agencies."

O'Leary said such soul-searching within the

laboratories during the past few years has helped DOE identify some areas of expertise of the laboratory system. "We're talking about customers, and the next logical step is to have [an examination] done externally," she said.

"Our sense was that we needed to have our own independent assessment," she said, "not necessarily done by federal employees but done by members of the scientific community without an interest in our laboratories, and perhaps most importantly done by industrial leaders who now look upon these laboratories as a wealthy resource for their own work in terms of moving products into the international competitive arena." ●JG

(Continued from Page One)

Job Performance

Sandia's Strategic Human Resource Plan identified the implementation of Performance Management for all positions, across all job levels, as one of its key strategies.

"This is a forward-looking approach," she continues. "It is a cyclical process that includes planning your work performance at the beginning of the cycle, ensuring that there's continuous feedback over the course of the cycle, that changing priorities are accounted for during the cycle, and at the end of the cycle, assessing how you performed against the set of expectations planned and agreed to between you and your supervisor. Additionally, the context is formalized to provide for career development discussions between employee and supervisor."

Process Began Last Year

Vice presidents and directors were introduced to the Performance Management system last year. "Within the last couple of months," Margaret explains, "the vice presidents have established their performance plans with [Executive VP] Jim Teg-

nelia and [President] Al Narath, and they are currently cascading those plans to their directors."

The Performance Management system for represented employees was instituted in November, and it will begin covering non-represented employees this year.

Margaret says employees will be learning about the system from their supervisors through department, center, or other organization meetings, after supervisors have attended workshops specifically focused on establishing performance plans and have developed implementation plans for their organizations.

The calendar for the new performance year is being put into final form and will be published in the near future. Meanwhile, supervisors and employees can begin developing performance expectations for the next 12-month period.

Strategy, Performance Aligned

"Input to members of the Performance Management process design teams contained a clear message from employees," she says. "Employees viewed the old performance appraisal system as divisive, time-consuming, and unproductive.

"Industry experience with performance management systems tells us that as we experience and

practice the process, we will get better," she continues. "Typically, the third time through, we should begin to feel comfortable with the process and fully appreciate the consequences of improved communications and strengthened employee, supervisor, and customer relationships."

As the Labs' business strategy is redefined, says Margaret, job performance expectations should be redefined to align with it. "This includes understanding more definitively what our jobs are, how we fit into the business strategy, and how we are performing compared to expectations."

In addition, says Margaret, there is provision for customer input at the end of each performance evaluation cycle. When planning performance, employee and supervisor agree on which customers will be asked about the year's job performance, as measured against goals set out at the beginning of the evaluation period.

"Visions may change, priorities change, objectives change, and this is not intended to be a mechanism that locks you into a course of action," she says. "It is intended to be a guide that helps you focus on those things that need to be focused on, and as the need to change arises, provides for discussion between employee and supervisor of that need." ●

'Sandians' Perspective,' 1991 and 1993

According to Survey, Sandians Feel Better about the Labs

Sandians have higher opinions of their immediate supervisors, their opportunities for involvement in the company, the Labs' management, and personnel policies and procedures than they did two years ago.

Those are the categories in which the 3,840 Sandians responding to the latest "Sandians' Perspective" survey registered the greatest increase in percentage of favorable responses, compared with a similar survey in 1991. But those aren't the only areas showing more-favorable responses: In 13 of 18 categories of questions, the Sandians expressed statistically significant increases in favorable opinions.

The other nine (from greatest to least increase) are performance appraisal, training and career development, work organization, working relationships, communication, mission/vision/values, quality, job satisfaction, and organization change.

Three categories did not undergo a statistically significant change: company image, rewards and recognition, and benefits.

Two categories declined significantly: job security (down to 37 percent from 39 percent favorable) and reaction to the survey (down to 47 percent from 50 percent favorable). ("Reaction to the survey" gauges opinions about how well managers will use survey results.) The drop in favorable responses about job security sent that category to the bottom of the list; it was fourth from the bottom in 1991.

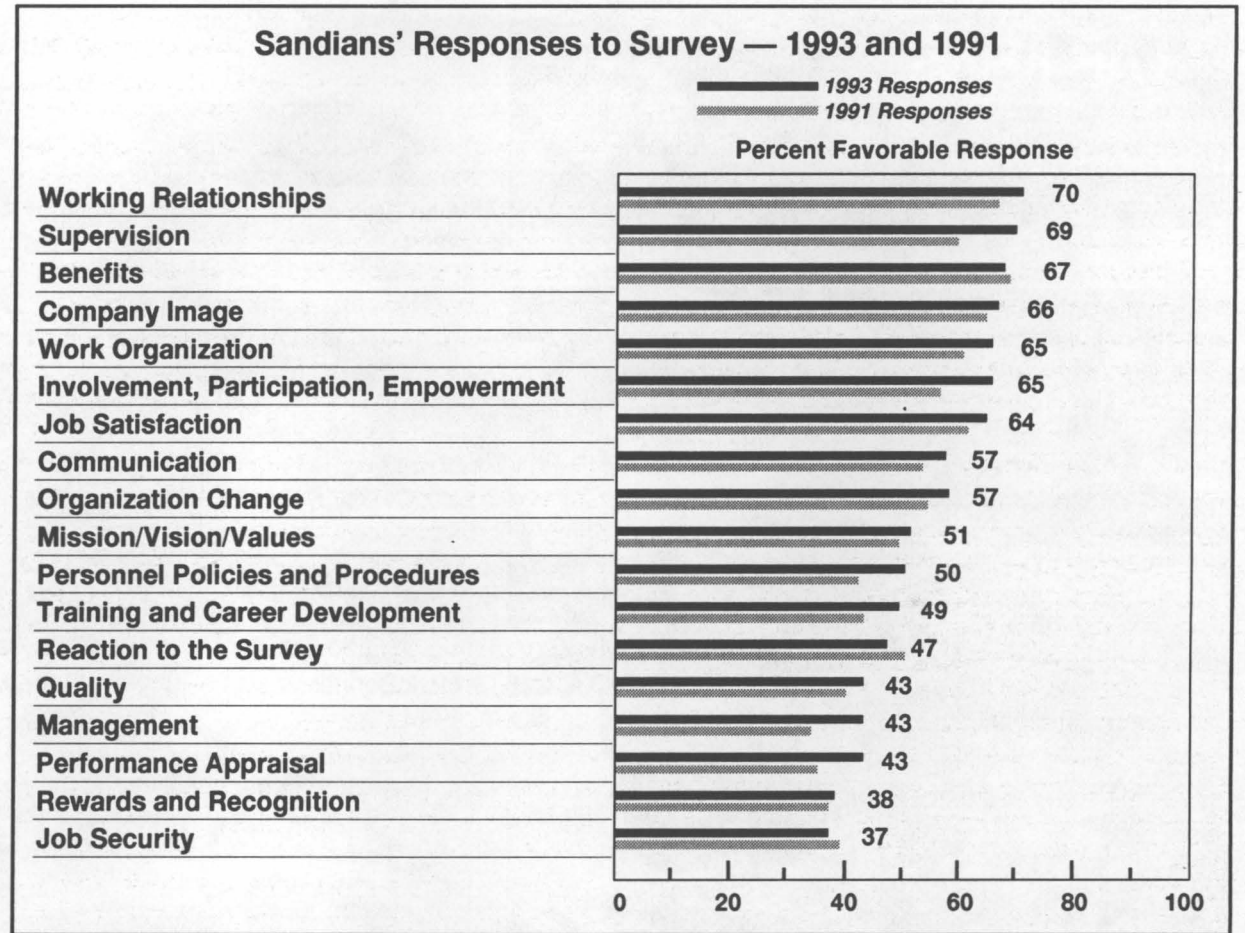
Management Rises Three Notches

The more-favorable responses about Sandia management raised that category three notches from its 1991 position at the bottom.

The company administering the survey in both years, International Survey Research Corp. (ISR), based its category comparisons on the individual questionnaire items in each category that were the same in both years. Though the 1993 survey was nearly identical to 1991, a few categories had different items.

For instance, the 1993 survey included three items about personnel policies and procedures. The 1991 survey had five items, three of which were the same as in 1993. In calculating the change from 1991 to 1993, ISR used the three questions the surveys had in common.

In individual questionnaire items in the "supervision" category, Sandians rated their immediate supervisors' people skills and guidance



PERCENT OF FAVORABLE RESPONSES to survey items in 18 categories are indicated in this chart. Numbers at the end of the bars are the percentage of favorable responses in the 1993 survey. Solid bars are 1993 results; shaded bars are 1991 results.

of employees much higher than in 1991, says ISR's report. In the "management" category, respondents were more likely in 1993 to rate their departments and centers as well-managed. They were slightly less certain that Sandia as a whole is well-managed (that item declined four percentage points).

In the "performance appraisal" category, opinions about all items except one improved. The exception is that slightly more respondents in 1993 said Sandia is too lenient with people who perform poorly.

In "training and career development," Sandians responded more favorably about opportunities to learn of job openings, fairness of the job posting system, and opportunities for training.

The improvement in "working relationships" is due to survey items indicating greater confidence that people are treated with respect regardless of their level and that teamwork is encouraged and given recognition. In "work organization," the respondents reported that their departments were better organized and that there was less duplication of effort.

When the survey results are broken down by location, only one statistically significant difference appears. Sandians at the California site feel less favorable about benefits than all Sandia employees (67 percent favorable for all respondents vs. 56 percent favorable at California).

In a gender comparison, men feel less positive about job security and women feel more positive about supervision, job security, and the company's image. Other differences between men's and women's responses were not statistically significant.

Besides noting changes in Sandians' opinions,

ISR's report compares the responses with those of employees at other research and development organizations. ISR has data from nearly 27,000 employees of R&D organizations.

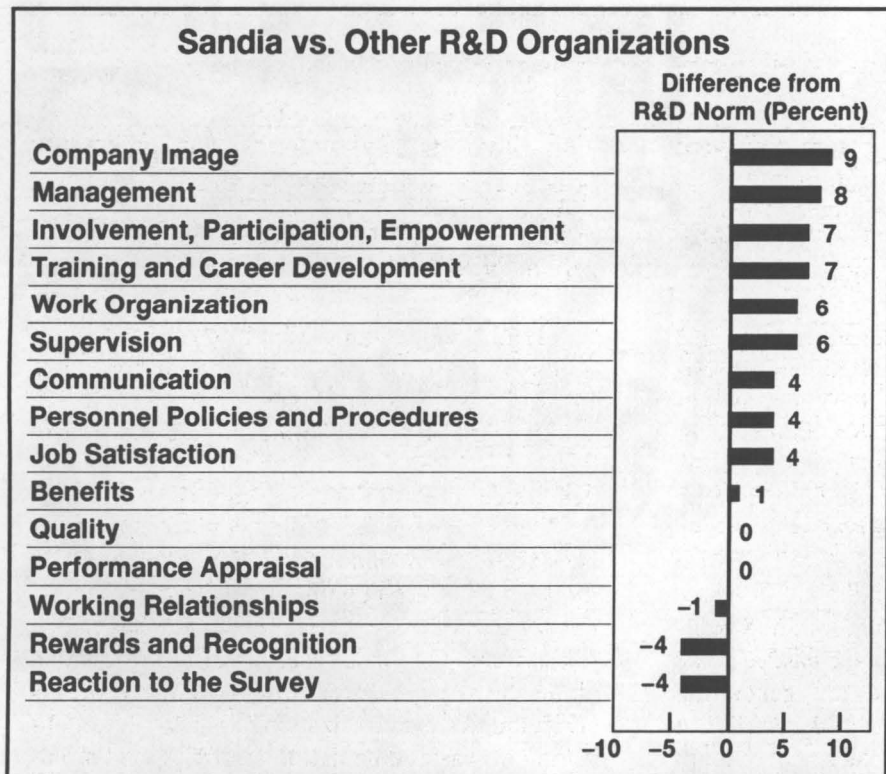
More Positive Than Most R&D Employees

According to ISR's comparison, Sandians feel better about their company than do employees of other R&D firms in nine of 15 categories that can be directly compared. They're less favorable in two categories and don't show any statistically significant difference in the other four. (See chart at bottom of page.)

At the top of the comparison with the R&D norm are Sandians' opinions about the company's image (9 percent higher than the norm) and management (8 percent higher). Sandians were more pessimistic than the norm in the categories of rewards and recognition, and reaction to the survey (each 4 percent below the R&D norm).

Project manager for the 1993 Sandians' Perspective was Bruce McClure of Individual Development Dept. 3521. Danny Brown, Manager of Human Resources Strategy Office 3511, is working with the Strategic Human Resources Planning Team to use results of the survey in developing recommended actions for the Sandia Quality Leadership Council.

Labs-wide Sandians' Perspective results have been distributed to all division offices, along with results for the division. Employees who would like to see the detailed results should contact their division office. ●CS



SANDIANS' PERSPECTIVE responses in 15 categories of questions asked in 1993 are compared here to responses from other R&D organizations. The chart shows the number of percentage points by which the Sandia responses fall above or below the norm for R&D organizations.

Nearly Half Completed the Survey
 The second "Sandians' Perspective," often called the Stanek Survey after the president of the company administering it, was given in the fall of 1993. It underwent only a few minor revisions, so that it would be comparable to the 1991 survey. Of the Sandians offered a chance to complete the survey, 48 percent, or 3,840, did so. In 1991, 52 percent completed the survey. The 1991 survey was completed at work. In 1993, Sandians received the survey at their work place and were encouraged to complete it at home.

MILEPOSTS

LAB NEWS

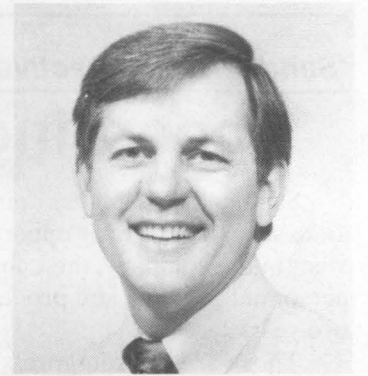
February 1994



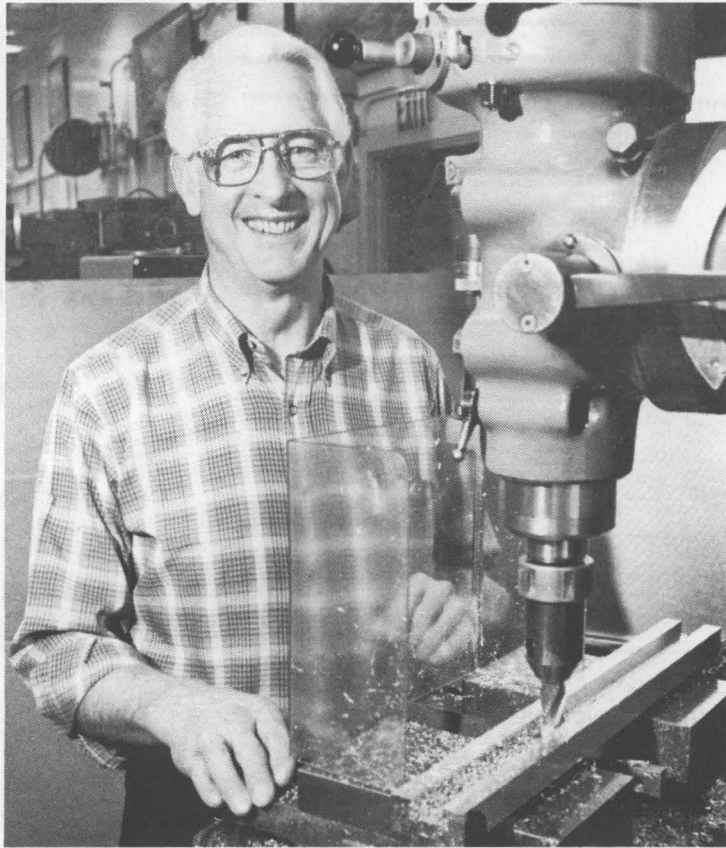
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9299 30



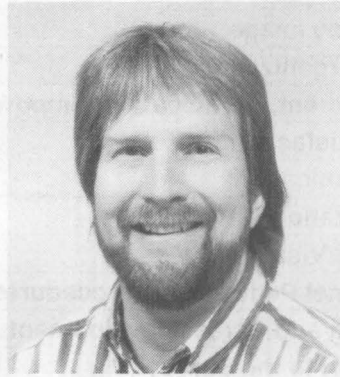
Fred Rodriguez
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Don McCoy
5504 25



Kyle Williams
2481 40



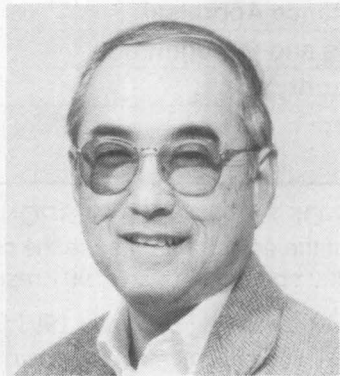
Mark Benner
1743 15



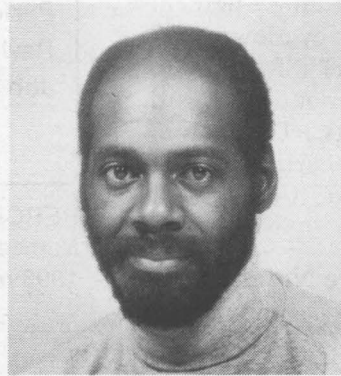
Robert Workhoven
7433 35



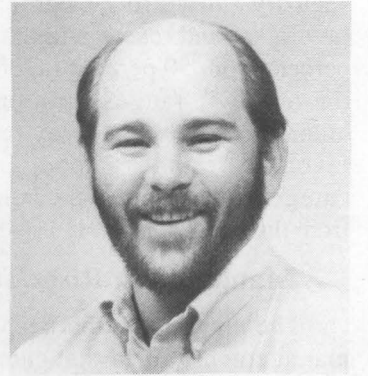
Dora Gunckel
6400 25



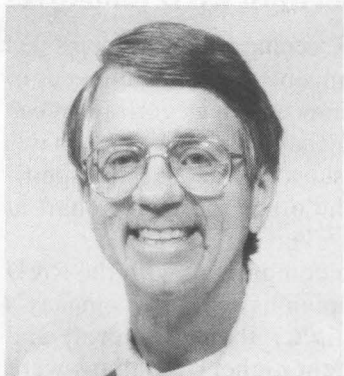
Dennis Miyoshi
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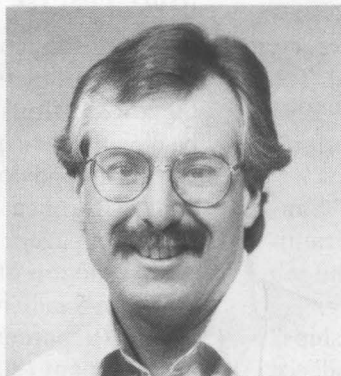
Parris Holmes
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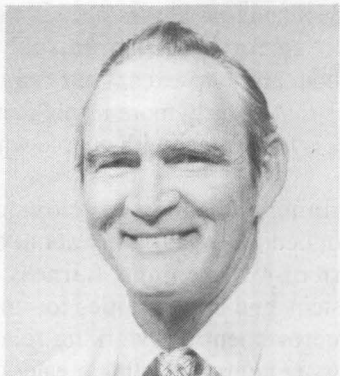
Guy Donovan
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John Campbell
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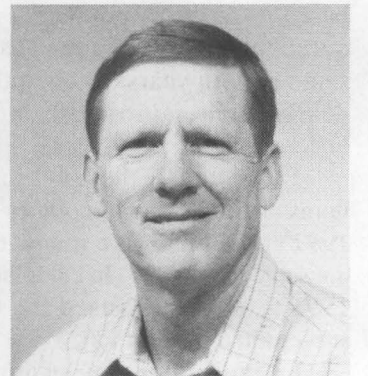
Richard Parker
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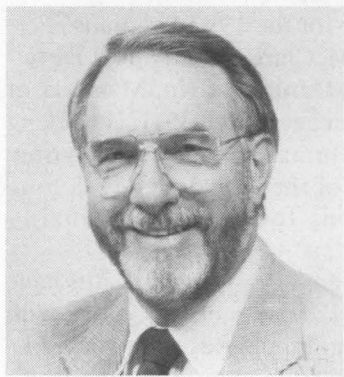
Charles Jenkins
2612 25



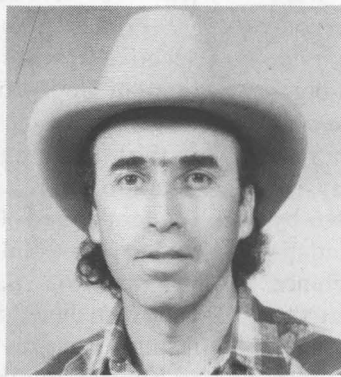
Juan Ramirez
1204 20



Tom Wright
5908 25



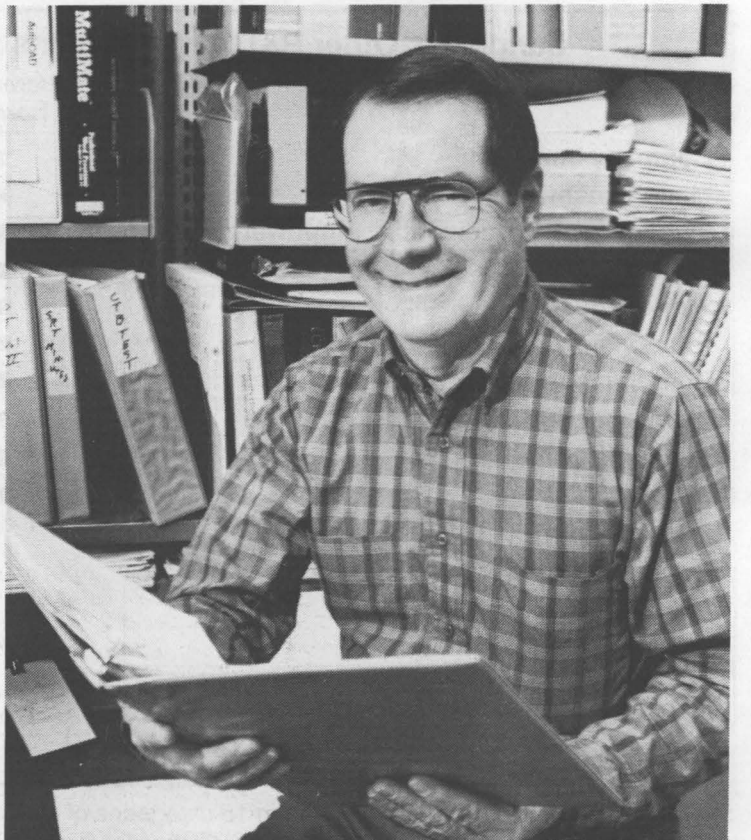
Frank Thome
6403 25



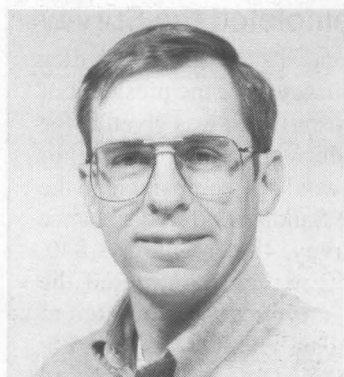
Manuel Trujillo
2472 15



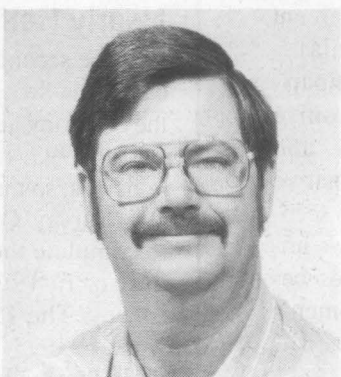
Johnson Morgan
2472 20



Roy Diesing
9812 35



James Knapp
1111 15



James Dishman
1311 20



Gary Ferguson
5408 25

Welcome

Albuquerque — Sara Dempster (1824), Christopher Evans (7816), Udella Kump (12111), Danielle Nieto (7575). Other New Mexico — Lillian Snyder (6331).

Elsewhere: Kansas — Heather Kirk (6412); Washington — Robert Cochran (1553).

Congratulations

To Charlotte Welty and Tim O'Hern (1512), a daughter, Hannah Jesse, Jan. 24.

To Penny Greer (9613) and James "Red" Jones (2172), married in Albuquerque, Jan. 28.

To Lynn Janik (6352) and Jack Washburn, married in Hawaii, Jan. 29.

Retirement Open House

The Labs is holding an open house in honor of retiree **Duane Hughes (7311)** at the Coronado Club Zia Room, Wednesday, Feb. 23, 5-7:30 p.m. Refreshments will be served. Friends and acquaintances are invited.

UNCLASSIFIED ADVERTISEMENTS • UNCLASSIFIED ADVERTISEMENTS • UNCLASSIFIED ADVERTISEMENTS

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

Ad Rules

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

MISCELLANEOUS

COUCH & LOVESEAT, w/loose pillows, off-white, \$200; trunk-mount bike carrier, \$25; bed frame, twin-size, \$5. Harrington, 899-1277.

ICE SKATES, Celebrity/Omnitrade, white, girl's size 1-1/2B, w/guards, hardly used, excellent condition, \$60. Espinoza, 898-5947.

CAR DOLLY, Big Tex, used twice, \$700. Disch, 299-8171.

REFRIGERATOR/FREEZER, GE, 20.8 cu. ft., almond, w/icemaker, excellent condition, \$150. Jeske, 899-2216.

CAMPER, '84 Jayco-J, cab-over pop-up, sleeps five, sink, stove, closets, for a long bed truck, \$1,775. Bitsui, 897-1268.

CHOW PUPPIES, AKC-registered, champion lines, seven wks. old, two black males, one cinnamon female, one black female, first shots, \$200. Brunacini, 281-4102.

SKI MACHINE EXERCISER, \$90; computer, Tandy 1000HX, w/color monitor, Deskmate software, \$75 OBO. Stichman, 856-6242.

SERGER, Singer Quantum Lock 4, top-of-the-line, excellent, \$395; pistol, Ruger Redhawk, .44 Magnum s.s., 5-1/2-in barrel, \$350. Hutchinson, 823-2620.

CIRCULAR SAW, bench-style, 8-in., tilt arbor, accessories, \$125; dual-wheel electric grinder, \$40; drill press, \$50. Kinney, 856-1512.

CAB-OVER CAMPER, 9-1/2-ft., self-contained, sleeps five, fits long wide bed, good condition, \$500 OBO. Chavez, 293-4268 after 5 p.m.

RIFLE, Theodore Roosevelt Winchester, Model 94, 30-30, carbine commemorative, never fired, original box and paperwork, \$350 firm. Standing, 299-2031.

SPIREA BUSHES, "bridal wreath," each of five bushes large enough to make several, free for the digging. Willis, 881-8077.

HARD DRIVE, Conner, 80MB, IDE, \$75; 2MB of 256K SIMMS, \$25. Hiits, 275-1758.

SOLOFLEX, w/butterfly and leg extension attachments, hardly used, excellent condition, \$1,400 new, sell for \$800. Henry, 296-1781.

MANNINGTON FLOORING, 3" Piedmont Plank, 300 sq. ft., new in boxes. Faucett, 296-0896.

WOODWORKING TOOLS: Matika plunge router, 1.75-hp, accepts 1/2" and 1/4" bits, \$90; Marples triangle, 45-degree, \$10. Wayland, 299-2587.

INTERIOR DOORS, two, six-panel, dark-stained, jams, trim, hardware, \$20/ea.; GE electric range top, \$10. Mauldin, 293-3763.

WEIGHTS, 110 lbs., Olympic-style, barbell, two dumbbells, \$35. Holmes, 897-0916.

FIREWOOD, down, seasoned cottonwood, you cut and haul, free. Graham, 865-9427.

CEILING FAN, new in box, \$45; desk, \$20; sewing table, w/drawer, \$15; bed foot and head boards, \$10/ea. Olecksiew, 898-6472.

BED, twin-size, Sealy mattress & box spring, \$100; Coral dishware, full set, 6 place settings, \$50. Clavey, 292-7667.

PORTABLE BAR, bamboo, w/two stools, \$20; HP 325, never used, \$30. Dwyer, 271-1328.

CRAGER RIMS & TIRES, 5-hole, from Chev. S-10, less than one yr. old, excellent condition, \$500 OBO. Walker, 294-2293.

PLANE TICKET, one-way to Knoxville, Tenn., must be used by end of June, \$75. Hudson, 821-3968.

COMPUTER, XT-compatible, 640K, 30MB HD, monochrome, modem, \$150; upright freezer, 11 cu. ft., \$100; window air conditioner, \$25. Cancilla, 293-1620.

NOSE BRA, for '88 Ford Ranger or Bronco II, \$10. Burke, 266-2334.

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

HEADBOARD, queen-size, matching nightstands, and bed frame, \$230; double mattress, box spring, and frame, without headboard, \$50. Cotter, 897-1470.

WOOD STOVE PIPE, two walled (6"/8") several 36" sections, never used, retail \$57, asking \$30 per section. Harris, 281-8145.

BED, full-size, \$100; chest of drawers, \$75; planter, 3' x 3' x 1' deep, \$25. Hamilton, 294-5850.

ELECTRIC STOVE, Whirlpool, almond, 4 yrs. old, remodeling, excellent condition, paid more than \$500, asking \$275 firm. Schalip, 892-6681.

FIREWOOD RACK, heavy metal, holds 1/2-cord; small firewood rack, metal, good for porch. Both for \$40. Pitts, 293-7763 or 293-5481.

SOLOFLEX, butterfly/leg attachments, excellent condition, \$650; stair stepper, electronic display, \$50; man's leather jacket, size 40, \$80 OBO. De La Rosa, 899-9650.

MICROWAVE, GE Model JE1453H, touch-pad controls, 700-watt output, 1.5 cu. ft. capacity, build-in kit, \$50. Holmes, 292-0898.

SOFA, pillow-back, white w/specks of other colors, 8-ft., great shape, \$125. Kelly, 821-9680, leave message.

EVERGREEN TREE, would make great firewood, free if you cut and haul. Jones, 255-7924.

COLOR TV, Sony, 20-in., w/stereo sound and remote control, excellent condition, \$175. Naru, 821-7490.

WATERBED, king-size, complete, bookcase headboard, \$100 OBO; ugly couch, brown plaid w/wood trim, \$30 OBO. Tencza, 822-9582.

GOLF CLUBS, Lynx Jaguar Irons, 3 to P.W., \$225; Palm Springs Irons, 3 to P.W., \$135, excellent condition. Mancuso, 275-9225.

CROSS-COUNTRY SKIS, 200cm Fischer, no-wax, 3-pin bindings, excellent, \$90; boots, size 41, \$7; poles, \$9; color TV, 9-in., w/remote, \$150. Lorence, 275-3586.

DUMBEK, hourglass-shaped ceramic Middle Eastern drum, w/padded case, made in Melbourne, Fla., \$50. Homer, 836-5043.

SNAKE, California King, white/black banded, \$50. Begano, 897-7247.

ENTERTAINMENT CENTER, Scandinavian, oak, smoke glass, space for 27-in. TV, VCR, and stereo, excellent condition. Smith, 275-8185.

UTILITY TRAILER, 5' x 12', w/side boards, heavy duty, new tires, chrome wheels, \$500 OBO. Gutierrez, 877-8298 after 5 p.m.

BATTERY CHARGER, 12-volt, 10/30/50-amps., used only four times, paid \$50 new, sell for \$25. Smiel, 865-9081.

KITCHEN TABLE, white Formica, brass-colored legs, 48" x 30" w/both drop leaves up, 22" x 30" with leaves down, free. Krumm, 883-3949.

PA SYSTEM, Peavy, 50-watt channel output, amplifier, input for four microphones, two 16-ohm speakers, \$350. Douglas, 281-9843.

SAUDER ENTERTAINMENT CENTER, oak finish, holds 27-in. TV, VCR, tapes, paid \$90 unassembled, sell for \$50 assembled. Gilmer, 299-2533.

WASHER & DRYER, Sears, excellent condition \$200. Gollither, 296-0367.

BRASS LAMPS, two, \$20; Bundy trumpet, w/case and stand, \$100; Filter Queen vacuum, complete w/attachments, \$375. Langwell, 293-2728.

TIRES: four 185/R14 90S Monarch radials, \$25/ea., or \$80 for all; two 185/70R14 88S, all-season radials, \$25/ea. Zirzow, 281-9896.

OSCILLOSCOPE, 40Mhz, 2-channel, Kikusui Model 5040, plus accessories, \$200 OBO. Bedeaux, 291-0836.

LABRADOR PUPPIES, chocolate, AKC-registered, large litter, excellent selection, both parents on premises and wonderful w/children, \$275. Fate, 293-2131.

TV, 27-in. '83 model, \$100; carpet, pink, 6' x 6', w/matting, \$10. Watson, 298-2374.

COMPUTER, Macintosh Performa 200, 80MB HD, 4MB RAM, keyboard, mouse, monochrome, refurbished, warranty, \$650 OBO. Brock, 296-7307, leave message.

'20 ANTIQUE COAL STOVE, CB radio w/mag mount, TV stand, PV microphone. Ask for Steve. Garcia, 343-8207.

RV FURNACE, \$40; propane tank and regulator, \$20; changing table, \$20; high chair, \$15. Koepp, 294-7136.

KEROSENE HEATER, Kerosun Omni 15, 8,700 Btu, mint condition, \$100; Aztec radiant wall heater, 500-watt, \$25. Kraynik, 856-1683.

SKI BOOTS, Munari, size 6; Raichle, size 7; latest Din safety standard, \$10/ea. Kerschen, 821-2848.

COUCH & LOVESEAT, cream color, matches any decor, hardly used, \$1,500 new, asking \$550; crystal glassware, \$5-\$75. Selleck, 260-0116.

REFRIGERATOR/FREEZER, Kenmore, 22-cu. ft., excellent condition, paid \$900 2 yrs. ago, sell for \$650. Roybal, 899-1127.

AUDIOVOX CAR SPEAKERS, 5-in., new in box, \$15. Montoya, 296-4268 before 9 p.m.

ELECTRIC TROLLING MOTOR, and two marine batteries; furniture: roll-top desk, antiques, coffee table w/matching end tables, etc. Hughes, 265-1698.

SWIVEL ROCKER, tan w/multicolor dots, like new condition, \$100. Spears, 266-9782.

GOLF CLUBS, Johnny Roberts, stainless steel, irons 2-10, woods 1-3, all leather/cowhide bag, \$125 OBO. Castillo, 242-9601.

PUEBLO POTTERY, three bowls, \$90, \$105, and \$130; large black-on-red wedding vase, approximately 21-in. tall, \$475. Locher, 266-2021.

UTILITY TABLE, w/electric outlet; Craftsman soldering gun; bedside commode. Pitti, 256-1629.

ROAD BIKE, 12-spd., black, \$100. Harrington, 899-1277.

'91 JEEP CHEROKEE LAREDO, AT, AC, PW, PL, excellent condition, \$14,950. Kauchich, 275-1034.

TRANSPORTATION

'77 FORD F250 PICKUP, Supercab/shell, AT, AC, camper special, 43K miles, \$3,500; '88 Plymouth Reliant LE, 4-dr., 4-cyl., 5-spd, PS, AC, \$3,500. Mathes, 832-6676.

GARAGE SALE, Feb. 19, 9 a.m.-1 p.m., 13116 Parkview NE, kids toys, regular mattress & box spring, more. Hammond, 294-2045.

TOURING BIKE, 12-spd., Nishiki Sebring, 21-in. frame, dark blue, equipped w/thorn-resistant tubes, rack, kickstand, \$125. Hesch, 298-4902.

'90 HONDA CIVIC WAGON, 4WD, 6-spd., AC, stereo, one owner, all service records, great gas mileage, excellent condition, \$7,850. Harley, 281-9777.

'74 VW BEETLE, runs well, \$800 OBO. Brooks, 255-7551 evenings or weekends.

'85 HONDA CRX-HF, AC, AM/FM, 5-spd., 68K miles, outstanding gas mileage, \$2,400. Fraley, 296-6795.

'87 MARK VII, LSC, 68K miles, one owner, has had lots of TLC, \$7,900. Iverson, 293-5139.

'85 MAZDA RX7, loaded, GSL, \$3,950. Loomis, 271-2381. Leave message for Pete.

'58 RAMBLER REBEL STATION WAGON, good body, 98% complete, good restoration project or great parts car, \$500 OBO. Griego, 873-2677.

'86 FORD MUSTANG 5.0 GT, all power, 5-spd., T-tops, AC, runs great, book value \$5,900, asking \$5,500 OBO. Johnson, 884-1728.

'82 HONDA ACCORD, 2-dr. hatchback, 5-spd., 92K miles, \$1,750 OBO. Foucher, 883-8638.

'84 JEEP GRAND WAGONEER, power everything, towing package, leather upholstery, 103K miles, outstanding condition, \$5,000. Kercheval, 1-864-6549.

'90 PONTIAC, 4-dr., AC, PB, PS, AT, AM/FM cassette, tilt wheel, priced to sell, below book. Riley, 869-2119.

'87 FORD TAURUS, 4-dr., AT, all extras, less than 20K miles, very clean, \$5,000 OBO. Dawson, 298-9508.

MAN'S ROAD BIKE, Novara Strada, 53cm, 10-spd., red, brand new, REI list price \$570, asking \$395. Roth, 344-7060.

MAN'S MOUNTAIN BIKE, Specialized Grasshopper, hardly used, paid \$450, will sell for \$350. Hammond, 294-2045.

'92 HONDA PRELUDE Si, silver, w/rear spoiler, AC, AM/FM stereo cassette, CD player, anti-theft, 15K miles, \$1,800. Snyder, 237-1065.

'83 CHEV. SUBURBAN, Silverado package, 305 V8, all power options, AC, very clean, well maintained, \$4,350 OBO. Sniogowski, 294-7329.

'74 MGB, only 62K miles, convertible, 4-spd., AM/FM, 4-cyl., good gas mileage, beautiful condition, \$3,500. Wilson, 281-6493.

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

'91 KAWASAKI KX250 DIRT BIKE, new seat cover and plastic, runs well and looks good, \$1,800. York, 828-9505.

'75 MERCEDES, 240D, AC, AM/FM, sunroof, PS, AT, smooth driving, good looking, excellent condition, \$3,500. Plummer, 822-8921.

'85 BUICK CENTURY LIMITED, 4-dr., 70K miles, one owner, new rack & pinion, very good condition, \$2,995 OBO. Jaeger, 299-0860.

'75 MERCEDES 300, diesel, sunroof, 125K miles, good condition, book value \$3,000, sell for \$1,800. Barger, 296-0676.

'84 TOYOTA TERCEL, 5-dr. hatchback, 5-spd., AC, 30+ mpg, 75K miles, excellent condition, \$2,200. Klavetter, 299-4299.

'83 OLDS. CUTLASS SUPREME, V6, AC, AM/FM cassette, 2-dr., 98K miles, runs well, \$2,000 OBO. Cole, 275-7126.

'92 GMC, C2500, fully loaded, still under warranty, 210 original miles, \$15,750 OBO. Green, 898-3791.

BIKES: Specialized "Stumpjumper Comp," Deore XT, 20.5-in., white, \$350; Fisher HKII, Deore, 20-in., white, \$250. Both excellent condition. Dwyer, 271-1328.

'74 CHEV. IMPALA, 2-dr., V8, AT, AC, recent tune-up, good condition, \$800. Sherlin, 266-4779.

'72 DODGE CHARGER, PS, PB, AC, AT, 318 CID, hideaway lights, a classic, excellent condition, \$5,195. Baney, 294-8970.

'89 HONDA PRELUDE Si, 40K miles, gold, excellent condition, \$11,400. Hosking, 836-2128.

'92 GEO STORM, one owner, 28K miles, AM/FM cassette, AC, 5-spd., tint, factory warranty, excellent condition, \$9,000 OBO. Gardner, 884-9264.

'79 MOBILE TRAVELER, 18.5-ft., sleeps four, low mileage, good condition. Sharp, 243-1498.

'82 MAZDA RX7 GSL, silver, 5-spd., PW, AC, moonroof, louvers, maintenance records, 88K miles, excellent condition, \$2,500. Schlimme, 293-0304.

REAL ESTATE

2.1-ACRE LOT, in wooded Sandia Mountains, level ground, electricity and water available, Vista Bonita Subdivision, \$25,000. Romero, 1-474-0342.

2-BDR. TOWNHOUSE, 2-story, 1,020 sq. ft., 1-1/2 baths, skylights, fireplace, single garage, near Tramway/Candelaria, \$77,000. Standing, 299-2031.

3-BDR. HOME, beautiful Ruidoso, NM, 2,000 sq. ft., 2-car garage, fully furnished, Alto Golf Club membership, \$149,900. Head, 828-2628.

27 ACRES, Edgewood, fronts Highway 66 on the south side, all utilities, terms. Lewing, Box 1731, Suncity, AZ, 85372, (602) 584-2291.

WANTED

BAND SAW, 12-in. or larger, Sears or Delta. Poulsen, 265-0566.

BUILDING LOT, especially interested in oversized lot or acreage with all city utilities but will consider others. Castillo, 836-4213.

CAR, compact, dependable, perhaps VW Bug, under \$1,000; small parcel of land for mobile home, w/all utilities included, north or south of Tijeras. Sanchez, 275-9363.

FOLKS to play mah-jongg, once a month or more frequently. Ask for Connie. Brooks, 255-7551.

OVERLOAD SPRINGS, for '85 Chev. 3/4-ton pickup, frame-mount-type preferred. Jones, 883-1284.

AMMUNITION, reloading equipment, and supplies. Hutchinson, 823-2620.

USED LIFE JACKETS, adult sizes, for boating. Owens, 836-7802.

VIDEO RECORDING of program "Turning Point," about radiation testing at Nevada Test Site, aired Feb. 2, 9 p.m., Channel 7. Spinello, 292-5681.

MATERNITY CLOTHES, business attire and casual, size 10 or medium. Roybal, 899-1127.

MUSIC STAND and drummer's stool. Orand, 275-2255.

POWER SANDER, 6" x 48"; band saw, 14-in. or larger. Hoge, 884-0054.

LOST & FOUND

FOUND: Man's lined glove and prescription glasses at TTC (Bldg. 825), during Dice briefings, claim at Bldg. 801 South. Garcia, 844-8263.

FOUND: Mickey Mouse bracelet, G Street and Wyoming parking lot, on Feb. 1. Komen, 844-1348.

Coronado Club Activities**It's a Good Time to Join the Club**

LOTS OF GOOD TIMES are what the C-Club offers, and there's never been a better time to join. Sign up for a year during February, March, or April, and you'll get two additional months free. Dues are \$96 a year (that's just a bit from each paycheck), or \$48 a year for retired Sandia and DOE employees. To sign up, visit the C-Club accounting office (downstairs). For more information, call Shirley on 265-6791.

NO SPECIAL EVENT tonight, Feb. 18, except that you can make your Friday evening special by dropping in at the Cantina. You'll enjoy the sociability and the libations.

HOT TAMALES RETURN — Next Friday, Feb. 25, the folks lucky enough to be at the C-Club

get a chance to enjoy the return appearance of Pat Burns and the Hot Tamale Band. That high-temperature group will be on stage from 7 to 11 p.m. Of course, you're always in luck when it comes to dinner choices at the club. This time, it will be filet mignon or golden-fried shrimp, two for \$14.95. Or you can make your way to the buffet line and enjoy baked ham, baron of beef, and roast turkey breast, plus all the accompaniments, for \$6.95. Dinner will be served 6-9 p.m. Call for reservations — 265-6791.

BINGO GOES ON — Every Thursday evening is Bingo Night. Card sales and the buffet line open at 5:30 p.m., and bingo gets under way with an early-bird game at 6:45. Prizes are possible, and good fun is guaranteed.

Sandia News Briefs**Laboratory Communications Publication Wins Award**

Laboratory Communications Dept. 12610 recently won the Distinguished Technical Communication Award from the Houston Chapter of the Society for Technical Communication (STC) for the publication titled *Sandia Capabilities*, a 36-page booklet with text and 58 photographs about Sandia activities that Dept. 12610 published last summer. The publication now enters the STC's international competition, winners of which will be announced in May. STC members include technical writers and communicators from research and development and scientific organizations.

Engineering Day at the Mall Includes Sandia Electric Vehicle

A Sandia electric vehicle and a solar-powered car designed by New Mexico Tech students are two of the exhibits at "Engineering Day at the Mall," Feb. 19-20 at Winrock Center, that might develop into everyday technology in the next century. Other exhibits show how to use your birth as a "seed" in a birthday plotter program and how buildings are designed and constructed. Engineering Day is sponsored by the Albuquerque section of the Institute of Electrical and Electronic Engineers and the Engineering Societies President's Council as a community service to the people of Albuquerque.

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

Feed Back

Q: We have "official business two-hour limit" parking in front of our building. We also have a group of people who daily abuse this parking for either four hours or all day. Our organization needs that parking availability for technology transfer visitors to our organization.

In light of the continuing tight budget, it appears that Sandia's Security organization has neither people nor time to enforce parking restrictions. We believe that in the true spirit of empowerment, the line organization should be able to enforce the parking restrictions if needed, and are requesting that.

If granted, our organization will enforce the restrictions by having violators' cars towed after a temporary sign has been posted.

A: It is clear you understand that parking space is a valuable resource that should be used to further the interests of this laboratory, not a resource to be abused by a few. We appreciate your understanding. Please spread it around. While it is true that the Security Force has reduced a number of activities to assure we stay within budget, we can still issue citations. We will pay some special attention to the "official business two-hour limit" areas.

As I'm sure you know, parking rules are corporate policy and all employees are bound by such policy — the same as all other policies. A parking citation, in our environment, is simply a notification to management that an employee has chosen to violate policy. Thus it becomes an "enforcement" issue only through the actions of the violator's management, and that is where the action belongs.

As regards towing a violator's car, we could do that, and we will if the illegal parking constitutes a safety or security problem, such as blocking access to a fire hydrant, etc. Our preference for enforce-

ment is for the employees to follow the rules and for their management to take appropriate disciplinary action when they don't.

Violators can be reported to Security by calling 4-4657 or 4-3155.

Frank Gallegos (7400)

Fun & Games

Telemark Skiing — "Pinheads" (you know who you are) are invited to get together for a day of fun at the Sandia Peak Ski Area Telemark Festival on Saturday, Feb. 26. Activities start at 8:30 a.m. and include free lessons and clinics, equipment demonstrations, long-sleeve T-shirts, door prizes, costume awards, and a post-festival celebration. Be sure to bring your own equipment and your "TELEvision." Call 292-4401 or 242-9133 for more information.

Summer Softball — The 1994 Sandia summer softball season is just a few months away. The initial coaches' meeting is set for Wednesday, Feb. 23, at the Coronado Club Zia Room, 5 p.m. This year there are plans for a coed league and an over-35 league. At least six teams are needed in each of the new leagues, so form teams now and send a team representative to the coaches' meeting. Everyone is welcome to attend the meeting. For information, call league president Don Wrobel (6319) on 891-8409.

Special Olympics — Dates are set for 1994 New Mexico Special Olympics state competitions. Winter games will be held Feb. 25-March 1 in Albuquerque. Volunteers are needed for all events. Call 856-0342 for details.

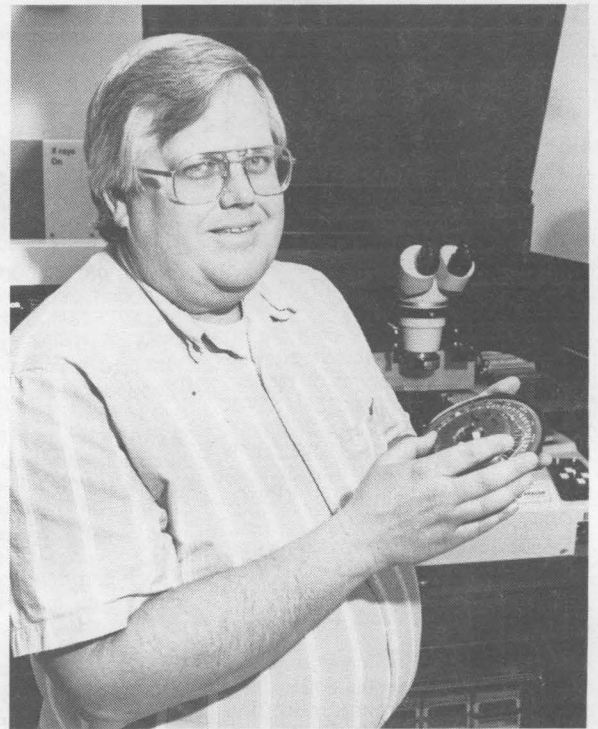
Take Note

Boy Scout Troop 496 is celebrating its 25th anniversary March 11, 7 p.m., at Covenant Presbyterian Church (9315 Candelaria NE). Past scouts and leaders are invited to attend. For information, call David Follstaedt (1112) on 299-5941.

The Muscular Dystrophy Association is looking for volunteer counselors to attend its annual New Mexico summer camp for children with neuromuscular diseases. This year's camp is being held in Socorro June 26-July 2. Each volunteer counselor teams up with a camper to enjoy fishing, boating, swimming, team sports, dances, and more. Volunteers also learn to help campers overcome barriers to living with disabilities. Meals, rooms, and transportation from Albuquerque are provided. For a volunteer application, call the MDA office on 828-1331. Counselors must be at least 18 years old.

UNM is looking for infants 9-12 months old and parents to participate in an emotional development and coping behavior study being conducted by psychologist Kathy Stansbury. If you would like to understand more about child development and emotions in your 9-12-month-old, call 277-4805 for a more complete description of this study in child development.

The UNM Science, Math, and Engineering Women's Career Development Conference and Mentorship Program is scheduled for Saturday, March 5, at the UNM Student Union Building ballroom, beginning at 8:30 a.m. One portion of the program is for developing a mentorship program to match female scientists and engineers in the community with female students at UNM. The conference goal is to bring together employers, students, and academicians to discuss gender issues in the workplace. Mike Torrez (3531), Special Programs coordinator at Sandia, and Ruth Salvaggio, associate professor of American studies at UNM, will speak. For information or to receive registration material, or to become a mentor, please call conference coordinator Carol Fleming on 277-2605 or 277-4774.



JIM SCHWANK of Radiation Technology and Assurance Dept. 1332 was recently named a fellow of the Institute of Electrical and Electronics Engineers (IEEE). The IEEE cited him "for contributions to the field of radiation effects on electronic devices and integrated circuits." Jim discovered and identified the mechanisms of device "rebound," a long-term failure mechanism of integrated circuits that is important to space systems. He is the author of approximately 60 papers about radiation effects in materials and devices. Jim serves or has served the IEEE Nuclear and Space Radiation Effects Conference (NSREC) as short course chairman, short course instructor, publicity chairman, and session chairman, and the Hardened Electronics and Radiation Technology (HEART) Conference as technical program chairman, guest editor, and session chairman. He won Outstanding Conference Paper awards at the 1984 and 1988 NSREC and 1985 and 1990 HEART conferences.

Labs Accomplishments FY93

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

Once a year for more than a dozen years, the LAB NEWS has summed up Sandia's principal achievements for the previous fiscal year. We continue that tradition with this special section for FY93.

The work summarized on the following pages was accomplished during the fiscal year that ended Sept. 30, 1993. All Sandia divisions were invited to submit achievements. This compilation is not ranked in any way, but an attempt has been made to group related items. The organizations associated with the accomplishments are shown in parentheses after each item.

Requests for further information should be sent to Sandia National Laboratories, Media Relations Dept., P.O. Box 5800, Albuquerque, NM 87185-0167.

To All Sandians:

I was impressed, as I reviewed this collection of the Laboratories' accomplishments for fiscal year 1993, by the undiminished rate of important achievements. While the "post-Cold War" changes affecting institutions around the world have remained as dynamic and unpredictable at Sandia as elsewhere, we continued to respond effectively to the needs these global changes created for our customers. As the year drew to a close, we bade farewell to AT&T, welcomed Martin Marietta as our new managing and operating contractor — and remained focused on our work.

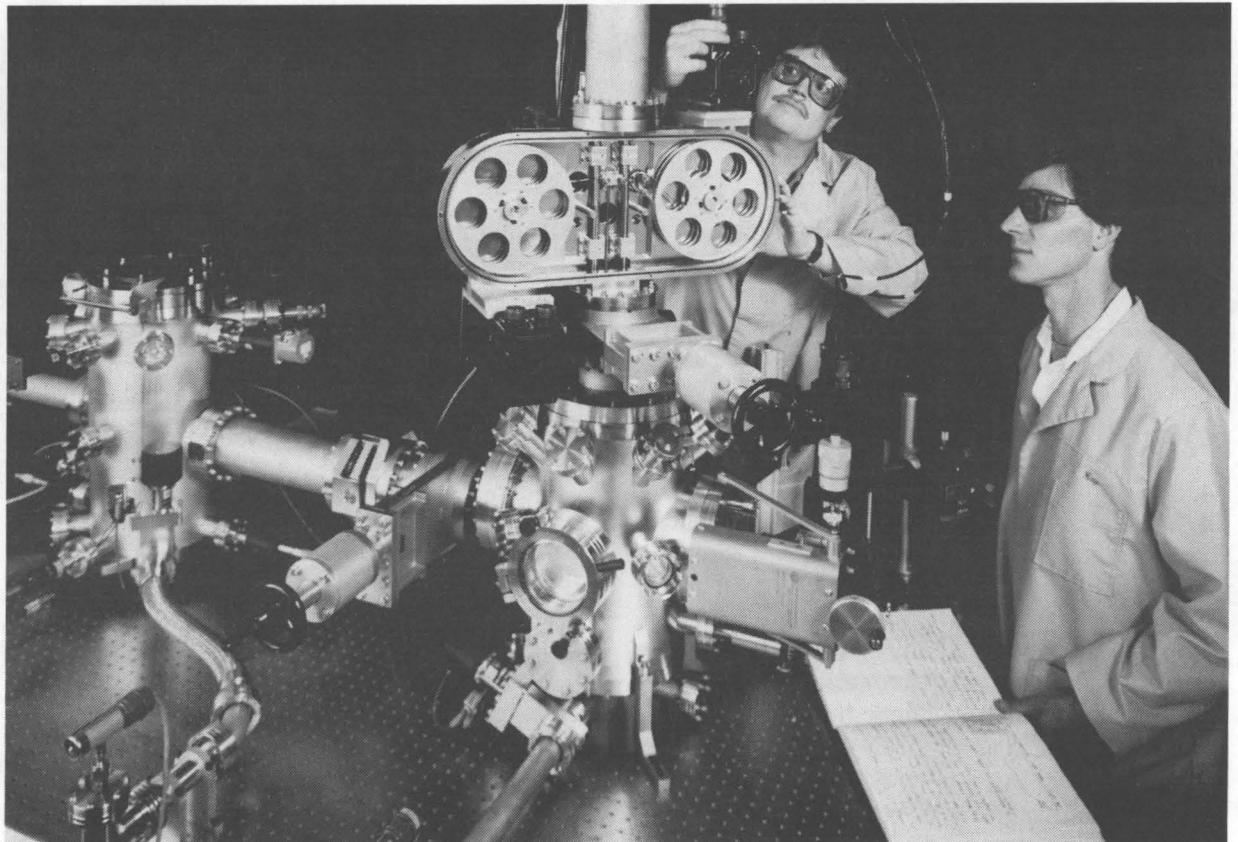
Each of Sandia's three Sectors — DOE Defense Programs, DOE Energy and Environment, and Work for Other Government Agencies — made significant contributions and entered the new fiscal year in a strong position. The ability of the Sectors to redirect effort rapidly in response to changing national priorities was an important factor in Sandia's successes. As in past years, our technical Core Competencies and Special Capabilities also played critically important roles.

The year was also marked by substantial progress in developing stronger "dual-benefit" partnerships with US industry, and teaming relationships with universities and other federal laboratories. Our technology-transfer activities contributed to our nation's economic competitiveness, while supporting DOE's core mission responsibilities in defense, energy, environment, and the basic sciences. Significant progress was made in concentrating our industrial R&D collaborations in the areas of agile manufacturing technologies, microelectronics, and information science and technology.

As I reflect on our achievements during these demanding and uncertain times, it becomes clear that Sandia's growing commitment to Total Quality, with its uncompromising focus on customers and on continuous improvement, has served us well. It remains key to our future.

The Laboratories' accomplishments are the product of all Sandians. I take great pride in being associated with this institution, and offer my congratulations to everyone for their "exceptional service in the national interest."

Al Narath, President



SANDIA'S second generation Extreme Ultraviolet Lithography (EUVL) system is designed to achieve 0.1 micron resolution using all reflective optics and a compact laser plasma source. George Wilkerson (left) and Kurt Berger, both of Materials Science and Technology Dept. 8342, prepare the system for testing. For more on this and other Labs technology that can be transferred to industry, see page 15 and 16.



LAB NEWS

SANDIA NATIONAL LABORATORIES SPECIAL SECTION

FEBRUARY 18, 1994

Advanced Manufacturing

The generation of conventional polymer/ceramic composite materials, which are used in many structural applications, involves energy- and labor-intensive steps, and results in opaque materials. We are developing a new approach to produce nanocomposite materials by simultaneously forming the polymer network and the inorganic reinforcement from liquid precursors. This system has led to **optically clear composite materials**, which, at approximately 25 percent of normal reinforcement levels, have mechanical properties approaching those obtained in conventional composites. In addition, the methodology allows the mechanical properties to be controlled over a wide range, making this protocol amenable to "fine-tuning" material properties to meet specific customer requirements for aerospace, automotive, and construction industry needs. (1700/1800)

Environmental regulation has created a need in the US electronics industry for new manufacturing processes that reduce hazardous waste generation. We have demonstrated a new robotic soldering process that **eliminates the use of organic solvents** to remove corrosive flux residues from soldered assemblies, and could potentially facilitate significant reductions in the amount of hazardous waste generated by metal-plating operations. Known as Laser Ablative Fluxless Soldering, this process employs a very short pulsed laser beam to ablatively clean metal oxides from joining surfaces before the application of solder, instead of using a chemical flux. The new process can be used to form reliable solder joints directly onto nickel-iron alloy surfaces. These alloys, which are used exten-

sively as conductors in electronic devices, are currently plated before soldering to enhance wettability. (1200/1800/2100)

The **National Center for Advanced Information Components Manufacturing (NCAICM)** was dedicated at Sandia/New Mexico on Jan. 14, 1993. The Center presented a workshop March 30-31, 1993, to define the project areas and the methods for industry participation, to assess industry needs, and to describe the resources available for partnering with DOE's national labs. The workshop was attended by representatives of 193 companies, 10 government agencies, and five universities. Phase 1 precompetitive projects have already been selected and will be completed at the center. Approximately 20 Phase 2 joint industry/laboratory projects will be selected by the Advanced Research Projects Agency, and it is anticipated that Sandia will be involved in 13 of these. The NCAICM program funding to Sandia is currently \$11.6 million for Phase 1 and \$10.5 million for Phase 2. (2900)

SMARTWELD is a computerized system for **rapid-response manufacturing** that integrates design, analysis, and fabrication tools for

Sandia National Laboratories, a prime contractor to the US Department of Energy, is operated by the Sandia Corporation, a wholly owned subsidiary of the Martin Marietta Corporation.

MARTIN MARIETTA

Advanced Manufacturing

optimized manufacture of welded assemblies. In the United States, welding is a \$50 billion industry that generates up to \$7 billion of waste due to rework and scrap. Many problems associated with welding arise from the high degree of trial and error that typically accompanies the development of weld schedules and joint designs. This waste will be reduced through concurrent design of product and process, realized through use of SMARTWELD in a matrixed project involving team members from a number of Sandia organizations at both the California and New Mexico sites. (1400/1500/1700/1800/2100/2400/2800/5300/6900/8200/8400/8700)

Researchers in the recently opened Advanced Machining Laboratory at the California site worked during the past year to develop techniques to **assure quality of precision-machined components** in-process, without the need for post-process inspection. The researchers first identified error sources in the machining process, and are developing calibration and control techniques to eliminate these errors. These include low-frequency errors such as temperature changes of the machine to high-frequency events such as machine tool chatter. For errors that are not so easily controlled or are highly variable, in-process part probing is used to correct errant tool paths. Finally, first-item inspection is employed to verify the process. The results include better parts with lower inspection costs, and a methodology for certifying small lots of machined parts. (8200)

Development of a micro machined version of a weapon surety component requires a micro



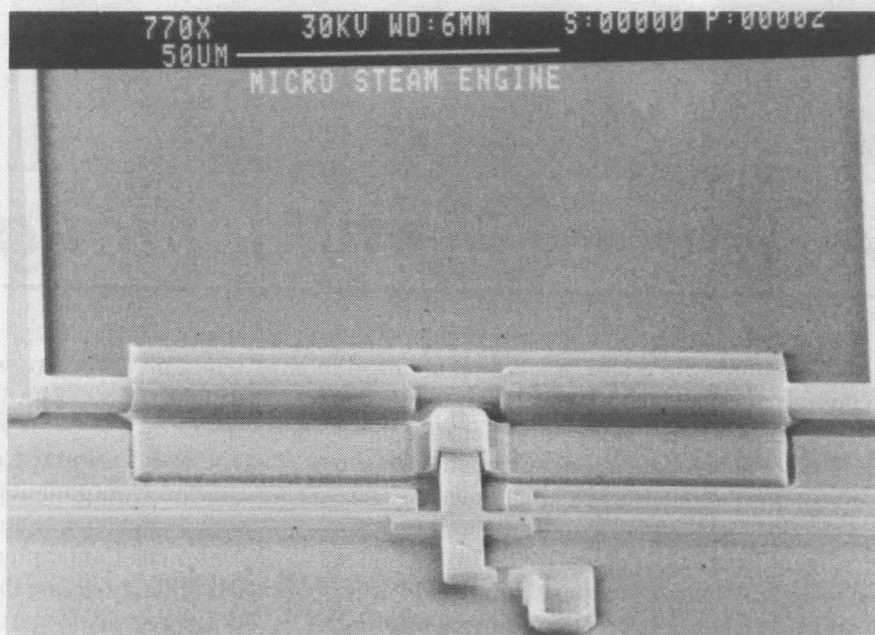
AN EXPERIMENT on a magnetically levitated positioner is done by (from left) Doug Jordan, Joel Darnold, and John Wronosky (all of Manufacturing Applications Dept. 2338). The technology could be used for ultra-precise applications, including integrated circuit manufacturing. (Photo by Mark Poulsen)

engine capable of providing sufficient force to activate lock mechanisms and position optical elements. Existing micro engine technologies do not provide such force, but a fundamentally new type of micro engine has been developed in Sandia's

Microelectronics Development Laboratory. Over a relatively large displacement, the actuator delivers two orders-of-magnitude greater force than state-of-the-art electrostatic comb devices. This new structure, which is effectively a **micro steam engine**, achieves greater than 10-micron displacement and 0.6 micro newtons of force with a rectangular piston six micrometers wide by two micrometers thick. In addition to weapon applications, the micro steam engine can be applied to actuating micro manipulation tooling, micro surgical tooling, micro positioning tooling, and biomedical instruments. (1300/2600/5800)

Sandia has played a key role in developing an advanced positioner for use in precision manufacturing applications. An example is integrated circuit lithography. The positioner uses **magnetic levitation (maglev) technology**. Its strengths are that it avoids friction and makes extreme accuracy possible. The positioning control system uses high-speed digital signal-processing electronics and software to control position in all six degrees-of-freedom simultaneously. Sandia's contributions in structural design, modal analysis and testing, and system integration were essential. The positioner has demonstrated the capacity to meet or exceed next-generation lithography requirements. Expressions of interest by industrial suppliers of positioners indicate exciting prospects for the early commercial application of the maglev approach. (1300/1400/2300/2600/2700)

A heavy-lift hydraulically driven **two-degree-of-freedom robot joint** was designed and constructed. Ultimately, the snake-like robot would consist of several connected joints, each of which operates like a universal or ball and socket joint. Joint motion is controlled by throttling hydraulic fluid flow with servovalves that are, in turn, controlled by an analog controller directed by a PC-based control terminal. This control scheme eliminates the jerky motions characteristic of most hydraulically driven actuators. While developed as a testbed for a flexible robot link, other potential uses include radioactive waste cleanup and several industrial applications. (1400/2300/9100/9800)



SANDIA'S Microelectronics Development Laboratory has developed a "micro steam engine with several possible applications, including micro surgical tooling and biomedical instruments. The device is powered by a rectangular piston six micrometers wide by two micrometers thick. Several of the engines could fit inside the period at the end of this sentence.

Arms Control Verification

An operational analysis system was delivered to the Air Force Technical Applications Center (AFTAC), which continuously **monitors compliance with nuclear treaties**. The AFTAC Distributed Subsurface Network (ADSN) is a functioning, distributed network of computer systems designed to provide the data processing and communication functions required to aid AFTAC in performing its seismic monitoring mission. This mission is to detect, locate, identify, and report all seismic events of interest. The objectives are to reduce the life-cycle costs of AFTAC's seismic system while maintaining current capabilities and mission performance. Significant savings are expected in staffing and maintenance, while system reliability and availability exceed requirements. (6100/9200/9400/12300)

At midnight on Sept. 22, 1993, DOE conducted the Non-Proliferation Experiment at the Nevada Test Site. The test consisted of detonating about 2.9 million pounds of ammonium nitrate/fuel oil mixture in a cylindrical cavity 19 feet high with a radius of 25 feet. The purpose was to obtain data to help **distinguish between non-nuclear and nuclear explosions**. Sandia's participation included the arming and firing of the explosives, and the design, fielding, and recording of gauges to measure stresses and ground motion. The objectives of the measurements were to obtain data beginning at the inelastic regime (less than 70 meters) out to regional ranges of several hundred kilometers. (9200/9300)

Nuclear Weapons

A joint team consisting of members from Sandia and the Nuclear Weapons Complex Production Agency at EG&G Mound has developed a **production process characterization (PPC)** methodology that ensures manufacturing processes are controlled and repeatable. This methodology combines process criticality ranking, cause-and-effect analyses, and designed experiments to characterize the manufacturing processes used to create a product. PPC has been applied to electromechanical devices, environment sensing switches, and electronic packaging within the nuclear weapons complex. A training class is being prepared and a Sandia report is being written to help instruct other government and commercial customers on the use of the PPC. (2600)

With the end of the Cold War, the US Strategic Command (STRATCOM) is becoming the Sandia weapon program's sole customer, as treaties and reorganizations increasingly consolidate the nation's operational nuclear arsenal within its forces. Over the past three years, Sandia's Strategic Offense Studies Department has been helping STRATCOM **modernize its war-planning system**. Involvement has included participation in a major re-engineering study of its Single Integrated Operational Plan planning process, application tools, and data base structure. This strategic planning study was completed for STRATCOM commander Gen. Lee Butler in July 1993. As a second contribution, Sandia's Strategic Offense Studies Department helped initiate and plan a series of adaptive nuclear exercises for STRATCOM's Air Room, where the national strategic war plan is developed. The capability of adapting — within just a few hours — the planning for employment of several nuclear weapons has received high visibility at STRATCOM, among the Joint Chiefs of Staff, and in the Office of the Secretary of Defense. (4100)

Development of the Strategic Command's (STRATCOM) Secure Recode System (SSRS) was completed in FY93 in preparation for its targeted January 1994 initial operational capability. The system is designed to support the changing and verification of **permissive action link (PAL) codes** on STRATCOM weapon systems. It includes hardware and software subsystems used by STRATCOM Headquarters to process code and key information generated by the National Security Agency and by Air Combat Command wings to perform field operations. It is designed to minimize vulnerability through implementation of end-to-end encryption and no-knowledge execution of PAL operations. A strong design-to-cost philoso-



SANDIA'S ARMS CONTROL/nonproliferation interactions with states of the former Soviet Union have included reciprocal visits by representatives of the two countries' weapon design labs. Four Sandians who visited Chelyabinsk-70 in Russia late last year were John Crawford, VP California Laboratory Div. 8000 (fifth from left); Roger Hagengruber, VP Defense Programs Div. 5000 (seventh from left); Paul Stokes, Manager of DP Sector Arms Control/Nonproliferation Special Programs Dept. 5004 (immediate right of Roger); and Tom Hunter, Director of Energy and Environment Sector Center 6900 (12th from left). The man standing directly behind the seated woman is Evgeny Avrorin, Chief Scientist of Chelyabinsk-70, who visited Sandia with a Russian delegation in April 1993. All others in the photo are members of the Chelyabinsk-70 staff.

phy, emphasizing requirements negotiations, led to a system that met the customers' requirements at a reasonable cost. SSRS development and production has been a cooperative effort throughout Sandia, AlliedSignal, and DOE. The program involved employees from a dozen Sandia and three AlliedSignal organizations. (2600/5100)

Three California weapon systems — the W48, W68, and W70 — are currently in the **process of dismantlement** at the Pantex plant. To verify the safety of the dismantlement process, DOE has asked the design labs to run a quality evaluation for each of these programs. The primary reviews were conducted during October and November 1992. Following initial observations, action items were assigned to correct problems that had been identified. After completion of the action items to the satisfaction of Sandia and Lawrence Livermore system engineers, a final Qualification Evaluation Release for Dismantlement (QERD) can be issued for each program. Currently the W68 and W70-1,3 programs have had complete/satisfactory QERDs issued, placing them in full compliance with current DOE dismantlement procedures. (5300)

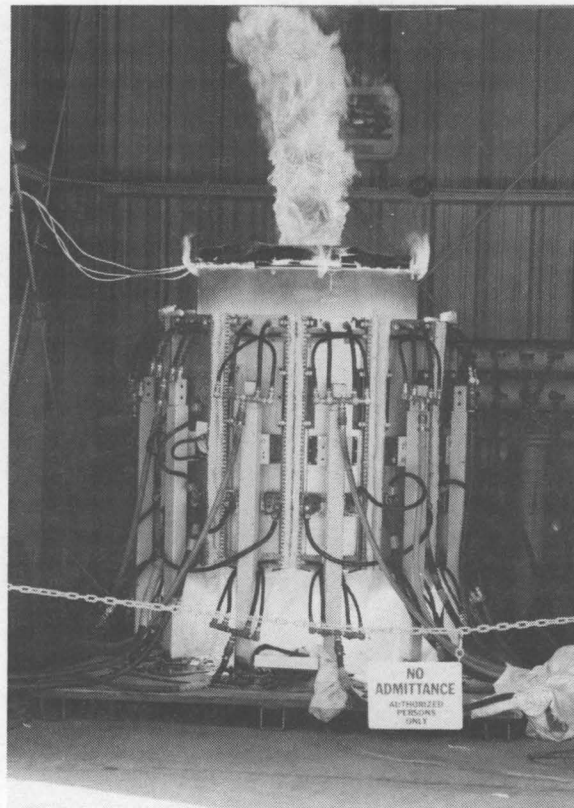
Sandia/California and Lawrence Livermore National Laboratory have completed an in-depth study of the W87, and issued a comprehensive assessment of its nuclear safety, vulnerability to plutonium dispersal, weapon reliability, production and surveillance issues, and personnel safety. The evaluation was performed as part of the **DOE weapons appraisal process** to identify, evaluate, and resolve technical issues for fielded nuclear weapons. The resulting report received a two-day peer review by Sandia/New Mexico and

Los Alamos National Laboratory. Each weapon in the enduring stockpile must be subjected to an in-depth study every five years. The W87 is the first weapon to undergo this review process. (5300)

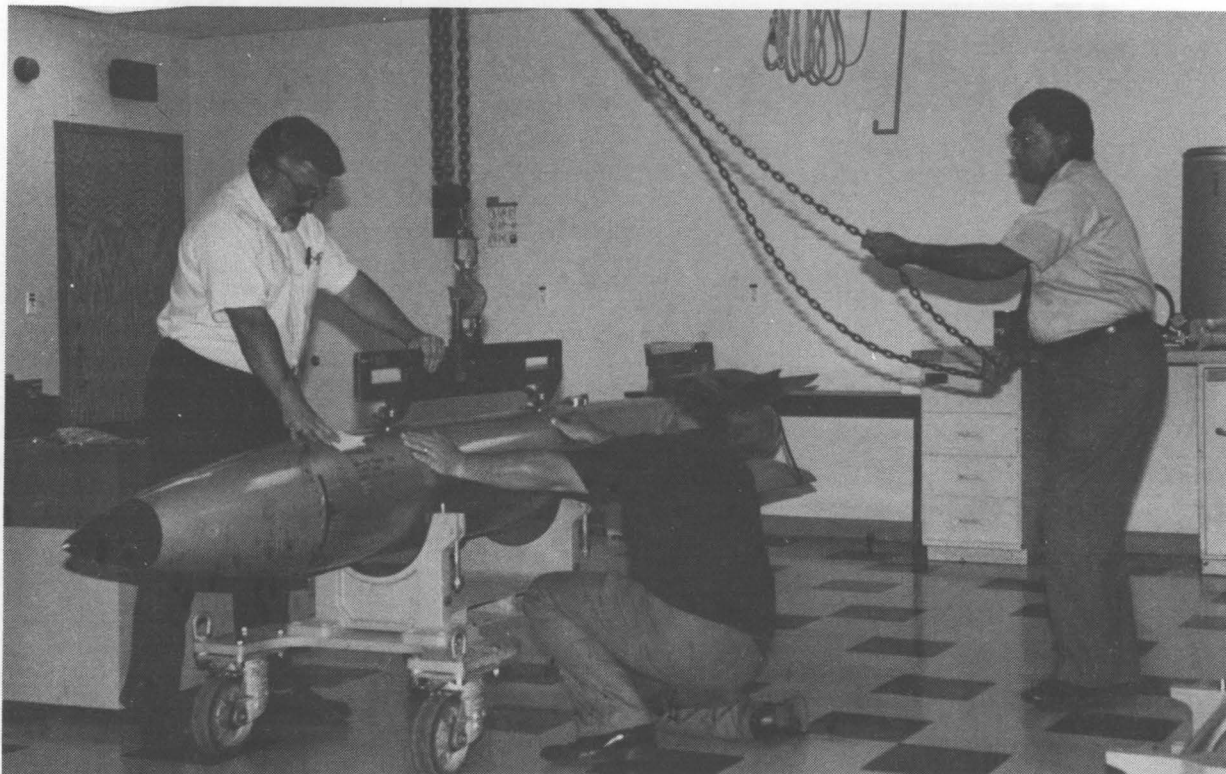
The present DOE Weapons Complex constructed over the past 50 years was sized to meet stockpile requirements substantially larger and more diverse than future needs. Sandia assisted the Deputy Assistant Secretary for Weapons Reconfiguration in designing a **smaller, less expensive complex** that is more sensitive to ES&H requirements. A new concept of "lead laboratory" — an expansion from historical weapon design responsibilities — was developed to consolidate and maintain technical competence required to adequately



MILITARY TECHNICIANS get first-generation training on a spin-rocket motor retrofit on a B83 weapon. The training was conducted by (from left and non-uniformed) Ken Kvam of Weapon Training and Evaluation Dept. 5513, and Don Starkey and Walt Ghio, both of Systems Engineering Dept. 5363.



AS PART OF an assessment of accident environments and system responses to accidents, Sandia conducted radiant heat tests of shipping and storage containers for Mk12A/W78 weapon systems. The flames are the result of combustion of gases from the container's foam inserts.



RAY MACALLISTER (left), Ralph Carr (kneeling), and Mike Rhoads, all of Weapon Training and Evaluation Dept. 5513, prepare a B61 bomb training unit for a Joint Task Group (JTG) evaluation of a retrofit order. The JTG is chaired by Field Command, Defense Nuclear Agency, and includes the military services, DOE Albuquerque Operations Office, and a variety of Sandia organizations.

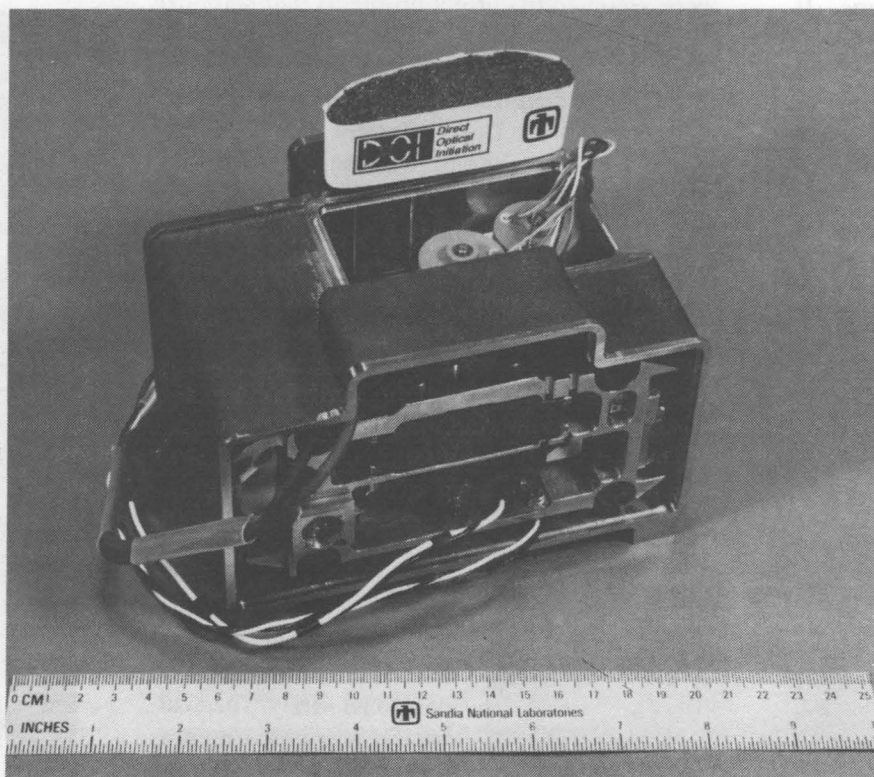
support facilities within the complex. Sandia was given leadership roles as System Assembly and Non-nuclear Component Lead Laboratories, and designated a Center of Excellence for Automation and Robotics. Sandia used modern quality tools to deploy DOE customer requirements into program objectives and teamed with the production agencies to plan and initiate technology development for the complex of the future. (5400)

We accomplished three major B83 Quality Improvement Program milestones. Alteration 331 field retrofits begun in March **replace the spin rocket motor** with an improved design, along with other selected components. This alteration is carried out in conjunction with already scheduled limited life component exchange. Sandia project and military liaison representatives worked in cooperation with Department of Defense service counterparts to perfect the field retrofit procedures and trained Air Force maintenance personnel before initiating field retrofits. In May 1993, DOE accepted the **first production unit of the B83-1**, which includes a new firing set, spin rocket motor, antennas, and other selected components. The B83-1 is the first weapon in the stockpile that facilitates encrypted permissive action link recoding. In August, the first development flight test of a B83 configured with the **new dual-channel common radar** being developed by Sandia was successfully completed at Tonopah Test Range. The common radar will be retrofitted into the B83-1 stockpile starting in FY95. (2200/2300/2500/ 2600/ 2700/5300/5500/5700)

DOE's Albuquerque Operations Office has charged Sandia with providing all microelectronics, frequency and magnetic devices, low-power pyrotechnic devices, thermal and chemical batteries, double-layer and high-energy-density capacitors, explosive-to-electronic transducers, and ceramics for nuclear weapons. This assignment will be satisfied through Sandia's **Manufacturing Development Engineering (MDE) Pro-**

gram. These assignments follow a two-year demonstration project during which Sandia delivered a number of components to AlliedSignal's Kansas City Division. In addition to delivering hardware, this demonstration project has put in place initial infrastructure elements to support product deliveries, including meeting quality requirements, scheduling, ES&H, procurement records management, and material control. (5400)

The Defense Programs Sector Arms Control/Nonproliferation Special Programs Department has been coordinating Sandia's **interactions with states of the former Soviet Union.** Sandia has two areas of interest in this endeavor: several lab-to-lab research and development projects, and five government-coordinated projects for the



THE DIRECT Optical Initiation (DOI) technology designed as the optical firing system for future weapon systems shows promise for other applications. It appears to have potential in medical laser systems such as those used in treatment of pigmented skin lesions and removal of tattoos, lithotripsy of kidney stones and gallstones, reduction of the size of enlarged prostate glands, removal of arterial obstructions (angioplasty), photodynamic and phonodynamic treatment of cancer, and corneal or lens ablation.

safety, security, and dismantlement of Russian nuclear weapons. The lab-to-lab projects, initiated in five centers by eight departments, include surety technology, materials technology, pulsed-power-related technology, cathode technology, environmental restoration, and nuclear reactor safety. To date, Sandia has invested more than \$900,000 in lab-to-lab projects. Sandia's Weapon Technology Center/Defense Programs Sector is managing the government-sponsored projects that enhance and promote the safety, security, and dismantlement of Russian nuclear weapons. These five projects include armored blankets, fissile material shipping and storage containers, accident response equipment, safety and security rail car modification kits, and support for the design of a fissile material storage facility. The Defense Nuclear Agency is providing \$26 million in support for these projects. (5000)

To satisfy new DOE requirements for **increased weapon safety** during limited-life component exchanges, the Military Liaison Program supported stockpile stewardship by incorporating positive measures to detect actuator status in the B61 bomb and the W62, W69, W78, and W80 warheads. We participated in multidisciplinary engineering teams with the systems, safety, and field engineering organizations, as well as the nuclear laboratories and DOE Albuquerque Operations Office representatives. After extensive validation and verification, we implemented and performed special procedures in the field. This field support improved our service to customers in that we minimized operational impact on the military services by providing transitional assistance until new hardware and procedures could be fielded. By agreement with the military services, we then coordinated and published maintenance procedures within the Joint Nuclear Weapons Publishing System, and trained the military technicians to subsequently perform the positive measures. (5100/5300/5500/12300)

A design guide (DG 10220) outlining the processes involved in the design, development, and manufacture of the equipment used for **handling, maintenance and transportation of nuclear weapons (H-Gear)** was written in FY93. The design guide was released for publication in November 1993. It covers the compiling and documentation of requirements, the design process, the fabrication of prototype hardware, design reviews, testing, and the manufacturing process for H-Gear. The process for writing the technical support manuals for the users and the spare hardware provisioning process are also covered. (5100/5300)

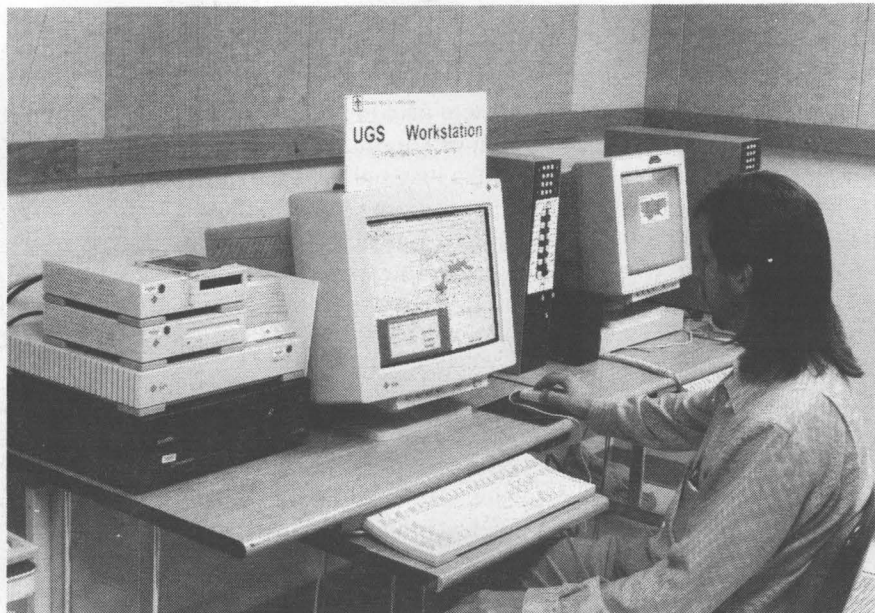
Our Military Liaison engineers and technical writers received 675 unsatisfactory reports (URs) from the military services on maintenance and logistics issues related to stockpiled nuclear weapons in FY93. We improved our resolution processes and response time over the previous year, and closed out many URs (87 percent). Also, we instituted a quarterly review — with DOE/AL and the joint-service Defense Nuclear Agency — of our **responsiveness to the military** to ensure continuing focus on the entire chain of customers. DOE's formal program review of our UR process was complimentary, and our UR performance was rated as excellent. (5500)

Other Defense-Related Work

A modular parallel processor optimized for **real-time control applications** has been developed for the Advanced Research Projects Agency. The processor uses up to 1,000 Motorola DSP 96002 floating-point processors for a peak computational rate of 60 billion floating-point operations per second, and the analog-in/analog-out interfaces support sampling rates up to 300 kHz. The high processing rate and parallel architecture make this processor suitable for computing state-space equations and other multiply/accumulate-intensive digital filters for real-time control. The system implements control algorithms developed in the Matlab programming language, and uses a Sun workstation as a host computer and an OpenWindows-based control panel. Systems have been delivered to the Naval Research Laboratory. (2300)

The first operational **Strategic Target System (STARS) test missile**, developed for the Ballistic Missile Defense Organization, was launched Aug. 25, 1993. The STARS M-1 mission — a joint British-US project — successfully delivered two payloads from Sandia's Kauai Test Facility, located at the Pacific Missile Range, to the Kwajalein Missile Range in the Marshall Islands. This was the second launch for the Sandia-developed STARS booster system. The developmental launch occurred Feb. 26, 1993. (1500/2700/2800/9100/9800)

The Integrated Manufacturing Design Initiative (IMDI), chartered to define and implement **concurrent engineering processes** "for the realization of weapon products," completed three pilot projects in FY93. These projects explored the



KEN PIORKOWSKI of Advanced Information Technology Dept. 9432 operates the Unattended Ground Sensor Workstation (UGSW) on-site at the Theater Air Command and Control Simulation Facility at Kirtland AFB. Ken wrote the software that drives the workstation.

dimensions and content of Concurrent Engineering, and demonstrated the effectiveness of the new processes. The pilot projects were supported with complementary projects in communications technology, environmentally conscious manufacturing, reliability modeling, design/manufacturing guides, and others. A key feature of the projects is the upfront involvement of everyone, from the designers to the production personnel. (5400)

Sandia completed an experimental feasibility study and conceptual pilot plant design for supercritical water oxidation (SCWO) **treatment of obsolete munitions**. The Army's Armament Research, Development, and Engineering Center (ARDEC) asked us to evaluate SCWO destruction

of colored smoke, dye, and pyrotechnic compositions in Sandia's bench-scale SCWO reactor. The process involves mixing a waste stream with water and an oxidizer, such as pure oxygen or air, inside the reactor. The solution is heated to approximately 450-600 degrees C and 4,000 psi, depending on the waste to be treated. The oxidizer and organic materials react within seconds to produce water, carbon dioxide, and simple salts that can be separated easily. We successfully demonstrated that SCWO destroys more than 99 percent of these wastes in 10 seconds. We are proceeding with the second phase of this project, which is developing a final design for an SCWO pilot plant. With an industrial partner, Sandia will design, fabricate, and conduct operational verification testing of the pilot plant, to be located at McAlester Army Ammunition Plant in Oklahoma. (8100/8300/8400/8700)

Nuclear Weapons

The Direct Optical Initiation (DOI) project passed a significant development milestone toward utilizing **optical firing systems** in future weapon systems. A prototype optical firing set demonstrated full functionality and surpassed its goals for delivering optical power through fibers. DOI revolutionizes firing set nuclear safety by using an optical detonator that requires a unique optical firing stimulus. The optical detonator is insensitive to electrical threats and incompatible with other common optical stimuli. The DOI technology is promising for other applications. It appears to have a potential for increasing laser powers currently being transmitted in medical fiber delivery systems, and extending treatment capabilities in certain applications. Some of these applications, such as treatment of pigmented skin lesions and removal of tattoos, involve cumbersome non-fiber delivery systems — "articulated arms" — for which DOI technology may provide a simpler, more reliable alternative. Other medical applications that may benefit from DOI technical expertise include laser lithotripsy of kidney stones and gallstones, reducing the size of enlarged prostate glands, removal of arterial obstructions at the heart (angioplasty), photodynamic and phonodynamic treatment of cancer, and corneal or lens ablation. (5100)

The **Stockpile Evaluation and Reliability Project** randomly selected a statistical sample of warheads and bombs from the war reserve stockpile. After the nuclear explosive materials were removed, 32 warheads and bombs were subjected to laboratory testing at environmental extremes, and 35 were flight tested by the Department of Defense. Ten significant-finding investigations were initiated as a result of this test activity. These

and previous years' findings have resulted in a nuclear weapons stockpile that has met or exceeded military requirements. (8100/12300)

During FY93, the Surety Technology Program (STP) administered by System Surety Engineering Dept. 12324 developed a stand-alone systems analysis code for **risk assessment of nuclear weapons**. In partnership with AT&T, the program demonstrated how this code can be used to analyze secure telecommunications. The STP also developed a chemical code that models the characteristics of thermally and mechanically damaged high explosives, and began coupling this code to thermal and mechanical analysis codes. Apart from their applicability to nuclear and conventional explosives, these coupled codes have potential applications in combustion efficiency and pollution control studies, and can even be used by the semiconductor industry to model glass-to-metal seals on microchips. (1500/6400/12300)

A major Sandia multi-organizational effort led by Assessment Technologies Dept. 12333 has been completed to support the Defense Nuclear Agency (DNA) Minuteman III **Weapon System Safety Assessment**. An accidental nuclear detonation pathway (NDP) evaluation was performed to accomplish one of two objectives in the assessment. The other objective was a plutonium dispersal probability assessment performed by DNA. In addition to the substantial effort to accomplish the NDP evaluation, Sandia supported DNA directly in Work-for-Others projects to characterize accident environments and system responses to accidents. (1500/2700/5100/5300/6400/6600/8700/9600/12300)

The Army is sponsoring a Sandia study to determine the structural compatibility of 155-mm-diameter **artillery projectiles** with in-bore pressure oscillations that occur in regenerative liquid propellant guns (RLPGs). The results of extensive laboratory tests and analyses of the payload and dynamic analyses of two different projectiles show that the main body of both projectiles and the payload in one of the projectiles can survive the RLPG in-bore pressure oscillation environment as currently defined. Analysis results also show that the pressure oscillations will cause structural damage to the payload in the other projectile and could cause reliability problems for the main fuzes in both projectiles. Martin Marietta Space Group (formerly GE Aerospace Division), the main contractor for the RLPG, is now working on reducing pressure oscillations in the RLPG. The Army has asked Sandia to determine the structural compatibility of the 155-mm-diameter XM898 SADARM (Seek and Destroy Armor) projectile with the RLPG in-bore environment. (8700)

Sandia awarded a \$68 million contract to ITT Corporation, Aerospace Communications Division, Clifton, N.J., for the procurement of 20 **electromagnetic pulse sensors** to support an Air Force requirement on Global Positioning System (GPS) satellites. These sensor deliveries will be spread over a period of five years, and will be integrated and tested as a part of the DOE-funded payload Sandia provides for GPS. The award followed an R&D activity, also at ITT, to design and develop the prototype sensor. This procurement contract is the largest award ever made by Sandia. (9200)

The Center for Data Systems Engineering developed an **Unattended Ground Sensor Workstation (UGSW)** that was incorporated into the

Other Defense-Related Work

Ground Environment Simulation Laboratory simulation network of the Theater Air Command and Control Simulation Facility at Kirtland Air Force Base. In this role, the UGSW receives real-time sensor updates from a simulation scenario designed to investigate the use of unattended ground sensors in detecting and identifying ground-based activities associated with mobile Theater Ballistic Missile operations. (9400)

A **precision guidance system** based on integration of an inertial navigation system and a Global Positioning System (GPS) receiver was tested on the Strategic Target Systems (STARS) Mission 1 flight in August 1993. The system provided an accurate navigation solution from launch until the end of the mission, and is believed to be the first demonstration of this technique during a ballistic missile flight. The system will be used on future STARS flights, and offers great potential for other applications such as precision strike systems. (9100)

The Ballistic Missile Defense Organization sponsored Sandia's Aerospace Systems Development Center to develop an **attitude control system for satellites and reentry vehicles (RVs)** during the exoatmospheric portion of their trajec-

tories. Several Labs organizations participated in the concept development and hardware prototype design, construction, and testing. The attitude control system provides a unique way to control the nutation or coning (controlled wobbling motion around the longitudinal axis) of a spinning satellite or RV by utilizing internal moving masses. This system has been acknowledged by experts in the field of satellite attitude control as an innovative and simple way to control spinning satellites. (2300/2600/2700/9100/9800)

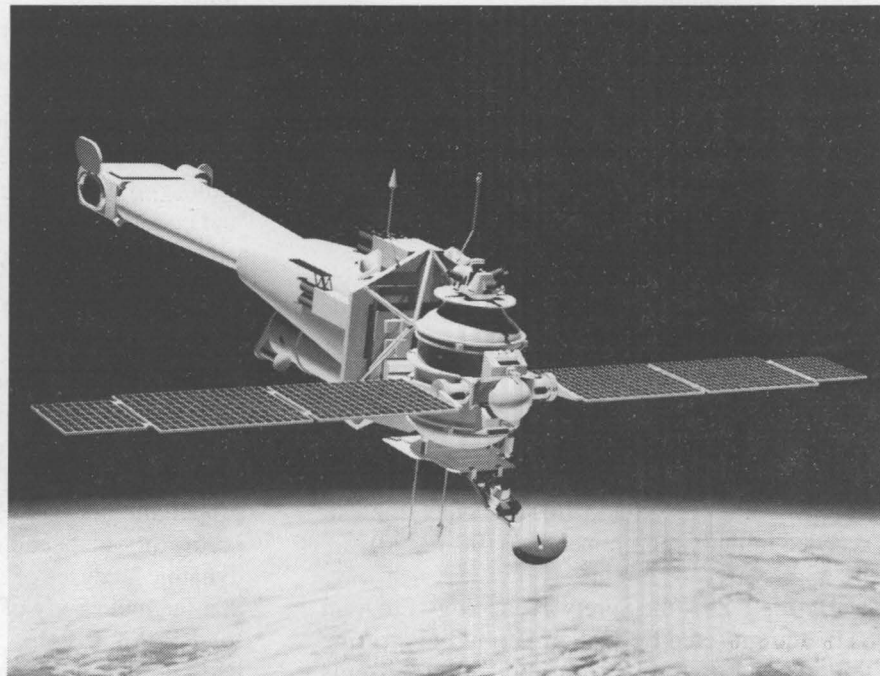
On Aug. 25, 1993, Sandia launched two payloads from the Kauai Test Facility 2,300 miles southwest to the Kwajalein Missile Range. The payloads — named Zodiac Beauchamp (ZB) and Aerothermal Reentry Experiment (ARE) — were the products of an international team of participants. The design agencies closely coordinated both vehicle designs to ensure the ZB vehicle matched the ARE vehicle through a significant portion of its reentry. The United Kingdom Ministry of Defence provided funding for design and fabrication of the ZB vehicle in the United Kingdom. Sandia designed and fabricated the ARE vehicle for a combination of government agencies and private contractors. The Ballistic Missile Defense Organization provided funding and direc-

tion through the US Army Space and Strategic Defense Command. Sandia designed the ARE vehicle to **collect data in the hostile environment** experienced by a damaged reentry vehicle as it enters Earth's atmosphere. This flight was the third and final test in a series designed to provide quantitative data to define the amount of damage an interceptor must inflict on a vehicle to disable it. Sandia recovered essentially 100 percent of the data collected on board during all three flights. (1500/2300/2400/2600/2700/2800/9800)

An engineering model of the SGRP (Stellar X-ray Polarimeter) was shipped to Russia for a test of integration with the Spectrum X-Gamma satellite to be launched in late 1995. The flight unit will rest at the focal point of a powerful X-ray telescope **viewing the distant cosmos**, and will measure the polarization of X-rays from cosmic sources. The SGRP unit includes a rotating platform, detectors, motors, mechanisms, and electronics, enclosed in a rugged, precisely machined structure. This instrument is the result of an international collaboration between Columbia University, Lawrence Livermore National Laboratory, Marshall Space Flight Center, and Sandia, with participants from Italy and the United Kingdom. Funding is from NASA. (5700/9200)

Sandia has developed expertise in the disciplines of active and passive control of structures, including development of a system for **active suppression of noise**. Actuator hardware utilizes piezoelectric (a material that changes dimensions in response to an applied voltage) elements mounted on devices that amplify the element motion. A Sandia-developed processor designed to have minimal time delay controls the system. We are also developing experimental and analytical tools for engineering the application of viscoelastic (VE) materials. (VE is a class of material that is effective for dissipating mechanical energy when deformed.) Applications are the passive damping of shock and vibration in structures and acoustic energy. Developers demonstrated the analytical design of a damper using a VE material to significantly reduce vibration of a prototype X-ray lithography platen. This work is supported by DOE Defense Programs and DoD Work-for-Others funding. (1400/1800/2300/2400/2700/9100)

THIS IS an artist's illustration of the Spectrum X-Gamma satellite containing the SGRP (Stellar X-ray Polarimeter) developed by Sandia and several partners. The satellite is expected to be launched in late 1995 on a mission to view the distant cosmos and measure the polarization of X-rays from cosmic sources.



Components/Materials and Processes

Particle contamination is the leading contributor to low yields in the **production of semiconductor devices**. Using computer simulation of fluid and particle transport, we have modeled the forces acting on particles in commercial chemical vapor deposition reactors in which contamination is a major problem. We worked with SEMATECH, Intel, and two major reactor tool manufacturers to analyze contamination mechanisms. We proposed six corrective modifications — to fix inherent design flaws — that will provide an estimated 10-fold reduction in contamination. One or more of these "fixes" were to be implemented by the manufacturers in early 1994. Design/operation guidelines developed through this work — to aid in designing future reactors — are being disseminated throughout the semiconductor tool community. (1500)

Sandia has successfully tested the prototype design of the MC4380 **neutron generator** for the W76 weapon system. The design uses the MC4277 neutron tube and incorporates large design margins for ease in manufacturing. The

MC4380 is the first neutron generator scheduled for production at Sandia under the plans for non-nuclear reconfiguration, and will be shipped for

the next limited-life component exchange for the W76. (2400/2500)

Pulsed Power Development

A fundamental unresolved issue in light-ion inertial confinement fusion (ICF) is the **coupling of ion beam energy** into X-ray radiation in radiation cavities (hohlraums). In a series of experiments last March, exploring this issue using a lithium ion beam on the multi-terawatt (10^{12} watts) PBFA (Particle Beam Fusion Accelerator) II, we produced the highest temperature ever recorded from the interaction of an intense ion beam with matter in a hohlraum. This experiment is one of a set being performed as part of Sandia's light-ion ICF program on PBFA II with proton and lithium beams. In these experiments, the beam's energy is deposited in a low-density plastic foam that heats up, and, in turn, radiates energy to a high atomic

number (high-Z) wall that surrounds the foam. As this high-Z wall is heated by the foam, it becomes a radiation cavity in the X-ray portion of the spectrum that can be used in future experiments to drive an inertial fusion target capsule. To carry out these experiments, it was necessary to develop an extensive theoretical modeling capability as well as a comprehensive target fabrication capability. Also, a new diagnostic suite was developed to perform the measurements of the X-ray output of these beam-heated targets. The experiments performed with lithium beams demonstrated an order-of-magnitude improvement in the coupling of ion-beam energy into our targets, when compared to previous experiments using proton beams. (1200)

Energy and Environment

Staff members of the Intelligent Systems and Robotics Center developed and demonstrated supervisory **control software for robotic systems** at the Hanford, Wash., site. These robotic systems will ultimately be used to retrieve 37 million gallons of radioactive waste from 149 single-shell storage tanks (photo on page nine). The waste-removal demonstration consists of two robots, an integrated sensing system, and several waste-dislodging tools. Diverse system components were quickly and easily integrated using the Sandia-developed software. A significant feature of the software is that the operator controls the robots and the supporting subsystems from a single graphical interface. The software uses model information and sensor data to accomplish the retrieval tasks safely and efficiently. The Hanford site waste-removal demonstration was a multi-laboratory effort and satisfied key milestones that involved the Environmental Protection Agency, DOE, and the Washington State Department of Ecology. (2100/6600)

During the next decade, DOE must retire and dismantle many nuclear weapon systems. In September 1993, Sandia demonstrated the Hazard-Separation System (HSS, photo on page nine) it is developing to enhance DOE's ability to **dismantle weapon components** and dispose of the resulting materials. The HSS combines abrasive water-jet cutting technology and real-time radiography. The HSS allows operators to determine the exact location of interior hazardous materials and to remove them through precision cutting. The system provides for accurate and fast waste stream separation, minimizes the production of hazardous wastes, and maximizes the recovery of recyclable materials.



SANDIA LED a multi-laboratory team in designing a climate-relevant payload for this unmanned aerospace vehicle. The payload, which was flown successfully for the first time in November 1993, carries NASA instruments meant to improve the understanding of global warming issues (item on page nine).

Hazardous materials can typically be removed in less than one minute. (1600/2300/2700/6600/9300)

Sandia, Cummins Power Generation, Inc. (CPG), Sunpower, Inc., and Thermacore, Inc. received a joint R&D 100 Award for the CPG 7.5-kilowatt Dish-Stirling system (photo on page eight). The self-contained system converts **solar energy to electricity** in remote areas. The system is the first commercial application of a free-piston Stirling engine and a liquid metal reflux heat-pipe receiver. The reflux heat-pipe receiver is a technology pioneered at Sandia.

The R&D 100 Awards recognize the 100 most technically significant new products each year, and are sponsored by *R&D Magazine*. This was one of five R&D 100 Awards received by Sandia in 1993. (6200)

Sandia's Photovoltaic Device Fabrication Laboratory staff achieved a milestone demonstration of a new photovoltaic cell, called the Emitter Wrap-Through (EWT) cell. Unlike most cells, the EWT cell includes an electrical grid design that does not shade the front surface of the cell. This increases the amount of sunlight that reaches the active part of the device, therefore increasing the efficiency of **conversion from sunlight to electrical energy**. The new design has the potential to achieve efficiencies of 18 percent with solar grade multicrystalline silicon on 100-square-centimeter solar cells, and is of interest to members of the Multicrystalline Silicon Research Consortium (MSRC). The MSRC was organized by Sandia and is made up of researchers from AstroPower, Crystal Systems, Mobil Solar, Solarex, Texas Instruments, the National Renewable Energy Laboratory, and Sandia. The MSRC conducts coordinated experiments to study processing and cell-design issues specific to multicrystalline silicon solar cells. (6200)

After nearly 10 years of planning, the Yucca Mountain Site Characterization Project (YMP) began constructing its Exploratory Studies Facility (ESF) — 12 miles of tunnels and underground test rooms (photo on page eight). Having helped design site-characterization activities and the ESF since the project began, Sandia staff were on hand as construction began. They fielded the first test activities associated with the ESF, studies that will assess the safety and stability of the underground openings. Later tests will be critical in determining whether **Yucca Mountain** is a suitable repository for high-level nuclear waste. (6300/9300)

The Fusion Technology Department was instructed by DOE's Office of Fusion Energy to build a 1.2-megawatt **electron beam test facility** (EB-1200) for development and performance evaluation of high heat flux plasma facing components for the International Thermonuclear Experimental Reactor (ITER). ITER is a 1.5-3-gigawatt thermal magnetic confinement tokamak being designed to demonstrate the physics — and investigate the technology — of long pulse, burning fusion plasma operation for the eventual production of electricity. Construction of EB-1200 has been completed, and initial performance testing is in progress. The construction project, costing nearly \$1.5 million in FY93, was executed on time and

Safeguards and Security



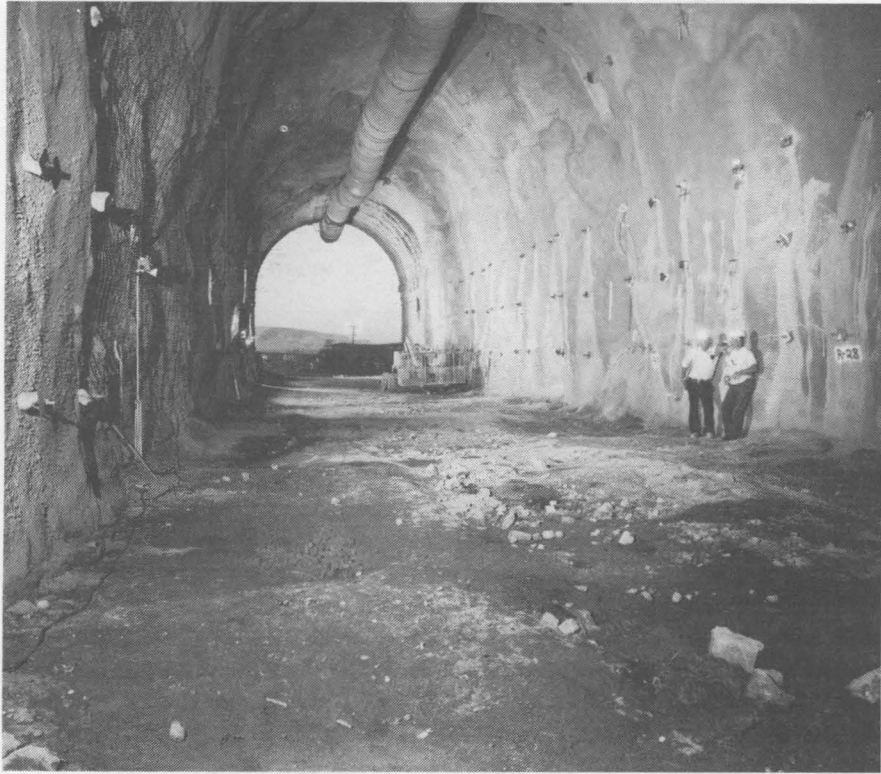
STICKY FOAM — an extremely tacky, tenacious material developed as part of the nuclear safeguards and security program — can be used to entangle and impair an individual. Sandia has demonstrated the technology, and an operational sticky-foam dispenser should be available in 1994 for testing by prison officers.

Sandia's Safeguards and Security Center completed **security awareness training** for 72 subcontractor Facility Security Officers (FSOs) who represented 1,596 employees. The objective was to train FSOs so they would design training programs for their cleared employees and thereby fulfill DOE requirements for security awareness. DOE requires a strong security awareness program for anyone who holds a clearance. The program mandates initial, comprehensive, annual, foreign-travel, and termination security briefings. The 72 FSOs were a trial group out of a potential population of 300 Sandia contractor firms that have cleared employees. FSOs, for the first time, worked with the Sandia Personnel Security staff and established team working relationships and contacts for clarifying and resolving various DOE and Sandia requirements. DOE was complimentary of the Sandia effort and will use it as a model. (7400)

Sandia has been working with the National Institute of Justice (NIJ) to explore technologies developed as part of the nuclear safeguards and security program for potential application in situations warranting **less-than-lethal force**. The objectives are to provide alternatives to the use of deadly force, provide for a graduated response capability, and address specific use-of-force situations such as fleeing felon, prison-cell extraction, and disturbance/riot situations. Sandia has a current project sponsored by the NIJ to design and develop a sticky-foam dispenser for potential use in subduing or capturing individuals. Sticky foam is an extremely tacky, tenacious material that can be used to entangle and impair an individual. Prototype, proof-of-principle hardware has been demonstrated and an operational sticky-foam dispenser should be available in 1994 for testing by prison officers. (5800/9600)

Energy and Environment

within the authorized budget. EB-1200 will be used in FY94 for continued development of plasma facing components (PFCs) for ITER. Large scale, actively cooled PFCs designed for steady state operation at heat flux loads in the range of 5-30 megawatts per square meter will be tested by Sandia in cooperation with our industrial partners. The industrial team is led by McDonnell Douglas



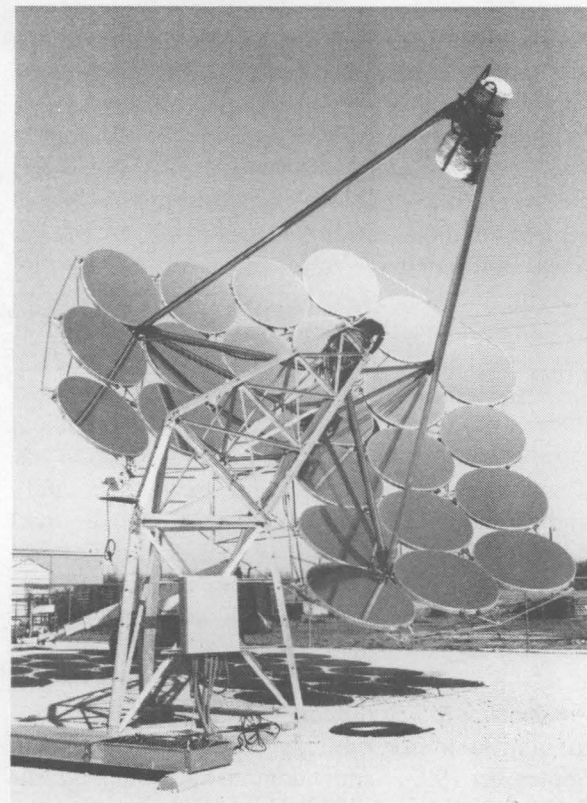
THIS 35-FOOT-WIDE opening will serve as the launching chamber for a tunnel-boring machine at the Yucca Mountain Site Characterization Project in Nevada. The machine will excavate seven miles of tunnels as part of the Exploratory Studies Facility. Yucca Mountain is being considered as a repository for high-level nuclear waste.

Aerospace Corp. PFC test module fabrication will be the responsibility of the industrial team. (6500)

As the scientific advisor to DOE on the **Waste Isolation Pilot Plant (WIPP)**, Sandia produced a Technical Needs Assessment Document and a Test Phase Plan formulating needs for experiments to support the demonstration of WIPP's compliance

with regulatory requirements. Sandia made significant progress in experiments to characterize the WIPP bedded-salt repository, and in developing a capability for modeling the long-term burial of radioactive and hazardous wastes. DOE decided in October to test radioactive wastes in laboratories rather than at WIPP. This decision has enhanced Sandia's ability to collect the right technical data quickly and at a potentially lower cost. (6300)

Probabilistic risk assessments (PRAs) on **nuclear power plants** are normally made while the power plants operate under full-power conditions. During the past year, the Reactor Systems Safety Analysis Department has been involved in the development and implementation of methods to perform PRAs



THE SELF-CONTAINED Cummins Power Generation, Inc. 7.5-kilowatt Dish-Stirling system converts solar energy to electricity in remote areas. Part of the technology used in the system was pioneered at Sandia.

on nuclear power plants while they operate in conditions other than full power. This analysis, sponsored by the US Nuclear Regulatory Commission, met a major milestone in June with the delivery of draft documentation providing preliminary numerical results for one plant. These findings indicate that the risk associated with less-than-full-power states may be comparable to the risk associated with full-power operations. The documentation provides a complete description of the approach used. (6400)

More than 30 experiments have been conducted to investigate Direct Containment Heating (DCH) in realistic **nuclear power plant structures**. These experiments have addressed issues concerning physical scale, hydrogen combustion, cavity and containment water, real reactor melts, system pressure, and the role of prototypic plant structures and prototypic Reactor Coolant System and containment conditions. Lessons learned have culminated in two reports. The first, "The Probability of Containment Failure by Direct Containment Heating in Zion," focuses on DCH resolution for the Zion Nuclear Power Plant in Zion, Ill., just north of Chicago. The report integrates uncertainties in initial condition, containment loads, and containment fragility to arrive at the probability of containment failure. The second report, "Integrated Report on DCH Issue Resolution for PWRs (Pressurized Water Reactors)," uses the Surrey Nuclear Power Plant near Jamestown, Va., as a second demonstration of issue resolution. An extrapolation methodology is outlined whereby DCH resolution can be examined for all existing PWRs. Both reports are now undergoing external peer review by a common panel of 15 experts. (6400)

The next scaling experiment of the FALCON (Fission Activated Laser Concept) **reactor pumped laser program** was successfully completed in the Annular Core Research Reactor. This experiment investigated new resonator concepts required for assessing the scaling of reactor pumped lasers to very high powers. Two sophisticated, unstable resonator concepts were evaluated. One of the resonators lased reproducibly with threshold pump powers in agreement with small signal gain measurements. The symmetric laser output signal of this resonator indicated

Quality

The **President's Quality Award** was created, developed, and awarded this year. This effort involved 1,200 individual applicants among 86 teams, and produced 16 winning teams. The process was coordinated, supported, and facilitated by the Corporate Quality Excellence Program (CQE), with the assistance of line organization volunteers. This process required the selection and training of examiners, and the development and facilitation of workshops for potential applicants and examiners. This year, the CQE Program also provided a loaned executive to Quality New Mexico for a two-year period. In addition, the CQE has the lead responsibility in the Governor's Business Executives for Education organization in developing and strengthening quality in public schools. (12911)

Reducing by 50 percent the time required to create qualified telemetry hardware — from two years to one year — was the goal of the multi-functional, multi-site product realization team assembled to create the **Integrated Telemetry Processor**. Team members from California, New Mexico, and Kansas City worked closely together using the latest computer networking and video-conferencing capabilities. By integrating new methods into the product realization process, the team shortened the time required without an increase in cost or a decrease in quality. Among the new methods used were: concurrent qualification using a new Interagency Engineering Procedure (EP401100), electrical and mechanical simulation in lieu of prototypes, and standardized computer-aided engineering tools among all sites and team members. (8400)



GEORGIANNE SMITH of Corporate Quality Excellence Dept. 12909 got best wishes from Sandia President Al Narath as he presented her with a President's Quality Award, which was created and developed during FY93. The first year's effort drew 1,200 individual applicants among 86 teams, and produced 16 winning teams. The awards ceremony was telecast live from the Technology Transfer Center at the New Mexico site to California.

Energy and Environment

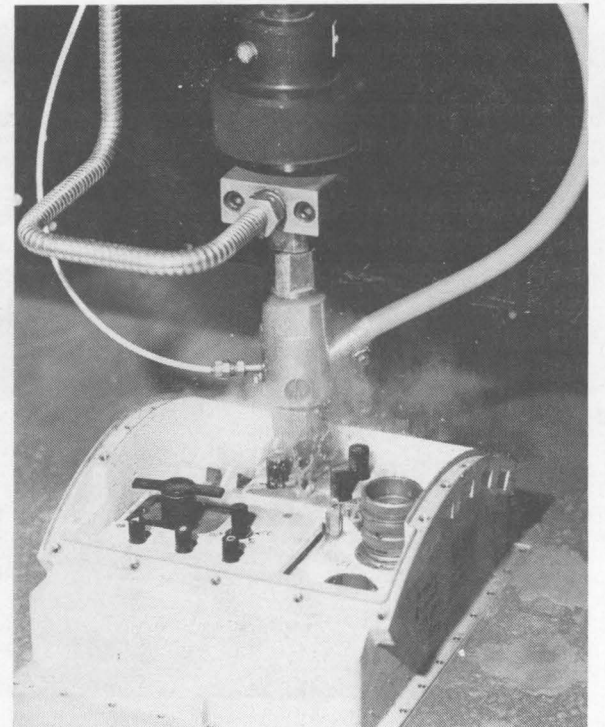
sufficient tolerance of medium aberrations to be considered a viable candidate for a high power reactor pumped oscillator amplifier system. (6500)

Oil stored in domal salt caverns suffers from two natural processes: (1) warming under the influence of the geothermal gradient, and (2) absorbing natural gas from the surrounding geologic media. Sandia is part of the DOE team formed to understand these two effects and their impact on subsequent processing of the oil. In consideration of the first effect, we have developed a code to describe the desirable cooling of oil during pipeline transport. We also field-verified this code during an oil transfer of approximately one million barrels. In consideration of the second effect, we have developed a phenomenological understanding of gas intrusion into salt storage caverns using both Strategic Petroleum Reserve and Waste Isolation Pilot Plant data. This model allows us to predict gas intrusion rates into oil storage caverns, and to quantify operating pressure dependence with historical performance. We characterized the effects of gas intrusion and oil heating into three major categories: operational constraints, environmental regulations, and safety considerations. We developed new field and laboratory measurement techniques to consistently characterize the gas content and composition of the gassy oil. (6100)

A Sandia-led multi-laboratory team designed and integrated the first-ever climate-relevant payload for an unmanned aerospace vehicle in less than six months. The payload carries five National Aeronautics and Space Administration radiometers for measuring Earth's **solar and thermal radiation**, and will support DOE's Atmospheric



THE HAZARD-SEPARATION System cutting head (right) is shown in a lab test cutting a component from a piece of equipment, like the process that would be used to dismantle many nuclear weapon systems. Jim Lutz of Environmentally Conscious Life-Cycle Systems Dept. 6625 (left) examines the component after it is cut away from the larger housing unit. (Photos by Mark Poulsen)

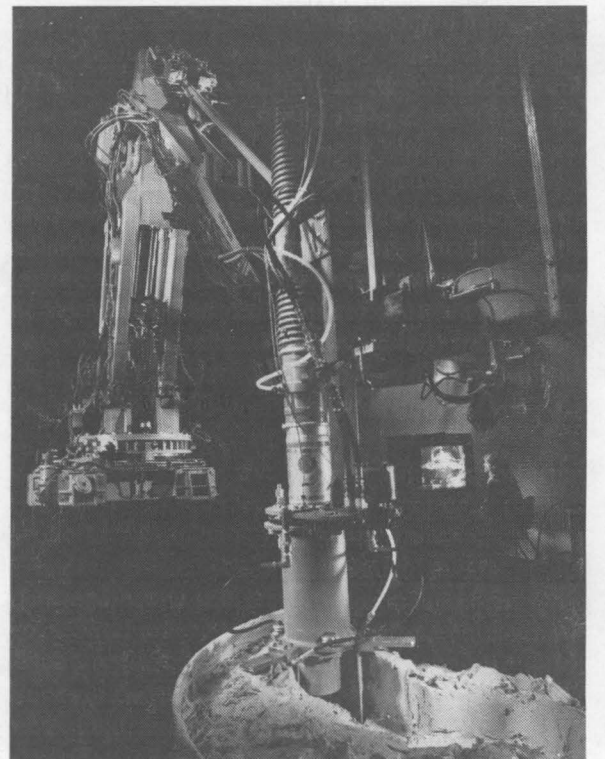


Radiation Measurement program by improving the understanding of global warming issues. Funded through the Strategic Environmental Research and Development Program, this payload had its first successful flight in November 1993. (2700/5300/8100/8400)

In October 1992, the **Burner Engineering Research Laboratory (BERL)** at Sandia's Combustion Research Facility became operational. This culminated a five-year effort between Sandia and the Gas Research Institute to build a facility where manufacturers can use Sandia's laser diagnostic capabilities to improve the efficiency and lower the emissions characteristics of their natural gas burners. BERL hosted its first user, the International Flame Research Foundation (IFRF) in March 1993. The IFRF used the BERL facility to gather data for a study on scaling of natural gas burners. (8300)

The corrosion behavior of a carbon steel and two stainless steels in molten nitrate salt mixtures was evaluated as a prelude to their use as the heat transfer fluid in Solar Two, a 10-megawatt **solar power tower demonstration plant**. Corrosion tests were conducted in several nitrate mixtures containing various impurity concentrations to identify the influence of trace impurities on corrosion kinetics. Isothermal corrosion testing identified the morphology and composition of the corrosion products, and showed that corrosion rates of the carbon steel and Type 316 stainless steel were acceptably low in all salt mixtures. The results of this study will allow for the selection of lower-cost nitrates for Solar Two at a significant savings to the program. (6200/8700)

A continuous monitoring instrument is being developed to measure toxic metals in the effluent from **hazardous-waste incinerators**. The instrument uses a high-power pulsed laser to break down particles and molecules to form energetically excited atoms and ions. Measurements of the light emitted by these species serve to identify and quantify elemental species present. An important advantage of this approach is that it can measure atomic species embedded in particles or fine aerosols, which account for a large percentage of metal emissions from incinerators. Laboratory demonstrations have been made of one microgram per cubic meter beryllium detectability, and detectability in the 10-100-microgram-per-cubic-

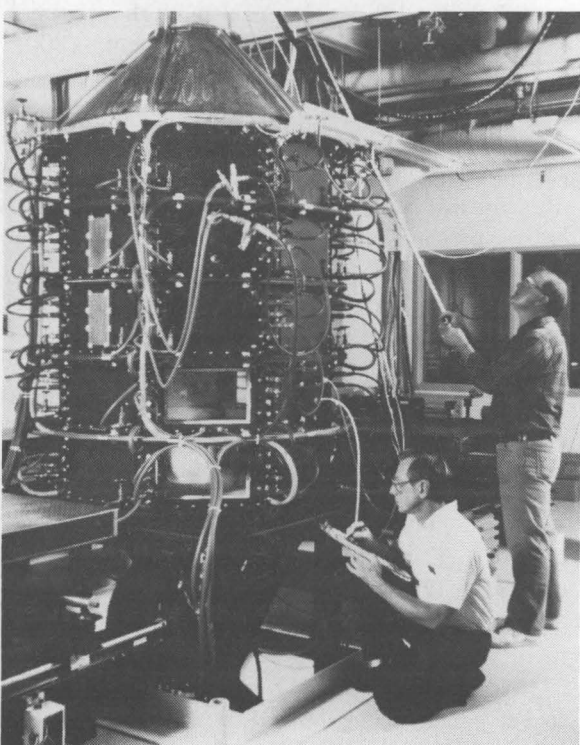


SANDIA'S Intelligent Systems and Robotics Center developed and demonstrated control software for robotic systems that will be used to retrieve 37 million gallons of radioactive waste from 149 single-shell storage tanks at the Hanford, Wash., site.

meter range for several other regulated metals, including cadmium, chromium, cobalt, and manganese. (8100/8300/8700)

Transportation

In work funded by the Federal Aviation Administration (FAA), Sandia has produced an experiment that allows the FAA to determine the reliability with which inspectors perform **airframe inspections**. This experiment was developed at the Sandia-operated FAA Aging Aircraft Non-Destructive Inspection Validation Center. The experimental hardware simulates the fuselage of a Boeing Model 737. Inspectors at nine airline maintenance facilities (including the facilities at United, American, and Delta) participated in the experiment. The tests currently being conducted will contribute to enhanced reliability inspections at maintenance facilities. (2700)



JIM BOEHMKE of Combustion in Engines and Furnaces Dept. 8362 (left) observes the flame inside the furnace at the new Burner Engineering Research Laboratory at Sandia's Combustion Research Facility at the California site. Lloyd Claytor of Energy and Environmental Research Corp., adjusts the furnace pressure.

Supporting Technologies



ONE OF THE two full scale (one-meter) working prototypes of the Robotic All Terrain Lunar Exploration Rover (RATLER) designed, assembled, and tested during FY93 goes through its paces on a Sandia test range. The RATLER system has logged approximately 15 hours of successful field operations in varied terrain (item on page 11).

Copper on Teflon is an ideal materials combination for high-frequency electronic circuits required for **advanced radar and communications applications**. With current manufacturing technology, it is impossible to produce the small (less than 30 micrometers) circuit features that are required for high-frequency components. We have developed a new process to produce patterned adherent copper conductors on Teflon substrates. Our process combines surface pretreatment with standard photolithographic techniques to produce circuit features that are less than 20 micrometers (more than a factor of five smaller than can be commercially produced). Circuit elements made this way can replace the complex hybrid circuits currently used for high-frequency applications. (1100/1300)

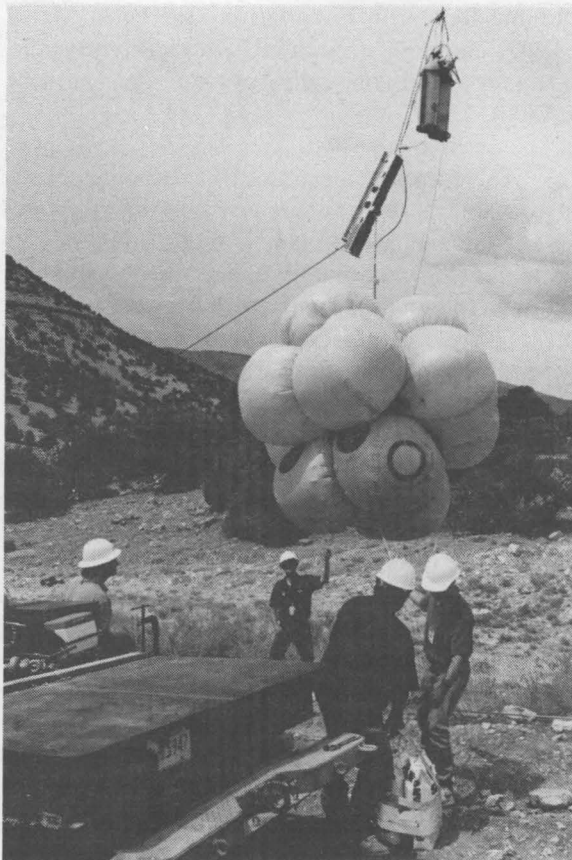
Sandia teamed with the Jet Propulsion Laboratory (JPL) to design a novel airbag system to provide **soft-landing capability for the Pathfinder** mission now scheduled to be flown to Mars in 1996. The US has never used an airbag system for soft landing on interplanetary missions, but we successfully demonstrated that the airbag concept is capable of protecting the lander during impact on the rock-strewn Martian surface. To evaluate the airbag system, we performed integrated structural analyses and experiments at Mars atmospheric pressure in Sandia's High Altitude Chamber, and conducted 1/3-scale drop tests at the Coyote Canyon test facility. Much to the delight of JPL, the Pathfinder Review Panel selected the airbag design for the mission. (1500/2600/2700)

As silicon (Si) integrated circuits shrink in size, there are increasingly stringent specifications on **metal-impurity content in Si wafers**, projected to be as low as one atom in 10^{14} (100 trillion). Such small concentrations will be difficult to achieve through current methods of impurity "gettering," a process in which detrimental metal atoms are removed by precipitating them as metal-silicide phases in unused regions of the wafer. We have shown that microscopic cavities within Si, formed by ion implantation of helium and subsequent heating, can trap two representative detrimental impurities — copper (Cu) and nickel — much more strongly than metal-silicide precipitation. For example, in a wafer at 600 degrees C containing Cu impurities, cavity gettering should reduce the Cu concentration by typically five

orders of magnitude more than silicide precipitation. This promising new concept exploits the high chemical reactivity of the bare silicon surfaces at the cavity walls. Twelve semiconductor companies have already requested information about the process. (1100)

NASA's use of hydrogen in rocket operations demands fast, flexible, reliable, **high-performance hydrogen sensors** for safety considerations (photo on page 11). Commercial detectors have not met these needs. By merging microchip technology with Sandia's hydrogen-sensing alloys, a new smart microchip that exceeds NASA's requirements was invented. The chip detects a wide range of hydrogen concentrations within seconds in a variety of environments. Using the micro sensor, Sandia designed and built leak-detection systems that have detected hydrogen leaks during field tests at NASA's Stennis Space Center. Sandia's hydrogen sensor technology received an R&D 100 award from *R&D Magazine*, thereby naming it one of the 100 most significant scientific advances of 1993. Uses are anticipated in waste site remediation, semiconductor processing, nuclear reactor safety, and future hydrogen-powered cars. (1300)

There is a long-standing need to determine the quality of lubricating fluids used in internal com-



SANDIA and the Jet Propulsion Laboratory (JPL) designed an airbag system to provide soft-landing capability for the planned 1996 Pathfinder mission to Mars. Preparing for drop tests at the Coyote Canyon test facility are (left to right) Jim Calderone of Energetic and Environmental Testing Dept. 2761, Don Waye and Dan Luna, both of Parachute Technology and Unsteady Aerodynamics Dept. 1552, and Tom Rivellini of JPL.

bustion engines and other types of machines. We have developed a new sensor that provides in situ, real-time measurements of **engine oil quality** using a rugged and mature electro-mechanical technology based on quartz resonant devices. Our dual acoustic resonator microbalance comprises one textured and one smooth resonator, and has been demonstrated to measure a range of fluid physical properties indicative of lubricant degradation, including density, viscosity, precipitation rate, and contaminant concentration. In laboratory tests, we successfully monitored engine oil sampled from an operating engine, and accurately determined when the oil reached the end of its useful life. We are currently transferring this technology to two industrial partners for use in automotive applications. (1300)

There is a strong need for effective disposable catalysts for producing **liquid hydrocarbon fuels from coal**. Using our recently patented method for producing size-selected nanometer-size clusters, we have synthesized a variety of inexpensive nanocluster materials — iron (Fe), iron sulfide (FeS_2), and molybdenum disulfide (MoS_2) — as substitutes for precious metal catalysts, and demonstrated unusual catalytic activity for these clusters. As one example, FeS_2 nanoclusters increased the hydrocarbon yield in coal liquefaction by 50 percent over baseline, whereas FeS_2 powder shows little activity. Also, Fe nanoclusters were the only iron catalyst to increase tar and gas yields over baseline in direct coal hydrolysis, and MoS_2 nanoclusters were six times more active for pyrene hydrogenation than a commercially supported palladium catalyst. These laboratory results could have important implications for producing liquid fuels from coal. (1100/6200)

A Scattering Center was developed jointly with the Universities of New Mexico and Missouri to solve **microstructural materials problems** (photo on page 11). The center comprises a unique suite of scattering instruments (X-ray and light), which span the particle size range from 0.1 nanometer to 10 micrometers. This range is significant in research areas such as porous materials, advanced ceramics, polymer blends, and reinforced polymers. Current activities include the study of the growth of ceramic reinforcement particles in silicone rubber by Dow-Corning, which contributed to lab development through a cooperative research and development agreement. (1800)

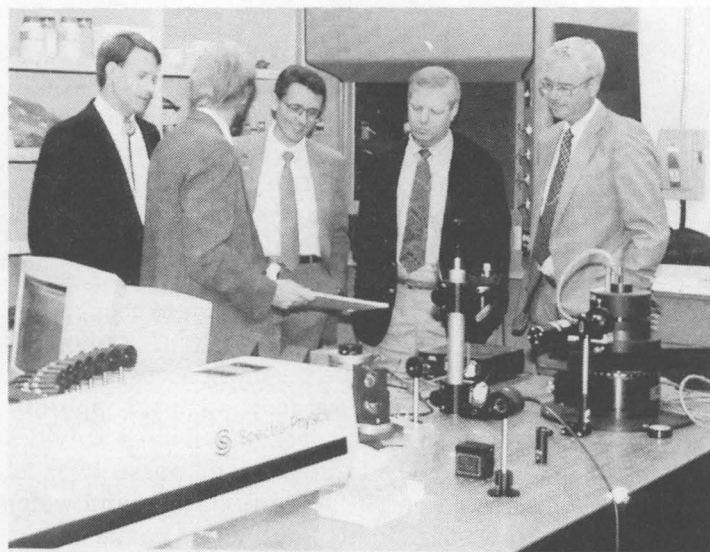
A significantly improved calibration technique has been developed for certifying Vector Automatic Network Analyzers (VANA) that are used for **microwave measurements**. The certification process, which uses Thru-Reflect-Line techniques, reduces the assigned uncertainty for large reflection coefficient measurement from ± 0.2 to values on the order of ± 0.02 . The VANAs are used by the Primary Standards Laboratory to calibrate microwave standards in support of calibration activities throughout the nuclear weapons complex, and by research and development organizations within Sandia. (1040)

A process to shorten by about a year the transition of the **Tritium Research Laboratory (TRL)** at Sandia/California from a moderate-hazard nuclear facility to a general purpose laboratory is expected to save about \$20 million. DOE has approved the first step, classifying the TRL as a low-hazard, non-reactor nuclear facility. This classification recognizes the reduced risk due to the presence of less than 30 grams of tritium in the laboratory. As part of the transition process, \$5 million worth of equipment was relocated to new users at Sandia/New Mexico, Los Alamos National Laboratory, and Savannah River. Before these new users were

Supporting Technologies

identified, the plan was to scrap the equipment. Even with the increased volume of cleanup work, personnel exposures and environmental tritium releases were the lowest since 1986. (8200/8600)

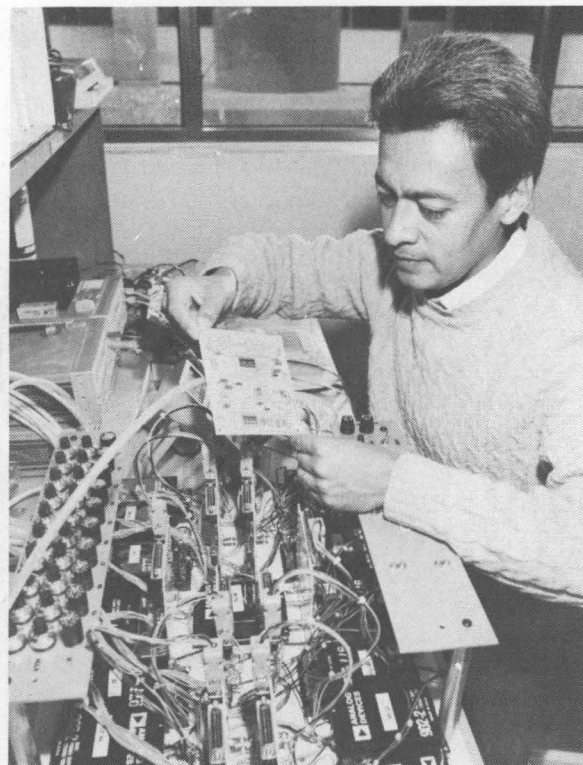
A new optical method for precise **space- and time-resolved measurements** of gas-phase temper-



SANDIA, working with the Universities of New Mexico and Missouri, helped develop a scattering center to solve microstructural materials problems. Discussing laser light-scattering instruments during the dedication of the Small Angle Scattering Center at UNM's Farris Engineering Center in August 1993 were (left to right) Tom Rieker of Ceramic Processing Science Dept. 1841; Greg Beauce of Organic Materials Processing Dept. 1815; Alan Hurd (1841); Al Romig, Director of Materials and Process Sciences Center 1800; and Paul Fleury, then VP of Research and Exploratory Technology Div. 1000.

ature and chemical composition was developed and demonstrated. The new diagnostic, based on degenerate four-wave mixing (DFWM), results from research on new techniques for combustion measurements, but holds the potential for broad application in the physical, chemical, and life sciences. The method uses resonant ultraviolet (UV) or infrared laser beams to generate a bright, highly collimated signal beam, resulting in high-sensitivity measurements even in harsh environments with minimal optical access. The UV-DFWM detectivity demonstrated for nitric oxide in an atmospheric-pressure flame is below 25 parts per million. Detailed theoretical analysis for predicting and interpreting DFWM spectra are incorporated into a fitting code. (8300)

During FY93, two full-scale (one-meter) working prototypes of the **Robotic All Terrain Lunar Exploration Rover (RATLER)** were designed, assembled, and tested. The first working unit is a simple pathfinder device that incorporates only the mechanical structure and drive mechanisms. The second unit built in FY93 is a complete robotic vehicle system, including multiple onboard processors, sensing, multi-tasking software, and radio links for both video and digital data. The video and digital data links communicate to a portable control console. The RATLER system has logged approximately 15 hours of successful field operations in varied terrain. Footage of the RATLER was nationally broadcast on the



SANDIA'S hydrogen-sensing alloys were merged with microchip technology to produce high-performance hydrogen sensors that exceed NASA requirements for safety in rocket operations. The sensor, being assembled by Jose Rodriguez of Silicon Technologies Dept. 1325, won an R&D 100 award from *R&D Magazine*.

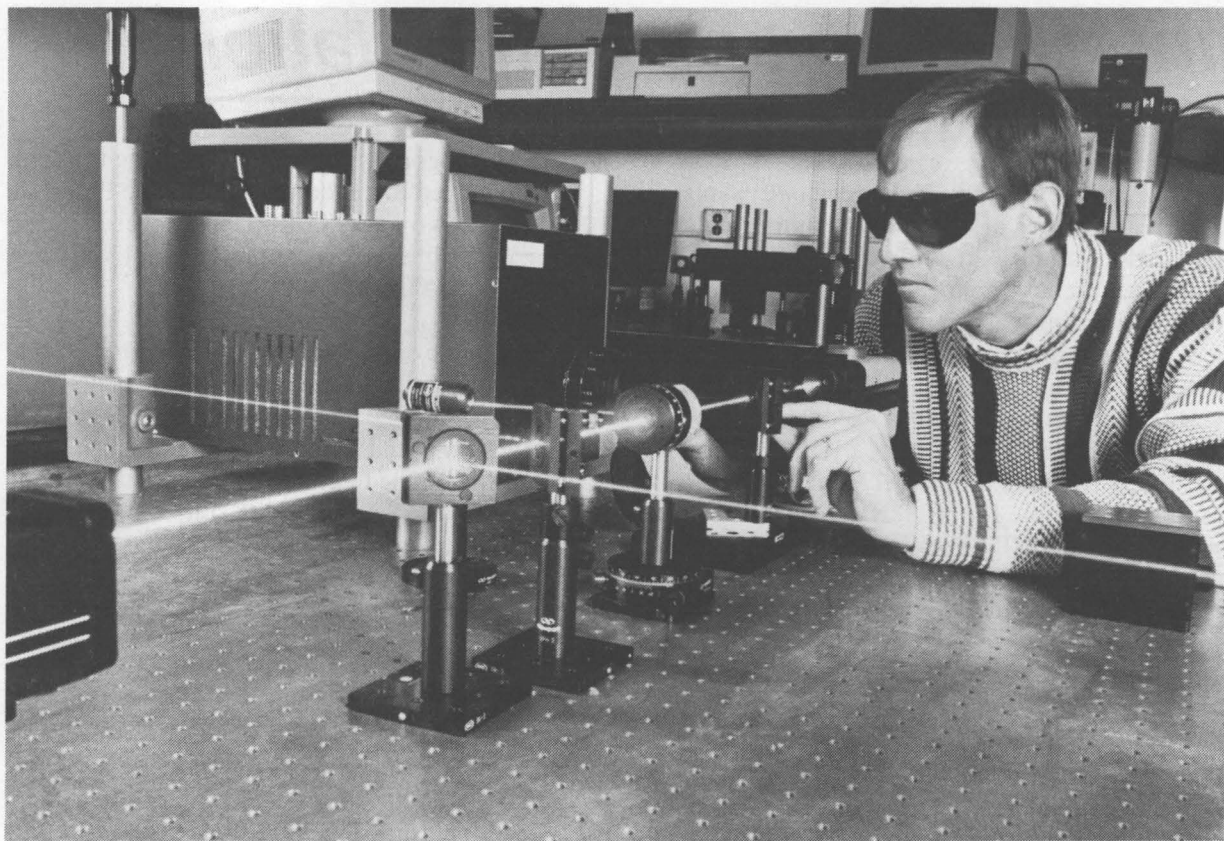
Public Broadcasting System twice during the year, and the RATLER design won the Mitutoyo International Design Engineering Competition award for May 1993. (9200/9600)

Biomedical Electronics

In July 1993, Sandia's first biomedical cooperative research and development agreement (CRADA) was signed with Massachusetts General Hospital's Wellman Laboratory in Boston. It is a four-year, \$13.4 million joint project that will lead to **new ways to treat victims of severe burns**. This CRADA accelerates the development and commercialization of a burn diagnostic and laser debridement (wound-surface cleansing) therapeutic device. Bloodless burn surgery will be possible with far less loss of underlying healthy tissue. The method uses improved sensor-based diagnostic techniques and laser ablation burn debridement, and will result in less blood transfusion and in more successful skin-grafting. Hospital recuperation times and the attendant high health care costs should be reduced. (1200/1300/1500/2100/2600/3300/6600/9100/9900)

Computer analysis of digital mammograms was demonstrated to provide a substantial and statistically significant increase in radiology screening efficiency. A trial on 85 historical mammogram clinical cases at the Scott & White Memorial Research Hospital in Temple, Texas, tested a Sandia-developed computer-aided mammographic screening process for detecting spiculated lesions (which are malignant 95 percent of the time). The computer analysis increased the average radiologist-detection sensitivity by nearly 10 percent, with no increase in false detections. (8100)

Quantitative spectroscopy monitors the amount of light a sample absorbs or reflects as a function of the wavelength of the light in order to quantify the amounts of individual components in the sample. To improve the precision of such measurements, a new procedure for selecting analytical wavelengths for use in **quantitative**



SCOTT HOLSWADE of Firing Set and Mechanical Design Dept. 2674 uses a low-powered helium-neon gas laser to test an infrared camera to be used in the development of a surgical laser system that will help doctors treat patients with severe burns. (Photo by Randy Montoya)

spectroscopy was developed. This procedure involves the use of genetic algorithms, which comprise a family of evolutionary search procedures that are based on the mechanics of natural selection and natural genetics. The new procedure for wavelength selection could have a significant impact on existing applications with regard to cost and performance by eliminating the measurement

of unimportant wavelengths, thus facilitating the use of less complex spectroscopic instrumentation. Furthermore, it is believed that this procedure may help broaden the use of quantitative spectroscopy to more complex and demanding problems such as noninvasively measuring blood glucose levels, and monitoring chemical and industrial processes in situ. (1800/12300)

Environment, Safety, and Health

ES&H Training Dept. 3524, with assistance from the Fire/Electrical & Building Codes Integration Dept. 7734, has designed, developed, and implemented a model program for Electrical Safety Awareness Training. This program was selected by DOE Headquarters as a **model safety**

program to transfer throughout the nuclear weapons complex under the Occupational Safety and Health Worker Protection Pilot (OSHWPP) initiative, and by the DOE Task Group on Electrical Safety (TGES). Under OSHWPP, DOE funded the transfer of the program to AlliedSignal's

Kansas City Division plant. The TGES has published a model program, based on Sandia's program, which is being presented in a series of seminars for all DOE contractors. The key elements in the DOE selection were the Sandia Corporate Electrical Safety Program planning document, and the Sandia Electrical Safety Committee. (3500/7700/7800)



MARY GILLILAND of Nonvolatile Memories Dept. 1341 uses a dry chemical fire extinguisher to put out a flammable liquid fire as instructor Ramon Maldonado (in black) of Firemark watches. Sandia plans and conducts several other types of safety training. An Electrical Safety Awareness Training program developed by the Labs is currently being piloted at selected DOE sites.

During FY93, the cesium separations capabilities of crystalline silico-titanate (CST) materials were improved by an order of magnitude for the highly alkaline salt solutions associated with Hanford **radioactive tank wastes**. Crystalline silico-titanates are now recognized as the best cesium separations technology under development. When these materials are produced as an engineered form suitable for ion-exchange column use, they will be capable of supporting numerous DOE waste treatment needs, including treatment of Hanford tank wastes, support of decontamination and decommissioning activities at various DOE facilities, and possibly as an engineered barrier to eliminate ground water transport of radionuclides within contaminated soils. Activities were initiated during FY93 to identify, select, and start negotiations with a cooperative research and development agreement partner for commercial production of CST materials. (6200/6600)

In 1991, DOE initiated a self-imposed moratorium on off-site shipments of Resource Conservation and Recovery Act (RCRA) wastes and certain Toxic Substance Control Act (TSCA) wastes from Radioactive Material Management Areas (RMMAs). ES&H team members met with DOE headquarters (HQ) review team members to agree on the approach and responses to comments

Information and Computation

The National Information Infrastructure Testbed (NIIT) was formed to accelerate the mainstream application of **distributed computing and network communications** technologies. Sandia was instrumental in pulling together a group of corporations, universities, government agencies, and national laboratories to turn the vision of a national information infrastructure into practical reality through NIIT. Sandia used its Supercomputer Consolidation Project — a 1,100-mile asynchronous transfer mode (ATM) network — as proof-of-principle for NIIT. Sandia's Consolidation Project and NIIT both focus on providing the enabling technologies in networking and distributed computing to solve important national problems. (1900)

A new **mesh-generation software algorithm** called PAVING has been created. It meshes an arbitrary three-dimensional surface geometry with an all-quadrilateral mesh. PAVING allows varying element size on the boundary as well as the interior of a region being modeled. The PAVING algorithm is used to generate mesh for use in the finite element method of analysis. Examples include structural, thermal, and fluid mechanics analyses. For any segment of industry that uses analysis in product design, generating meshes is a difficult and time-consuming task. Mesh generation is a limiting factor for completing rapid analyses in support of design iterations. For example, to generate the mesh for an automobile for a computer simulation of a crash requires six to eight weeks. This is too long to allow engineers the flexibility they need to speed the design process. Use of the

PAVING algorithm will greatly reduce the time now required to generate a mesh. The PAVING algorithm won a 1993 R&D 100 award, and is now available in several commercial software products. (1400)

To improve the **Labs' communications capabilities**, an information architecture was defined, prototypes were demonstrated, and implementation was initiated. An electronic mail prototype demonstrated the feasibility of integrating several internal mail systems with a common directory and connection to external mail systems. The new telephone switch will provide ubiquitous, low-speed communications; a fiber optic ring structure for very high speed communications is in place; and building rewiring for very high speed communications to desktops is under way. Common-look-and-feel guidelines have been developed and proposed as standards, and international standards have been developed and advanced for natural language modeling. The importance of improving Labs business practices was identified, and an approach to accomplishing improvements advanced. An information system to support improved processes was prototyped. (1900/4400/10300)

The Vital Issues Process (VIP) is a novel technique developed and applied by Sandia to incorporate stakeholder input into the **identification and prioritization of issues** of vital importance to a decision-maker (customer). The novelty of the technique is derived from the integration of a qualitative, synthesis-oriented perspective with a quan-

titative, analytically based approach. Successful applications include a prepared response to the Energy Policy Act on behalf of DOE Secretary Hazel O'Leary, strategic planning with the Office of Foreign Intelligence, and developing a foundation for the Environmentally Conscious Manufacturing Institute. The value of the VIP has been recognized through consistently positive customer feedback. (6900)

Sandia began exploring multi-use applications for **image and signal processing** and automatic target recognition (ATR) technologies, continuing in the exploratory development of these key technologies for a variety of ongoing programs for military surveillance and targeting applications. In addition, these techniques were successfully extended to new military applications such as the automatic identification of non-cooperative aircraft in ultra-high-range resolution radar data. The same technologies also were used to help solve several non-military problems. Under the sponsorship of the National Center for Manufacturing Sciences, a neural network target recognition algorithm was modified to identify harmful flux residues on printed circuit boards in an effort to eliminate chlorofluorocarbons from flux-cleaning procedures. Also, a DOE/Laboratory Directed Research and Development biomedical project investigating non-invasive techniques for prosthetic applications was supported by providing 2-D and 3-D image reconstruction and processing for multi-frame ultrasonic data using tools developed for military applications. (2100/6600/9100/12300)

Environment, Safety, and Health

on the Sandia/New Mexico RMMA procedures. HQ approval was transmitted to Sandia/New Mexico from DOE's Kirtland Area Office on May 28, 1993. The Radioactive and Mixed Waste Department has subsequently provided guidance to line organizations in the *ES&H Manual* (Chapter 19D). HQ's acceptance of Sandia/New Mexico's procedures allows for **disposal of non-radioactively contaminated waste** streams through the Hazardous Waste Facility. (7500)

During FY93, Synthetica Technologies' steam reforming process was selected to destroy the organic compounds and reduce volumes in a significant portion of Sandia's **mixed and low-level wastes**. Procurement activities are under way to support startup operations in late FY94. Sandia will be one of the first DOE facilities to perform thermal destruction of organic compounds in mixed wastes. In cooperation with Synthetica Technologies, Sandia also worked during FY93 to develop a steam reforming capability to treat Hanford and Idaho tank wastes, and to support remediation of soils contaminated with organic wastes. (6500/6600/7500)

During FY93, the Environment, Safety, and Facilities Management Division launched a Quarterly Metrics Report to measure performance against selected quality, ES&H, and management goals. The concise reporting and quarterly updates have enabled us to stay current with our **performance and customer issues** in 11 important areas, including injury reduction, management surveillances, our responsible areas under the DOE/Sandia Appraisal, and internal services that we provide. All centers in the division participated in the development and periodic distribution of this report. (7000)

Sandia was cited for an environmental violation having to do with the burial of cadmium-coated, suspect counterfeit bolts. In lieu of a monetary fine, the New Mexico Environment Department (NMED) asked that **Sandia produce a video** targeted to potential public/private industries and organizations that were users of high-

strength bolts. The video was designed to warn users of the potential safety problems associated with the counterfeits and to detail disposal requirements. A team of Sandia and DOE employees wrote and produced the video, which was delivered to NMED and sent to more than 30 industrial associations and institutions. Feedback from local and state governments as well as industrial organizations has been positive. This is an example of how Sandia can share lessons learned with our communities. (4300/7100/7200/12600)

In preparation for the 1993 Albuquerque Operations Office (DOE/AL) Technical Safety Appraisal (TSA), the External Interface Office (EIO) was assigned the task to develop and implement the Sandia **appraisal management process**. The EIO process resulted in many precedent-setting initiatives. Among them: (1) effective teaming was established and maintained between the two main Sandia locations and the Kirtland Area Office (DOE/KAO), (2) a Labs-wide matrix approach for managing the process was developed and used, (3) EIO staff developed and provided training to affected line organizations, DOE/KAO, and executive management, (4) metrics were collected during and after the TSA, which showed that DOE expectations were met and exceeded, and (5) an Appraisal Management Guide was developed. (12600)

The physical inventory and bar coding of all **radioactive and mixed waste** at Sandia/New Mexico was completed. The inventory was necessary to satisfy several audit action plans, to verify the accuracy of existing records, and to provide complete data for Sandia/New Mexico's Resource Conservation and Recovery Act mixed waste permit application and Federal Facility Compliance Act inventory and site treatment plan. Analysis of the results shows that about 80 percent of the waste is low-level radioactive only (no chemical hazards), while most of the balance is mixed radioactive and hazardous waste. This information is being used to help prioritize waste management projects and resource allocations. (7500)

The Motor Pool Services Department was recognized for its **waste minimization** activities through publication in the Fall 1993 edition of DOE's quarterly newsletter for the nuclear weapons complex, *The Pollution Prevention Advisor*. Waste minimization activities have alleviated waste and saved the motor pool thousands of dollars in products purchased and disposal costs. Some waste minimization activities being implemented include: (1) blending used motor oil with diesel fuel for use as heating fuel; (2) crushing used oil filters to reduce waste volume and expel most of the remaining oil for the blending process; (3) reusing oil bottles so oil can be bought in bulk, thereby eliminating disposal of quart containers; (4) recovering and recycling freon to protect the



FRED RAETHER of Motor Pool Services Dept. 7614 connects a blender that takes oil from the crankcase of a DOE tractor, filters it, and mixes it with the tractor's diesel fuel. Recycling the motor oil saves money and avoids the environmental impact of disposing of it as a hazardous waste.

environment; (5) reconditioning antifreeze for recycling in the same or different vehicle; (6) recovering car wash water to reduce biodegradable detergent and water use; (7) leasing solvents through vendors to eliminate new product purchases and disposal; (8) recovering scrap metal for recycling by crushing certain types of empty aerosol cans; (9) leasing and laundering cloth rags to eliminate the use and disposal of paper towels; and (10) requiring vendors to supply vehicle parts, tires, and batteries on a "one for one," "new for old" agreement. (7600)

Following the recommendations of a study team, the Corporate Ergonomics Group (CEG) was formed in October to develop a **comprehensive ergonomics program**. Comprising staff from the Safety Engineering, Industrial Hygiene, Occupational Medicine, and Education departments from both the New Mexico and California sites, the CEG acquired professional training to analyze worksites and to offer consultations. The CEG also evaluated chairs and video display terminal workstations for use at Sandia, developed a comprehensive worksite analysis procedure, and streamlined internal procedures for providing ergonomic products and services to Sandians. An education and training plan was developed to help transition from responsive treatment to prevention of cumulative trauma disorders, and liaisons were built with other national laboratories and DOE headquarters to develop better ergonomics standards. (3300/3500/7700/8500/8600)



MARY GOULD of Medical Dept. 8527, a member of the Corporate Ergonomics Group, looks over one of several ergonomic chairs available for inspection at a "chair fair" at the Coronado Club last year. Sandians were invited to examine and evaluate the chairs of 13 manufacturers.

Laboratories Support

Because of a lack of resources, Sandia's telephone system was not able to provide advanced digital voice and data services to Sandia customers. To meet programmatic requirements, Sandia acquired the existing Air Force 5ESS telephone switch and moved it to a specially constructed telephone switch building. The 5ESS was then expanded and updated to provide **state-of-the-art digital services**. All Sandia customers with the prefix 845 were transferred to the new switch equipment in July 1993, and soon afterward Sandia assumed all operational responsibilities for its telephone service. Sandians now have a host of digital services available, including electronic directory lookup and data transmission using the existing telephone wire network. In addition, Sandia will be able to meet its commitment to DOE to separate secure and open data services. (1900)

Sandia opened the Employee Development Center (EDC), a new corporate service to assist with internal employee movement and **individual career development**. The EDC, chartered by the Sandia Program Council, offers a Labs-wide resource to all employees — all job classifications, all locations — who either find themselves available for reassignment, or need information and/or assistance on resume writing, interviewing skills, and other general career issues. The EDC also helps managers who have "staffing realignment" issues to address, or opportunities for matrixing work to other organizations. The EDC sponsors innovative staffing techniques that communicate both opportunities and employee availability across the Labs. The EDC helps enhance employee agility within the company. (3500)

The Core Competency In-Reach Project (CCIP) was completed in FY93. It was the central part of a three-pronged effort to better understand the **technical competencies** on which Sandia relies to create value for its customers. A team of 18 people — including process facilitators, technical consultants, and data analysts — interacted with another 320 people (almost 10 percent of Sandia's technical staff) from 37 technical directorates. Working together, they identified approximately 4,000 enabling technical capabilities. These were grouped and collected into successively more-encompassing categories, culminating in the proposing of five fundamental technical capability categories (or competencies) for Sandia. This data provided a framework and a rich source of information for the process that led to our current understanding of Sandia's core competencies — its research foundations and its integrated capabilities. (1010/4500)

Excellent teamwork utilizing project management and "fast track" construction methods helped Sandia meet a critical milestone in our commitment to DOE's **National Center for Advanced Manufacturing Technologies** initiative. The Process Development Lab (now renamed the Advanced Manufacturing Processes Lab, AMPL), previously located within the security confines of Tech Area 1, was officially moved outside the area in September 1993. The AMPL is one of the first facilities to be made available for initiative operations in this area. Regular weekly meetings with security representatives and the customer — from inception to final construction acceptance — kept the project on schedule while changing technical requirements were met. The project was completed on schedule and within cost constraints, and met all technical requirements. (7300)

The **property inventory project** conducted mostly during FY93 — actually an 18-month project begun in May 1992 — located approximately



TOM BROWN of Accident Analysis/Consequence Assessment Dept. 6413 (left) talks with Lawrence McCartney of Information Analysis and Simulation Dept. 9421 at an Energy and Environment (E/E) Sector Job Fair. The Job Fair allowed employees and managers to discuss E/E Sector matrixing and job opportunities.

99.5 percent of the total value of property for all Sandia locations. The latest inventory was complicated by the necessity to locate loaned items at more than 180 kindergarten through 12th grade schools, and at many colleges, universities, and contractors. Property coordinators and employees throughout Sandia contributed to the success of this inventory. (7600)

Construction of the **Integrated Materials Research Lab (IMRL)** was completed, and work was begun on the occupancy and landscaping phases. Sandians will begin moving in October 1994. The facility will house an integration of basic research in new electronic structural materials such as semiconductors, superconductors, ceramics, amorphous metals, and dielectric materials, as well as applied research in new devices, components, and systems, including microsensors, optical components, and optical electronics. IMRL is a four-story office and light-laboratory building with full basement, visitors' entrance, roof-top penthouse mechanical room, and first floor chemical storage facility. The building contains 105,000 net square feet (space to be occupied by offices, labs, etc.). The building was designed to meet stringent vibration requirements for some lab equipment. Major features include improved energy conservation, handicap access throughout the building, vibration-sensitive structure, chemical storage facility, liquid nitrogen system, deionized water system, high purity nitrogen system, laser labs, fiber optic local area computer network, and lab exhaust systems. (7300/7900)

A site-wide **electronic mail system** (cc:Mail) that supports the exchange of documents, files, and graphics reached "critical mass" at Sandia/California during FY93, and, according to feedback from customers, is increasing the site's effectiveness. More than 800 people are on-line in California, and other Sandians receive "paper mail" generated by the system. The Information Systems and Services Department was the lead organization in making the change, but the Networking and Communications Department and

representatives from each center played important roles. More than 56 people were involved. cc:Mail is a major facet of Sandia/California's electronic information services architecture that will provide services to individuals, work groups, and service functions. (1900/8500)

The Facilities Development Center has seen a continued increase in customer-funded projects valued at less than \$10,000. In FY93, the Facilities Express Department completed 1,400 **service orders** valued at \$5 million, an increase of 35 percent over FY92. The average completion of orders in 48 days translates to a 38-percent faster response time. Our commitment to manage customer requirements through process quality management improvement has provided the foundation for this success. (7900)

In severing its operational ties to AT&T, Sandia was required to transfer responsibility for administration of its 401(k) **savings plan program** to a new contractor. At the same time, new features making the plan more responsive to employee needs and desires were identified and prioritized. Extensive effort went into defining a suitable program, soliciting work proposals from potential contractors, analyzing the proposals, negotiating and placing an agreement, coordinating the transmission of data from American Transtech to Fidelity (the company selected as the new contractor), and communicating the results to employees. All data and funds were transferred intact and on schedule, and operational procedures were developed to deal with transaction anomalies. (3500/10200/10300/10500)

Through a team effort coordinated by the Corporate Policy Department — including members of the Corporate Policy staff, primary responsible organizations, process owners, stakeholders, and the Sandia Labs Policy Board — 35 new and revised Sandia Labs Policy (SLP) documents were approved for issuance, 20 policy issues were addressed and resolved, 17 Operating Instructions (OI) were issued, 15 SLPs and OIs were canceled, and the first phase

Technology Transfer

With the cooperation of Los Alamos, Lawrence Livermore, and Oak Ridge national labs; AlliedSignal/Kansas City; and the National Institute of Standards and Technology, Sandia opened a DOE/Defense Programs-sponsored Machine Tool Access Center (MTAC). The center will provide short-term **technical assistance to the US machine tool industry**. This nationwide outreach program, called the National Machine Tool Partnership, is a result of industry surveys and strategic planning by a Sandia-chaired investigating team. With the help of technical organizations throughout Sandia, the center responded to approximately 120 requests for assistance by the end of FY93. The program is expected to grow in magnitude and scope to include education, training, long-term projects, standards, and industry infrastructure development components. (2400)

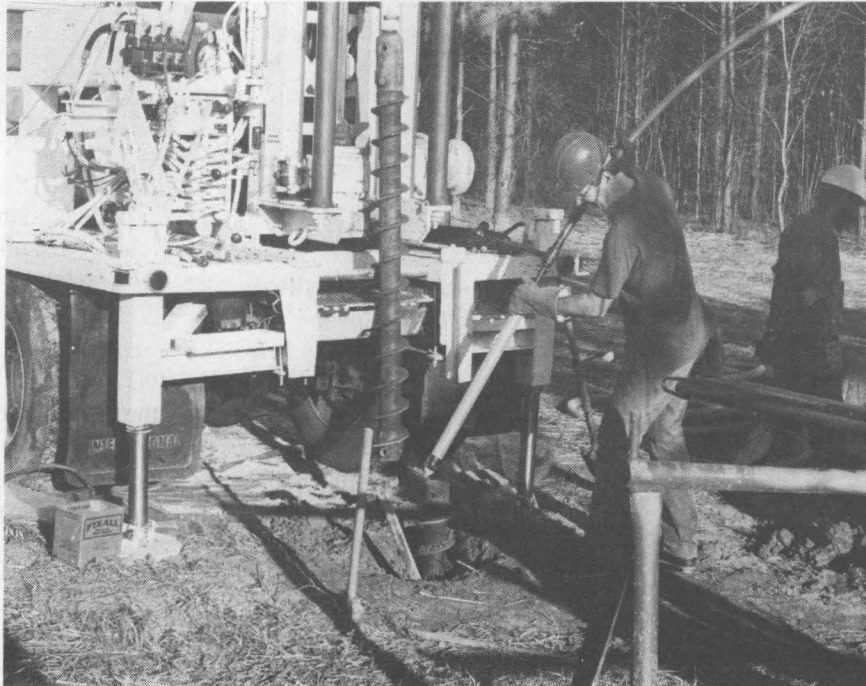
Sandia and the A. C. Rochester Division of General Motors (GM/ACR) agreed to a three-year cooperative research and development agreement (CRADA) to develop **automotive electronics** for under-hood applications. General Motors will require highly reliable, high-temperature electronics to meet future automotive emission standards. Sandia will identify, analyze, and test the high-temperature characteristics of various technologies used in manufacturing hybrid microcircuits. A series of thermal analyses already completed researched the effects of die-attach materials and thickness, alumina substrate purity, thermal boundary conditions, and wire-bond sizes on the temperature rise of a single die. Also, a reliability assessment was made of GM/ACR's three integrated circuit (IC) suppliers. This assessment identified potential IC failure mechanisms and recommended

ways to improve product reliability. Environmental testing (thermal, mechanical, and chemical) has begun on the die-attach materials. (1500/2200/2400)

Two cooperative research and development agreements (CRADAs) have been signed with US industry to develop new technology for advanced lithium ion and sodium sulfur **rechargeable batteries**. A CRADA with the US Advanced Battery Consortium (USABC) was signed in December 1992. A second CRADA — with the Battery Technology Initiative (BTI) — was signed in August 1993. The USABC (GM, Ford, Chrysler, and Electric Power Research Institute) has targeted batteries

for electric vehicles, whereas the BTI (Eveready, Rayovac, Wilson Greatbatch, Ltd., and AT&T) has focused on batteries for consumer applications. The value of the CRADAs over their three-year lives is nearly \$20 million. (2200/8700)

In July 1993, SunSolutions — an independent business unit of Sun Microsystems — and Sandia agreed to a non-exclusive license for Sandia software named CLERVER. (CLERVER combines the two words "clients" and "servers.") CLERVER multiplexes any X-Windows-based software application (a client) to any number of servers. The software
(Continued at bottom of page sixteen)



SANDIA REACHED a license agreement with a Fort Worth, Texas, company that will give the company the right to commercialize the In Situ Permeable Flow Sensor. During testing, Sandy Ballard of Geophysics Dept. 6116 inserts the sensor into the ground at a test site at the Savannah River Plant in South Carolina (item on page 16).

Laboratories Support

of a new Information Management Manual was published. Also, as a part of the Corporate Policy Department's Forms Design and Management responsibilities, a **major review of corporate forms** was conducted with the line organizations, which resulted in deletion of approximately 3,000 forms from the active corporate file. (10600)

Sandia's Invoice Status Line is an innovative messaging system that provides Sandia suppliers direct access to information in the Integrated Procurement System (IPS/R) by interfacing between the Laboratories Information System machine and a telephone. The system enables suppliers to obtain **invoice status information** via a touch-tone telephone. More than 95 percent of these types of calls are answered by the automated system without the caller speaking with a Payment Processing Team member. The system is operational from 6 a.m. to 6 p.m. weekdays, and 8 a.m. to noon on Saturdays. Status Line was implemented in June 1993, and is answering approximately 1,600 calls per month. (10300/10500)

The Sandia Voice Information System (SVIS) provides complete **voicemail services** for Sandia/New Mexico customers. SVIS gives Sandians the ability to bid on posted jobs, enroll in benefits programs, and access purchase and material requisition information via their telephones. Sandia vendors can also use the system to check on the status of their invoices (see previous accomplishment). The system provides reliable service to thousands of callers monthly. (3500/7400/10200/10300/10500)

The Help Desk for Laboratory Information Systems was expanded to improve service for customers of Sandia's central-site administrative computing systems. A single point of contact was established for assistance with any **administrative information system**, including Human Resources, ES&H Training, Property, Financial, Procurement, Just-In-Time, Locator, Office Vision, Purchasing, Sandia Phone Book, Reimbursement and Vouchering, Service Centers, and the Technical Library. Customers can now call one phone number to obtain access information, and get help with the diagnosis and resolution of technical problems. Eighty percent of customer queries are satisfied with the initial phone call. (10300)

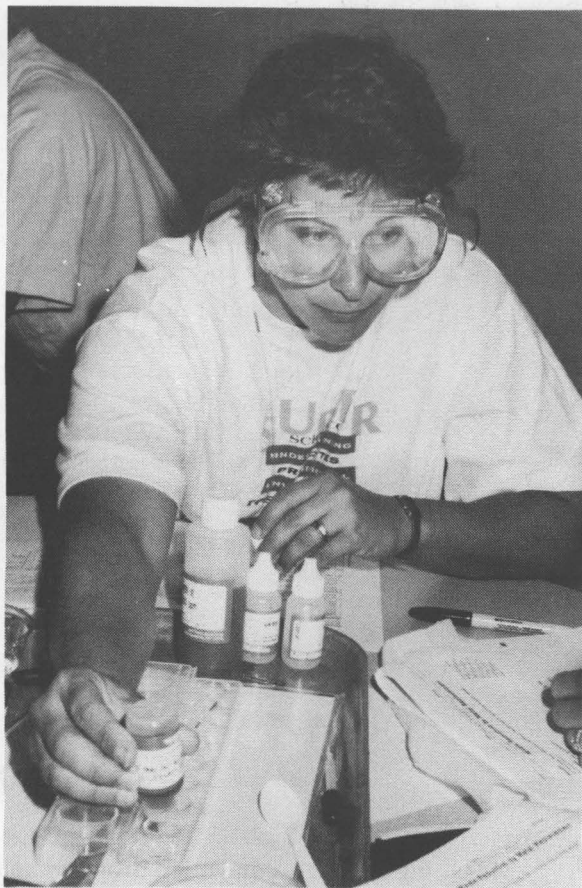
Several organizations within the Chief Financial Officer Division completed development of a new **Financial Information System (FIS)** for the Labs. FIS is an integrated accounting, budget, and reporting system that also includes reimbursable accounting, corporate chart-of-accounts, and funds tracking. The new FIS will improve the quality and timeliness of financial data at Sandia. Representatives from divisions and sectors provided input on the new reporting functions. These features include an expanded case number and new reporting tools that allow users to view or print reports, query on-line, or download data. The Corporate Education and Training Department participated in a concurrent training effort focused on producing job aids and reference manuals that assist employees in understanding how to obtain financial reports and data. (10300/10500)

Managing Sandia's controlled property and materials will be much easier in the future, thanks to the **Enhanced Property Management System** designed and implemented by the Application Support and Enhancements Department. This new system offers many new features for line organizations, including on-line query capability, the ability to update property ownership and location information on-line, and electronic transfer of property to other organizations and to Reapplication. Working closely with the Property Management Systems, Property Management (California site), and Capital Accounting Services departments, the design team was able to deliver a completely redesigned system in less than seven months. Much of the reason for the success of this effort is attributable to the willingness of the Property Management and Accounting organizations to redesign their business practices in response to customer requirements for more accurate and timely information. (7600/8500/10300/10500)

Audit Center 12800 successfully completed the most aggressive audit plan in Sandia's history by eliminating more than \$400 million worth of subcontract audit backlog and completing a **review of all internal audit requirements**. The plan fulfilled requirements by senior management and the Audit Committee to minimize risk to DOE, AT&T, Martin Marietta, and Sandia. It used risk analysis that allowed for a more focused audit effort. Resources from AT&T and contracted services were integrated into Sandia resources, the first successful integration of contracted audit resources. (12800)

Education Outreach

The University of Turabo dedicated its new Sandia National Laboratories Engineering Building in March 1993, in ceremonies featuring former Executive Vice President Lee Bray, and Energy and Environment VP Dan Hartley as speakers. Sandians have served as engineering deans — John Otts 1989-90, Bill Dawes 1990-92, Steve Casalnuovo 1992-present — since the beginning of the **Puerto Rico school's engineering program**. The first students began classes in August 1990, and the program now has more than 300 students. With new DOE support, two new teacher summer workshops — one at Sandia/California and one at Sandia/New Mexico — and a High School Science Honors Pro-



TRACY, Calif., middle school teacher Kathleen Turner investigates ways to remove metal contamination from a solution during the 1993 SUPER! Summer Institute at Sandia/California.

gram also were initiated during FY93. One student from each state and 10 foreign students attended the three-week science honors program, which ended with an environmental restoration contest. (3020)

The long-awaited Sandia report on the **status of education in America** was published in June 1993, following a lengthy peer review. The report dispels myths and identifies urgent challenges facing the nation's education system. *Perspectives on Education in America* has already had an impact on the future of education in America. Education leaders are using the study, now in its third printing, to help fashion an improved education system. The preeminent education publication in the country, *Phi Delta Kappan*, said, "This new view allows the critics and the proponents to join forces and to focus on the all-too-real problems that plague many school systems. If we manage that task successfully, [these Sandians] will rate prominent mention in the history of education in the 20th century." (4100)

During FY93, Sandia/California's traveling Science/Math Carnival visited 80 elementary schools, reaching 35,000 students and 1,100 teachers. Using up to 14 hands-on exhibits, the carnival presents **basic science concepts to children** in an exciting way that makes them want to learn and that encourages teachers to teach more science. The carnivals were staffed by 160 Sandians and contractors representing 52 Sandia organizations, providing role models for children representing a broad range of cultural and ethnic backgrounds. A new training program for volunteers, consisting of videotaped demonstrations of each exhibit, scripts, and suggestions for adapting demonstrations to



SEVERAL SANDIANS were on hand in Puerto Rico when the University of Turabo dedicated its new Sandia National Laboratories Engineering Building in March 1993. Sandians have served as engineering deans since the beginning of the school's engineering program in August 1990.

various grade levels, was begun to ensure that the presentations are accurate and age-appropriate. Funds for carnival equipment came from Education Outreach funding provided by DOE. (8500)

Focusing on environmental research done at Sandia, 45 teachers and school administrators explored the science behind selected environmental issues during the **summer teachers' institute**, Science Understanding Promotes Environmental Responsibility (SUPER!). This four-week workshop showed middle school teachers how to present science in a way that is immediately relevant to students' lives and to society. Joining Sandia/California's technical expertise with the teaching expertise of the Lawrence Hall of Science and the environmental expertise of the California Environmental Protection Agency, SUPER! was top-rated among the 15 institutes funded through the 1993 Federal Coordinating Council Science, Engineering, and Technology Summer Teacher Enhancement Initiative. (8100/8200/8500/ 8600/ 8700)

Technology Transfer

(Continued from page fifteen)

ware allows computer drawings, documents, or the control of computer execution programs to be shared on an interactive basis. Sun plans to release CLERVER as SharedAp. It will be part of a larger desktop conference product called ShowMe. Various sources estimate the market value for such **interactive, collaborative software** products to be in the billions of dollars. There are potential applications in computer-aided design, education, technical training, disaster response, and in other areas that require remote problem solving. (2800)

From October 1992 through September 1993, Sandia obtained approval for 64 **cooperative research and development agreements** (CRADAs) with a total value of almost \$309 million. At the end of FY93, 57 additional CRADAs were either awaiting approval by the DOE Albuquerque Operations Office, or were in various stages of negotiation with prospective partners. Continually updated information about all CRADA projects is provided by the Technology Transfer Center through its Quarterly CRADA

Report, which includes summary descriptions of projects, funding profiles, and quarterly progress reports from principal investigators. Fourteen commercial licenses and 233 non-commercial licensing agreements were completed. Through the Small-Business Program, 70 technical assistance projects were completed. (4200)

Minimum feature sizes on advanced integrated circuits continue to shrink with each new generation of microelectronic devices. Lithography, or pattern transfer, is the critical technology necessary for achieving higher density chips, and today accounts for fully one-third of the total processing costs. Sandia is **developing an advanced lithography** known as Extreme Ultraviolet Lithography (EUVL), which uses radiation at 134 angstroms, and all reflective imaging systems to achieve minimum line widths of 0.1 microns and below. During the past year, the EUVL team has developed a second-generation imaging system with a hundred-fold increase in print area, which will allow the placement of more features on a single chip. This has involved novel target development, optics modeling and fabrica-

tion, and precision hardware design by a diverse team of scientists and engineers in collaboration with AT&T Bell Laboratories. This program is supported by the Technology Transfer Initiative and the Advanced Research Projects Agency. (1200/1400/1800/2200/2300/2600/6500/8300/ 8400/8700/9200)

Sandia has concluded a license agreement with SIE, Inc. (a division of Computalog USA, Inc.) of Fort Worth, Texas, under which SIE acquires the right to commercialize the In Situ Permeable Flow Sensor. The sensor is a Sandia-developed, Office of Technology Development-funded technology for **measuring ground-water flow velocity**. Ground-water flow is perhaps the most important mechanism for the dispersal of many types of toxic wastes, once they have been released into the subsurface. Accurate information about the ground-water flow field, therefore, is critical to the characterization of waste sites, monitoring of waste remediation activities, and monitoring the post-closure performance of remediated waste sites. (6100)