

Intense hopes: Ten companies team to commercialize Sandia's powder-to-parts net shaping technology

Computer-controlled lasers can create complex custom parts or molds from metallic powder in a day

By Neal Singer

Commercialization of a possibly pivotal manufacturing technology — computer-controlled lasers that, in hours, weld air-blown streams of metallic powders into custom parts and manufacturing molds — is the goal of 10 companies teaming with Sandia in a new cooperative research and development agreement (CRADA) funded for \$3 million over the next two years.

The technology is called LENS, for Laser Engineered Net Shaping. When perfected, it should provide the companies involved in the CRADA a lead of several weeks in bringing to market

new products ranging from toys to tools, as well as the capability to quickly vary the shapes and materials of products as market conditions shift.

The LENS CRADA start-up meeting was held at Sandia/New Mexico Nov. 20-21. Industry will contribute \$1.2 million and \$304,000 in in-kind services; DOE's Technology Partnership Program, \$1.0 million; and Sandia's Laboratory Directed Research and Development program, which funds speculative defense-related

(Continued on page 5)

When perfected, the LENS technique should give companies a lead of several weeks in bringing to market new products ranging from toys to tools.



LASER SHAPING — Researcher Lane Harwell (1484) makes an 11-inch-high mini-skyscraper of the T-bird emblem using Sandia's Laser Engineered Net Shaping technique. Ten companies are teaming with Sandia in a two-year, \$3 million cooperative research and development agreement to commercialize the technology.

(Photo by Randy Montoya)

Stockpile stewardship support is bipartisan now, Domenici says, but budget battles will continue

By Larry Perrine

US Senator Pete Domenici is pleased that support for DOE's stockpile management/stewardship program appears to be growing and becoming increasingly bipartisan, but he also believes it will be a continuing battle in Congress and with future presidents to maintain the necessary financial support.

That was part of his colloquium message to Sandians Nov. 21 when he delivered his first major talk to a Labs-wide audience in more than two years. The Republican senator from New Mexico spoke to a full house in the main auditorium of the new Center for National Security and Arms Control (CNSAC), and his talk was telecast live to more Sandians in the Technology Transfer Center, to internal network monitors, and to Sandia/California.

Domenici a central figure in debate

Sandia, Los Alamos, and Lawrence Livermore national labs are involved in many stockpile management and stewardship programs designed to ensure the continuing safety and reliability of nuclear weapons in the face of a US moratorium on full-scale nuclear weapons tests. President Clinton announced his support of the moratorium in 1993 and reaffirmed it in 1995. Full-scale tests would actually be banned under the proposed Comprehensive Test Ban Treaty (CTBT) that will be deliberated in Congress soon. Senator Domenici will be a central figure in those deliberations.

As chairman of the Budget Committee and member of the Appropriations Committee, Domenici has led the battle to increase DOE's Defense Programs budget to \$4.5 billion to fund stockpile management/stewardship programs.

(Continued on page 6)

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Labs developing means to sniff out mines chemically and electronically

Menace of land mines almost an insurmountable problem

By Chris Miller

Sandia has joined the effort to rid the world of what Ron Woodfin (2522) describes as "the worst form of pollution mankind has ever come up with" — land mines.

Ron oversees much of Sandia's exploratory work in land-mine detection and demining, which ranges from chemical sensing to laying down a quick-hardening foam to clear a path for military vehicles. Sandia also is developing robotic vehicles and backscattered X-ray technologies that can be used to support the demining effort.

The Sandia team focuses its efforts on three types, or levels, of demining activities.

The first is standard military demining used for clearing a path for soldiers and vehicles during war. Speed counts, and some casualties are expected.

The second level, also connected with military

operations, deals with an army's need to clear greater numbers of mines in an occupied country. This is similar to the case of the United Nations' occupying forces in Bosnia-Herzegovina.

The third level is humanitarian demining and involves trying to remove all mines and restoring an area to productive use.

'No silver bullet'

Ron, who has represented Sandia at several international conferences on demining, says the general consensus is that there is no "silver bullet," or one technology that can unfailingly detect all types of mines under all types of conditions.

Current state-of-the-art demining technologies are mostly various forms of anomaly detectors — they detect things not expected in their environments. The detectors use passive infrared, microwave, electrical conductivity, and ground-

(Continued on page 4)



3 Supercritical water oxidation system to help destroy obsolete munitions

8 Older than Sandia, military liaison group celebrates its 50th birthday

This & That

Sandians saving more than \$1 million a week - New employee contributions and the "company match" amount going into Sandia's Savings Plans now total more than \$1 million a week, says Rebecca Spires (10310). The biweekly amount sent to Fidelity on Nov. 13 was exactly \$2,105,793.18; over a year, that would amount to almost \$55 million.

As of Nov. 21, the Sandia Savings Plans contained a total balance of almost \$1.2 billion. The five biggest funds were (in millions of dollars, rounded to nearest million): Contrafund, \$241; Interest Income, \$236; Growth & Income, \$214; US Equity Index Pool, \$143; and Balanced Fund, \$84. The AT&T Shares Fund still contained nearly \$76 million on Nov. 21. (Remember to move your Savings Plan money in the AT&T, Lucent, and NCR shares funds into other funds before the 6/1/98 deadline.)

Special note to retirees - Our apologies and our thanks go to several retirees and surviving spouses for their patience as we worked out a few kinks in our mailing list. A problem occurred as Sandia was switching over to a new Labs-wide software that keeps all kinds of records. We think the problem is fixed now, but a "bug" crawled into the process for several weeks and wouldn't let us update any retiree mailing addresses. If any of you missed an issue or two, please call Nancy Campanozzi at 505-844-7522 and tell her which issues you didn't get. She'll send them as long as our limited supply lasts.

Get that sticker off my banana! - I'm all for good old capitalism, but several recent incidents make me think some firms are going too far.

Lab News senior editor John German, married for two years now, says his wife Michelle called recently to cancel an old credit card that was still in her maiden name. The credit card rep tried to discourage Michelle from canceling, saying she should keep in mind the high divorce rate these days. Going too far? I think so.

The real "topper" though, is the little round stickers I found on some bananas I had just put in a shopping cart. They asked, "Got milk?" What's next - an ad for toilet paper on the prunes?

Handy bookmark - If you frequently need to find phone numbers, e-mail addresses, and more for employees of the Department of Energy and its many facilities (including all national labs), bookmark this handy Web site: <http://www.doe.gov/html/doe/people/doephone.html>.

Smell checker? - An alleged "friend" told me last week it was obvious I didn't use my computer smell checker on my last column. I should have seen a cheap shot coming, but instead took the bait and replied, "You mean spell checker, I assume." "No, I mean *smell* checker," he said. "Your last column stunk!" Rodney Dangerfield gets more respect.

- Larry Perrine (845-8511, MS 0167, lgperri@sandia.gov)

Realignment Board identifies 35 new impacted positions

Sandia's Realignment Board met Nov. 17 to review staffing plans for FY98 and identified 35 "impacted" positions that are to be eliminated during the next few months.

As a result, 52 employees have been notified that they are members of "impacted peer groups," or that their positions are being eliminated, and they are being encouraged to seek other work within the Labs.

Don Blanton, Director of Human Resources Customer Service Center 3500, says the goal this year, as in the past two years, is to find resolutions for all impacted positions so that no involuntary separations, or layoffs, are necessary.

"Even though there are a relatively small number of impacted positions, we will still need a concentrated effort and teamwork across the Laboratories to ensure successful resolution," he says.

Staffing plans used to identify impacts

During FY96 and FY97, almost 800 positions were eliminated without involuntary separations via Sandia's Workforce Realignment Process, a formal three-step process for moving people into functions that more directly contribute to Sandia's mission. (For a review of the process, see <http://www.hris.sandia.gov/realign/home.html> on Sandia's Internal Web.)

Several hundred people left the Labs voluntarily during those two realignment cycles with the help of a Voluntary Separation Incentive Program (VSIP) package. No VSIP package will be available this year.

The 35 impacted positions this year were identified through careful scrutiny of staffing plans that detail each division's current and anticipated work requirements and how many and what types of people will be needed to accomplish that work.

Cross section of employees affected

The impacted positions span seven divisions and affect managers, technical staff, laboratory staff, technologists, Administrative Staff Associates (ASAs), and Metal Trades Council (MTC) and Office and Professional Employees International Union (OPEIU) employees, says Realignment Process Manager Becky Statler (3500).

Of the 35 impacted positions, 13 are occupied by union-represented employees; those employees were given surplus notices Sept. 29. As a result, some seniority-related "bumping" may occur within the union-represented ranks during the next few months, Becky says.

The 60-day Voluntary Action Period of the realignment process began Dec. 1 for nonrepresented employees who are members of impacted peer groups. They have been notified of their status by their managers.

The *Lab News* will continue to cover realignment-related developments as they occur.

-John German

Feedback

No special case number for religious holidays

Q: Is there a case number to which religious observances may be charged?

A: Currently, Sandia does not have an A-order available to charge time off for time away from work for religious activities. Our prime contract does not address this issue specifically but does allow paid time off in the form of vacation and flex time. Lockheed Martin has a corporate policy state-

ment that does address this and allows employees to take time off from work to attend religious activities but instructs them to charge this time to vacation or compensatory/flex time. Past practice at Sandia has been to instruct employees to charge time away from work for religious activities to vacation or flex time and will continue as such. In light of the amount of vacation days, compressed work weeks, and flex time, the need for additional paid time off for religious activities is not warranted and would not be manageable.

-Machelle Karler (15103)

Q: When is the Labs going to make some provision for visitors to properly turn in temporary badges when making a final exit from the tech area through the automated gates? Does this present a good picture for a "highly secure" facility when we cannot afford guards at the gates and now cannot afford drop boxes for visitor badges?

A: We recognize that we need drop boxes. The Sandia machine shop is currently designing them. We hope to place them at the automated gates in the future. We are also beginning a process where visitors are given postage-paid addressed envelopes and instructions to mail badges if they are unable to leave them in a drop box or with a Security Police Officer.

-Frank Gallegos (7400)

Q: When will the next family day be held for spouses and family members to visit Sandia?

A: There will be a 50th anniversary celebration that will include families. It is being planned now.

-Don Carson (12600)

External Web page owners: Update bad links to webmaster

Links on many Sandia external Web pages for contacting the webmaster are incorrect and do not work. This is particularly true on many old external Web pages that have not been updated for several months.

If you have an external Web page that includes a link to the webmaster with the address of webmaster@www.sandia.gov, please update it immediately. The correct address is webmaster@sandia.gov (without the www). Until you take this action, messages to the webmaster will not get through, and Sandia customers and potential customers will be frustrated.

Some pages also have similar incorrect links from such names as "Send comments, suggestions, questions." In no case will the webmaster@www.sandia.gov address work. It must be changed to webmaster@sandia.gov.

If you have questions, contact Larry Perrine (12640) at 845-8511 or lgperri@sandia.gov.

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Ken Frazier, Editor505/844-6210

Barry Schrader, California site contact510/294-2447

Lab News fax505/844-0645

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LOCKHEED MARTIN

Sandia method to destroy old munitions is scaled up for pilot plant at Army's Pine Bluff Arsenal

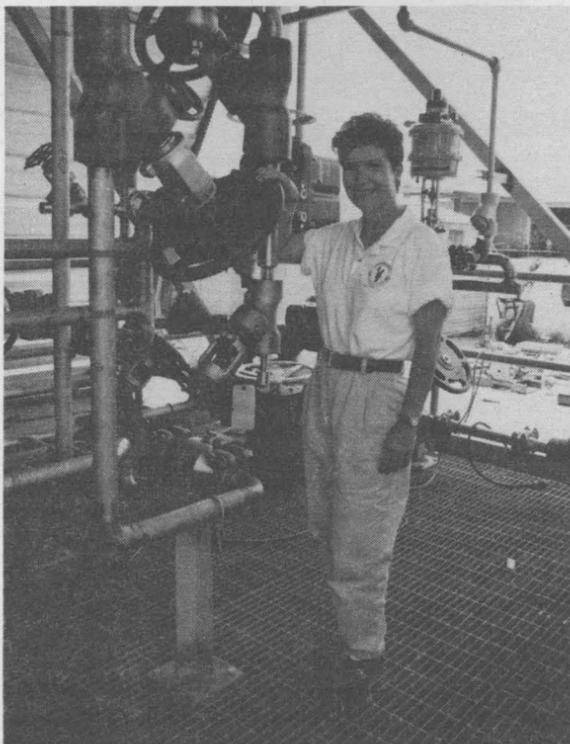
Supercritical water oxidation will be used for demilitarization

By Nancy Garcia

Technologies developed in the laboratory to destroy wastes without hazardous emissions are being applied in a pilot-scale plant under construction at the Army's Pine Bluff Arsenal in Arkansas.

There, up to 80 pounds per hour of obsolete munitions, slurred in water, will be destroyed in a supercritical water oxidation (SCWO) system. The SCWO system pressurizes and heats the slurry, which fuels an oxidation reaction. The wastes are destroyed within seconds, producing such innocuous end products as carbon dioxide, water, and salts.

The Army is responsible for demilitarization of obsolete munitions from all services. Open burn/open detonation is the mainstay operation,



ON-SITE OVERSIGHT— Sandia's M.C. Stoddard (8119), the project manager, displays equipment at McAbee Construction in Tuskaloosa, Ala., where the skids were built for the pilot plant demilitarization system.

favored due to its low cost, simplicity, and effectiveness. However, some munitions, such as colored smokes and dyes, are sufficiently hazardous that they have been barred from disposal by this method.

Incineration, also widely used, has proven challenging for the smokes and dyes due to their high emissions of soot, ash, and corrosive gases. These smoke and dye munitions, some of which date from World War II, are therefore ideal candidates for SCWO.

At the heart of the new system is a novel reactor design intended to overcome a potential complication. Treating smoke and dye munitions can create effluent of up to 35 percent salt. The salt is insoluble under these conditions (700°C and 4,000 psi) and can plug the reactor.

Sandia demonstrated a design that inhibits salt deposits by injecting pure water through small pores in an inner liner to form a protective boundary.

Known as the transpiring wall reactor, this design was developed by Aerojet GenCorp for cooling and fluid management in missile and rocket applications. Brent Haroldsen (8118) led design testing in Sandia's Engineering Evaluation SCWO Reactor, which has the only transpiring wall reactor in operation. Brent was supported by Bert Brown (also 8118). Bernice Mills (8713) provided surface chemistry expertise for diagnostics consultation and data interpretation.

Delivered last month

Sandia's laboratory reactor testing focused on developing operating parameters and evaluating design issues for the transpiring wall concept and led to the reactor design for the Pine Bluff Arsenal pilot plant. Destruction kinetics of the Army materials were developed in Steve Rice's (8361) Super-

critical Flow Reactor, and the conceptual design for the plant was developed by Tony Lajeunesse (8118). Results from Sandia's laboratory reactors were critical in the Army's decision to commit this technology to a pilot plant.

Last month, construction reached a milestone when the SCWO system was delivered on skids to the arsenal.

"The leverage achieved from our numerous SCWO sponsors has been exceptional," says M.C. Stoddard (8119), project manager of the Pine Bluff Arsenal pilot plant.

The laboratory work providing the foundation for this plant was funded by the Army and the DOE-DP/DoD Office of Munitions Memorandum of Understanding.

In addition, significant benefit has been realized from complementary work sponsored by other federal agencies. The DOE Office of Technology Development (EM-50) cosponsored Sandia's procurement of the first transpiring wall reactor and its testing. The Office of Naval Research/Defense Advanced Research Projects Agency sponsored validation testing of the feed injector, a key feature of the transpiring wall reactor. Steve's chemical kinetics studies, funded by the Strategic Environmental Research and Development Program, determined the auxiliary fuel selected to initiate the waste destruction reaction.

The plant is being built by Foster Wheeler Development Corp. of Livingston, N.J., under contract to Sandia. Dennis Arizumi (8118), who led the design and construction of Sandia's Engineering Evaluation Reactor, provides the technical interface between Foster Wheeler and Pine Bluff Arsenal. M.C. provides technical, contract, and programmatic direction to both Foster Wheeler and the Army sponsor, the US Army Armament Research, Development, and Engineering Center (ARDEC) in Picatinny Arsenal, N. J., and the Demilitarization Technology Office at Savanna Army Depot, Ill.

Pine Bluff Arsenal was selected as the site for the SCWO plant because it is both an existing demilitarization site and the center of government expertise in colored smokes and dyes, having originally produced many of these materials.

Pine Bluff Arsenal is currently a production, storage, and demilitarization facility for conventional munitions — operating several incinerators. The arsenal also manages storage and destruction of the second-largest chemical agent stockpile in the United States.

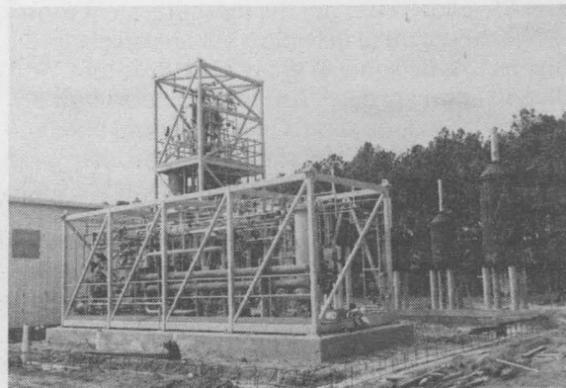
Expecting the unexpected

Under ARDEC, Pine Bluff Arsenal is responsible for preparing the site and supporting facility design and installation. Site preparation includes developing a waste handling and feed system as a front end for the SCWO unit. Pine Bluff Arsenal will participate in the demonstration and validation testing along with Sandia and Foster Wheeler. Once testing is complete, the SCWO unit will be transitioned to normal operations for destruction of the smoke and dye inventory. The Army also plans to use the plant as a test bed to evaluate treating other military wastes. This project is a showcase for alternative technology development there.

The Pine Bluff Arsenal pilot plant is a team effort requiring close communication and coordination among the key participants: Sandia, ARDEC, Pine Bluff Arsenal, Foster Wheeler, and Koch Process Industries.

"Especially as we transition into field installation and testing, each participant owns important task elements that are interconnected with everyone else's," says M.C. "It's a dynamic time for the project — the most exciting time for engineers, who are energized as hardware finally comes

"The leverage achieved from our numerous SCWO sponsors has been exceptional."



DELIVERANCE — The Supercritical Water Oxidation system was delivered on skids to Pine Bluff Arsenal in Arkansas in October. Testing at the Army pilot plant is scheduled to start in March 1998.

Sandia California News

together and start-up draws near."

"We expect the unexpected in starting up a pilot unit like this," says Dennis. "Our computer control system will allow remote access to plant operational data, so hopefully we won't need to rent an apartment in Pine Bluff," he adds.

Recently, the construction site at Pine Bluff was toured by about 150 attendees from the 6th Annual Demil User's Meeting. The meeting is an international forum for people responsible for implementing demilitarization of obsolete munitions.

This work was initiated at Sandia in FY92 as a simple feasibility study involving only a few laboratory tests. The early work was developed under the direction of Sheridan Johnston (4527), Jack Swearengen (former Sandian), and Ken Tschritter (8118). From there it grew to a SCWO plant that will be used to dispose the DoD's smoke and dye inventory. Testing is scheduled to begin in March 1998.

"This project is a fine example of unique Sandia contributions in all aspects of research to development to application," says Howard Hirano, Manager of Technology Applications Dept. 8119.

LEAP leaps past goal

The Livermore Employees Assistance Program (LEAP) has set an all-time high in donations with \$190,000 pledged this year, easily surpassing the \$175,000 goal.

Some 71 percent of the California site's employees participated, with an average gift of \$276. The first-time Leadership campaign among management at the site raised \$64,000 of the total, with a 93 percent participation rate.

The giving was up from last year in two respects. Last year 63 percent pledged, and the total given was \$150,000.

Employees selected some 96 different charitable agencies for their donations this year, 28 of those picked by the LEAP committee, plus the United Way and Combined Health organizations.

LEAP chair Brian Maxwell (8940) had effusive praise for all the contributors and LEAP team. "To me it shows how caring and involved Sandians are in outreach to their communities. The core committee and Center reps worked very hard to make this happen. It was a wonderful experience!"

Members of the core committee included vice chair Gary Shamber (8511), Geri Carson (8821), Ed Hathaway (8609), Ken Nunez (8822), and Barbara Troen (8802). They were assisted this year by the Tri-Valley Community Fund staff for the first time.

Land mines

(Continued from page 1)

penetrating radar, but they so far have been very expensive and low in accuracy and have high false-alarm rates.

Metal detectors are the most prevalent form of electronic mine detection but are largely ineffective for some of today's plastic mines. And like all anomaly detectors, metal detectors give high rates of false alarms in battle zones filled with bullet casings and other metal debris.

Brute force methods using plows, rakes, and explosive breaching are sometimes used to clear a path for soldiers and vehicles but almost always fail to find or detonate all mines. The most reliable method of mine clearing, but also the slowest and most dangerous, is manually probing the soil with a rod.

Worldwide, there are an estimated 100 million land mines in 68 countries. Those with the worst problems are Angola, Afghanistan, Cambodia, Iraq, Laos, and Bosnia-Herzegovina.

Each year an estimated 100,000 mines worldwide are cleared, but 2 million are laid. An average of 2,000 people each month are killed or maimed by land mines.

"Even if everyone stopped laying mines today, it still would take 1,000 years to clear those now in the ground throughout the world," Ron says. "In my mind, it's the worst form of pollution mankind has ever come up with, bar none."

Chemical sensing

One of the most promising technologies under development at Sandia to identify sea mines, land mines, and unexploded ordnance is chemical sensing.

All mines emit molecules of the explosive chemicals contained inside them. Sandia is helping to develop a portable system incorporating ion mobility spectrometry (IMS) — the same technology developed for the explosives-detection portal to check airline passengers (*Lab News*, Sept. 12) — that will be capable of quickly detecting and classifying minute quantities of explosive molecules.

The system is not an anomaly detector — it looks for the explosives molecules themselves rather than a container holding the explosives. It incorporates a new Sandia-developed concentration technology, which potentially can chemically amplify the source strength thousands of times.

The project originally was directed at detecting sea mines and unexploded ordnance in shallow water and is sponsored jointly by DOE and the Department of Defense, Office of Munitions. Many land mines are placed in shallow water such as rice paddies, fords, domestic water sources, laundry areas, and irrigation canals.

That work, which is ongoing, has since been expanded to include land-mine detection with the help of Defense Advanced Research Projects Agency (DARPA) and Laboratory Directed Research and Development funding.

"We are the world leader by a nose in the area of chemical sensing for explosives classification, and we will be able to demonstrate that soundly in the next six months," says Ron, who has worked closely on the project with numerous Sandians in a cross-section of disciplines. They include Joe Simonson (2422), Phil Rodacy (1552), Bill Chambers (1824), Greg Frye (1315), Jim Phelan (6131), Steve Webb (6524), Ed Jones (2522), Bernie Gomez (2522), Pam Leslie (1552), Chuck Rhykerd (5848), Steve Reber (1552), and David Faucett (2522).

Explosives in soil, air, and water

Jim and Steve Webb are supporting the development of the land mine chemical sensing technology by modeling the environmental fate and transport (EF&T) of explosives signature molecules. They are analyzing how environmental conditions such as temperature and precipitation influence the movement of explosives molecules through soil, air, and water.

"What this work will emphasize is the significant influence of environmental conditions, such

as temperature, soil type, precipitation, and evaporation on the movement of chemical signature molecules to locations that can be detected by the chemical detector," Jim says.

"For instance, the amount of explosives signature molecules emitted from a mine in Bosnia may show a much different concentration at the ground surface than a mine in Iraq or Afghanistan. We'll also evaluate such things as whether it's better to look for mines in the afternoon when soil is warmer rather than during the morning, and how rainfall affects detection."

DARPA is co-funding the effort through a DoD/DOE/EPA program called SERDP, or Strategic Environmental Research and Development Program.

Mock minefield in Area 3

Phil and Bill have been doing much of the field work related to the development of the chemical sensor technology. They periodically take soil samples from a small mock minefield inside a fenced area at the south end of Tech Area 3. The minefield contains six unfuzed antitank mines and several surrogate mines made of plastic or consisting of metal boxes painted with explosive compounds. They also plan to conduct field tests on small antipersonnel mines.

Phil and Bill periodically analyze soil samples to determine the concentration of explosives molecules that can be found at various distances from the mines. They also have taken samples in shallow water for the chemical detection of unexploded ordnance (UXO).

Water and soil pose different challenges, they say. Explosives dissolve easily in water, making it difficult to extract the explosives molecules. Water also is often a dirty environment, with salts, organic materials, and pollution interfering with the detection process. Soil also has interfering chemicals, and environmental factors such as moisture and temperature can affect the performance of the technology.

The IMS technology already has successfully analyzed both water and soil field samples in the laboratory at the Explosive Components Facility. The technology also was successfully demonstrated in the field on San Clemente Island as part of a two-year program with the Office of Naval Research.

Portability the goal

The goal now is to reduce the technology to the portable stage, which has been aided by a new IMS designed and developed by Electronic Research Group in Las Cruces, based on work done at New Mexico State University.

Ron estimates a portable system weighing no more than 20 pounds will be ready to field test for sea mines by next spring. The system probably will have a sensing tube that extends from a box and will be simple to use: A green light will indicate the unit is sampling but has found no explosives; a yellow light will mean a small concentration of explosives has been found and that further sampling is required; and a red light will indicate that a significant concentration of explosive has been detected.

Phil said if the water field tests go well in the spring, the technology should be in use by the military and available for licensing within another year. The soil IMS system probably will be ready for field use a year or two after that.

"We want to get this down to what one person can carry reasonably comfortably, and which ultimately could be put on some robotic crawler of some sort," says Bill. "The push is really to scale this down to a rugged, lightweight package for the field."

DARPA is also funding a parallel three-year project by Sandia and an industry partner, Nomadics



MINE SNIFFER — Phil Rodacy (1552) demonstrates a mock chemical sensing detector on an antitank mine in the makeshift minefield in Tech Area 3. The final field-ready sensor probably will look similar to the mock detector and will be easy to use. (Photo by Randy Montoya)

Inc., of Stillwater, Okla., directed at efficient chemical sensing of land mines. This project will use results of Jim Phelan and Steve Webb's EF&T model, as well as the analysis results of Phil Rodacy and Bill Chambers. Joe is managing the project, which is part of a large DARPA chemical sensor development program involving multiple universities, industrial researchers, and national labs.

The program seeks to develop artificial sensors that can successfully mimic the extreme sensitivity and specificity of trained dogs. The Sandia/Nomadics responsibility in this program is to design a "front end" prototype that can quickly and efficiently gather traces of explosive materials in the field and deliver them in usable form to the various chemical sensors.

Development of a miniaturized mine detector is one of the applications of a wider Grand Challenge LDRD Proposal to develop an autonomous microscale chemical laboratory, more commonly called "μChemLab."

Greg Frye says Sandia's microfabrication capabilities are being used to develop chemical sensing modules the size of a postage stamp that will be used to make microchemical-analysis systems the size of current palm top computers.

The systems will have unprecedented capabilities for sensitively detecting and deciphering detailed chemical signatures. They will have a wide variety of uses in areas such as covert sensing for nonproliferation, contraband and land-mine detection, medical diagnostics, and environmental and process monitoring.

Backscattered X-rays

Sandia also is receiving funding from the US Army as well as through a DoD/DOE Memorandum of Understanding managed by Tom Hitchcock (2521) to help develop a mobile, continuously scanning X-ray machine that can detect mines. Steven Shope (9521), project manager of the backscattered X-ray project, says in September the technology successfully imaged antitank mines buried in sand and rocky New Mexico soil. The image showed enough detail to ascertain the type of mine and the location of its fuze, which is important for unearthing it.

"This was the first time this technique had been (Continued on next page)

Laser shaping

(Continued from page 1)

research, \$0.5 million.

Members of the CRADA range from Fortune 500 companies to small, recently started ones. They are AlliedSignal Inc., Eastman Kodak Co., Hasbro Inc., Laser Fare Inc., Lockheed Martin Corp., MTS Systems Corp., Minnesota Mining and Manufacturing (3M) Co., Optomec Design Co., Teleflex Inc., and Wyman-Gordon Co.

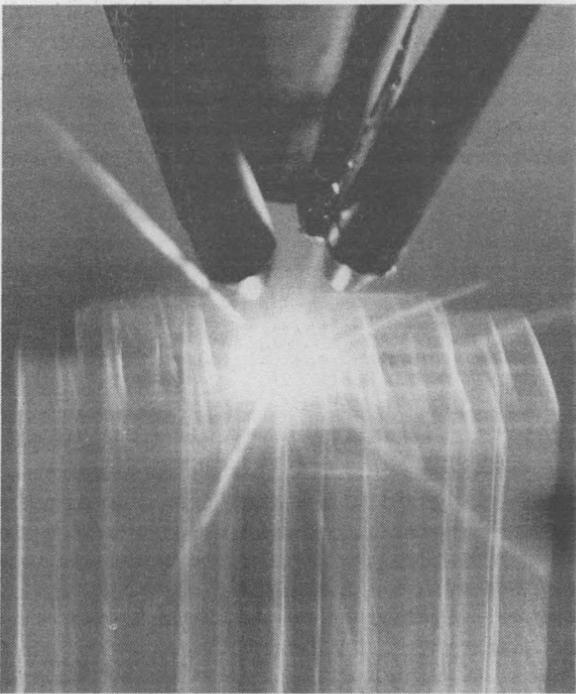
"Additional companies can join if their application receives the approval of all the partners," says Jim Searcy, Director of Sandia's Manufacturing Technologies Center 1400.

Small lots of high-density parts

The purpose of LENS is to make small lots of high-density parts or molds, a difficult operation because high temperatures make it hard to form accurate, smooth objects from molten metals.

The technology produces shapes close enough to the final product to eliminate the need for rough machining.

Nozzles each direct a stream of metal powder to a central point beneath them. Simultaneously, that point is heated by a high-powered laser beam. The laser and jets remain stationary while the model and its substrate are moved to provide



LENS FOCUS — Four nozzles deliver powder sintered by a laser beam into a Sandia thunderbird logo design.

(Continued from preceding page)

demonstrated in the field," says Steven, who has worked on the project with Grant Lockwood (9311) and Joe Wehlburg (9521). "It's the only process that gives a real-time image of a buried mine."

Development of a field-ready prototype, however, is still about a year away, and it could be another year after that until the backscattered X-ray mine detector is in actual use.

The continuously scanning X-ray machine itself was designed and fabricated by Imatron Inc. under contract to the US Army's Night Vision and Electromagnetic Sensors Directorate (NVESD) at Fort Belvoir, Va. Sandia was contracted by NVESD to prepare the X-ray unit for field tests, to integrate Sandia-developed detector technology, and to integrate imaging algorithms developed by the University of Florida into a fieldable land-mine detector.

The technique relies on the absorption and scattering of energetic photons. A detector system located above the soil intercepts backscattered photons. A higher detector response is recorded when the beam strikes a plastic land mine than when it strikes only soil.

For the recent field test, the experimental backscatter X-ray imaging system was suspended from a gantry that rolled on small, movable tracks above a small field in which several antitank and antipersonnel mines had been buried. The information was sent to a computer situated in a van near the field.

continually new areas on which to deposit metal.

Project manager Clint Atwood (1484) explains how the technique works: "We slice a CAD [Computer-Aided Design] model in horizontal sections, then move the part beneath the laser as we add metal to fill in that layer."

Says Duane Dimos, Manager of Direct Fabrication Dept. 1831, "The process produces materials with outstanding mechanical properties — very high strength and high ductility." Another plus, he says, is the ability to mix powder streams of different materials.

"Our goals are to make intricate material combinations in complex geometries out of hard-to-machine materials," says Jon Munford, Manager of Mechanical Process Engineering Dept. 1484.

According to Glen Lichtenberg, an Eastman Kodak mechanical process engineer at the meeting, "We expect the new process to produce unique features in mold cavities [the business part of the mold], which will allow some competitive advantage." In addition to film, Kodak, headquartered in Rochester, N.Y., makes a variety of processing equipment and optical devices.

Layers build one at a time

Layers deposit sequentially — first on a substrate, and then on the built-up layers — until the desired cross-sectional geometry is completed with production of a three-dimensional metal product.

The vision of producing a manufacturer's mold or custom part in a day has interested American industry for years. In 1994, when LENS was still only a dream, a video by Sandia's Visual Communications Department on why the US should support development of LENS technology — "Advanced Manufacturing: The Vision" — won a special award at the US International Film and Video Festival from the National Association of Manufacturers "for the audio visual production which best represents the US manufacturing industry." The film warned of possible foreign dominance of the powerful manufacturing technique unless a commitment was made to move

"The system can image land mines down to about four inches through water and snow and all types of debris such as rocks, logs, and leaves," Steve says. "It can image one square meter in about five minutes."

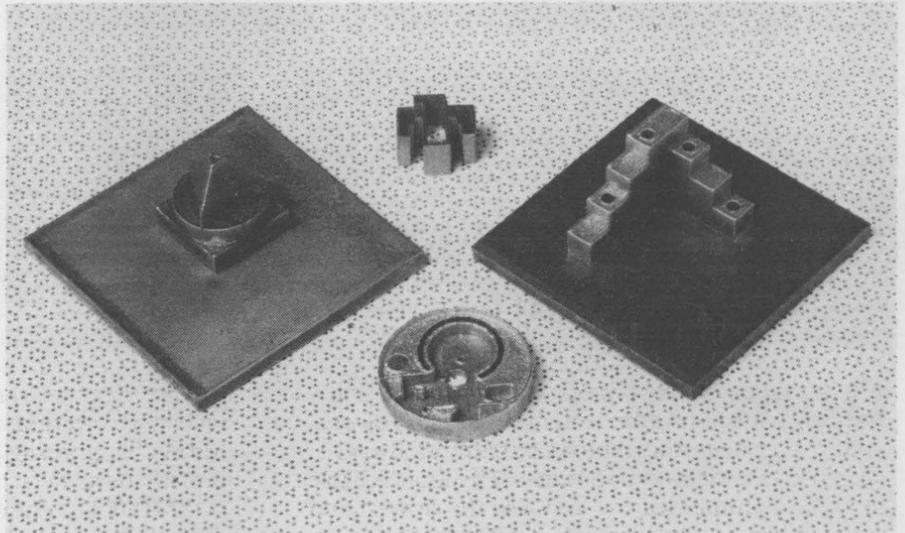
Steve says now that the technology has been successfully demonstrated in a field test, the next step is to produce a prototype system that probably will go into a redesigned Humvee. An ideal platform for the detector system itself, Steve says, probably would be Sandia's Remote Telerobotic Vehicle for Intelligent Remediation (RETRVIR), an all-terrain vehicle that has a robotic arm that can dig and pick up objects weighing up to 250 pounds.

Foam countermeasure development

Ron also is project manager and principal investigator for another MOU-sponsored project to determine the effectiveness of rigid polyurethane foam to neutralize mines and barriers.

Several field tests have been conducted to determine the effectiveness of quick-hardening foam to serve as a cushion against land- and water-mine explosions for vehicles and soldiers. The foam has successfully withstood the weight of trucks and tanks.

Although the field tests so far have shown that the foam is adequate from the standpoints of wear and strength, further work and tests are continuing, including explosives experiments in air, soil, and water, Ron says.



SAMPLE WORK PIECES show versatility of LENS technique.

ahead in America.

LENS technology was initiated at Sandia in 1995 through a Laboratory Directed Research and Development project because of the Labs' interest in low-volume production of highly specialized nuclear weapons components.

"Because Sandia's Defense Program needs are so specialized, this technology is important for us and should provide a powerful fabrication tool for complex shapes and materials," says Bob Eagan, VP of Physical Sciences & Components Div. 1000.

While the LENS technique has worked in Sandia's laboratories, the purpose of the CRADA is to produce an industrial tool that works automatically, robustly, and without constant supervision by a lab attendant.

The CRADA team also will provide a commercial design definition for LENS equipment, making it possible for one or more of the membership to offer LENS equipment as a commercial product.

'It's pretty hot stuff'

Dave Keicher is vice president of Optomec, a small Albuquerque company that has opted to produce LENS as a commercial product. The 13-year-old company has had annual sales of \$350,000 until this year, when requests for preliminary LENS technology drove sales to more than \$1 million, including the sale of a LENS machine to Ohio State University for research purposes.

Cost of the machines, he estimates, will be in the \$350,000 to \$500,000 range. The physical system is roughly eight feet long, eight feet high, and 3.5 feet deep.

"It's pretty hot stuff," Keicher says.

The company intends to make sample parts on demand for potential customers to show what the technique can do and how quickly it can do it.

While other universities and laboratories are pursuing similar research (notably the University of Michigan and Los Alamos National Laboratory), the Sandia CRADA is the first large-scale partnership created in this field.

One billion to be a small number

Says Dave Abbott, development manager for AeroMet, a subsidiary of MTS Systems Corp., "At AeroMet, we already have our own laser deposition process. But we're planning on leveraging the technical resources of the LENS consortium to enhance our process in three basic areas: parameter development, system enhancement, and software development."

Problems to be worked out include "dimensional accuracy — the process isn't quite precise enough," says Clint, "and achievement of a better finish on the metal." The finished product now has a slightly corrugated surface.

LENS extends earlier techniques of rapid prototyping and rapid manufacturing. Those earlier techniques, now a \$1 billion industry, use lasers to heat plastics into liquid and then form prototypes from the plastic. That process decreased the waiting period from months to weeks between conception of an idea and its appearance as a product on the market.

"When LENS gets going, \$1 billion will be a small number," says Jim.



Domenici

(Continued from page 1)

When underground weapons testing ceased, the President announced his intent to stabilize Defense Programs activities at \$4 billion annually.

"In the course of the hearings this year," said Domenici, "I became increasingly convinced that the weapons labs are facing unprecedented challenges in accomplishing their missions without testing and that more resources were essential. That led me to work with the National Security Council and the Departments of Energy and Defense to revisit the budget planned in the next few years. The President has now announced that the budget will be set at \$4.5 billion per year for the next 10 years."

Appropriations aren't entitlements

He cautioned, however, that such appropriations are not entitlements. "Even though the President starts with a \$4.5 billion budget request, that doesn't mean it will sail through Congress. I am expecting gigantic debates in Congress as we try to protect that figure — I'll need help from Sandia in helping me defend that figure."

Praised in his introduction by Sandia President Paul Robinson as a senator who has a depth of understanding of security issues and broad energy issues and who is unique in his under-

standing and support of technology, Domenici returned the praise:

"Let me congratulate you for all that you do in making sure that our stockpile stewardship initiative works. Together with Livermore and Los Alamos, you bear the burden for preserving the integrity of our stockpile. All of you at Sandia are responding superbly to that challenge, and it is a difficult one. For as long as our nation relies on the nuclear stockpile as the ultimate guardian of our freedom, as I believe it will for many decades to come, your challenge will continue and increase in complexity."

Domenici acknowledged Sandia's work on the B61-11 earth-penetrating weapon that replaced the huge B53 weapon that had been in the stockpile for years, especially since the B61-11 was developed and put into the stockpile without full-scale nuclear tests.

"Your successful delivery of [the B61-11] was a good test of the new challenges you will be facing in a world without testing, with a far older stockpile in the future."

"Whether or not one agrees with the nuclear-testing ban in America and the treaty proposed for the world [CTBT], for the time being and for the foreseeable future, you are operating under that ban," he said. "Your successful delivery of this new capability — allowing for the retirement of the B53 — is a great accomplishment. It was a good test of the new challenges you will be facing in a world without testing, with a far older stockpile in the future."

He said Labs' programs in advanced manufacturing, robotics, and intelligent machines will be major contributors in allowing Sandia to make similar contributions to the weapons program in the future.

Nonproliferation programs praise

Domenici went on to note the important role that Sandia plays in nonproliferation programs.

"While the tensions provoking global conflict are vastly reduced, the world is still a very complex and dangerous place. Some of the greatest dangers are associated with the threats of weapon proliferation. You are playing key roles in programs like the Materials Protection, Control, and Accounting Program that is placing former Soviet nuclear materials under reliable safeguards at more than 40 facilities.

"You are also using the Initiatives for Proliferation Prevention to link your scientists with former Soviet scientists and US companies. This program is designed to prevent migration of these scientists to other nations that are seeking to build new weapons capabilities."

Domenici also commended Sandia's work with industry and communities, making special note of the eight R&D 100 awards the Labs won this year (*Lab News*, July 4). "Your success in these awards is indicative of the emphasis you are placing on industrial and business interactions and commercial impact. I urge that you not let up one bit in your efforts in that regard."

He said the \$250 million cooperative research and development agreement (CRADA) with Intel and its partners on extreme ultraviolet lithography (*Lab News*, Sept. 26) is a "superb example" of the kinds of benefits he envisioned when the National Competitiveness and Technology Transfer Act was started in 1989.

"That Intel CRADA should not only provide the technology for new generations of semiconductor chips to Intel and its partners, it should also enable

Sandia to maintain capabilities to feed back into your weapons program. I have been told over and over again that it is indeed a two-way street. Like all CRADAs, there are plenty of benefits to our national missions along with benefits to the industrial partners."

Discussing the proposed Comprehensive Test Ban Treaty in more detail, Domenici said, "I have just begun to understand it and get briefed on it. Thanks to you and the other labs — in particular to you here at Sandia — I'm hoping I will be as informed and as factually correct on it as anybody in the Senate." (Domenici and his staff have visited Sandia several times in recent months to consult with national security specialists about issues relating to the CTBT.)

He said he plans to be a "major player" in the treaty deliberations and he looks forward to "your leadership helping me."

"One of the issues with that treaty . . . is the
(Continued on next page)

"This [the CTBT] is not a disarmament treaty. That's another misconception."

Domenici makes bold nuclear policy statements at ANS meeting, calls for reexamination of issues

Senator Pete Domenici (R-N.M.) made some strong statements about US nuclear policy and called for a reexamination of related issues during his Nov. 17 keynote address to the American Nuclear Society (ANS) annual meeting in Albuquerque. The *Lab News* thought Sandians would be interested in the following verbatim summary from his talk. The full text of his speech, "Future Perspectives on Nuclear Issues," is available by e-mailing Goldie Piatt in Sandia's Government Relations office: gmpiat@sandia.gov.

The United States has made nuclear policy decisions based on a number of incorrect premises:

- The 1977 decision by the United States to halt research into reprocessing and mixed-oxide fuel did not curtail other countries' pursuit of those technologies. Now the US is unable to use those technologies to meet urgent energy or nonproliferation needs and has largely been left out of international nuclear fuel cycle issues.
- Scientific evidence may not support the "linear-no-threshold" assumptions used to predict the effects of radiation. As a result, the US spends billions each year cleaning up sites to levels within five percent of natural background radiation even though natural background radiation varies by up to 50 percent.
- Irradiation of food products is rarely used in the United States, despite convincing evidence of its benefits in curtailing food-borne illnesses.

While those decisions need to be reexamined, other decisions need to be made on the basis of the best available science and evaluation of new national policies:

- Nuclear energy, which in 1996 reduced US greenhouse gas emissions from electric utilities by 25 percent, should be expanded to enable the US to meet greenhouse gas emissions goals without imposing taxes or other costly limitations on the use of carbon-based energy forms.
- The United States should move away from sizing its nuclear stockpile in accordance with bilateral accords with Russia. Instead, within the limitations of existing treaties, the US should move to a "threat-based stockpile."
- The United States should consider de-alerting its nuclear stockpile and eliminating the ground-based leg of the nuclear triad.
- As the United States and Russia rapidly dismantle nuclear weapons, both should pursue a swift program to convert classified weapons components into unclassified shapes that are quickly placed under international verification. That material should then be transformed into MOX fuel for use in civilian reactors.
- The United States should move to interim storage of spent nuclear fuel while continuing to actively pursue the permanent repository. In the years before that repository is sealed, there will be time to study alternative options. A serious review of accelerator transmutation of waste should be undertaken.
- The Federal government should stop blocking the State of California's efforts to build a low-level nuclear waste disposal facility at Ward Valley, Calif.
- The United States should expand programs to protect fissile materials in Russia and shift the activities of former Soviet weapons scientists into commercial projects.

(Continued from preceding page)

extent to which it is misinterpreted by various groups to suit their own agendas," he said. "I know that Sandia has been directly attacked for your work on the B61-11. That's one of the reasons I chose to speak of it publicly today, because that was done under a no-testing agenda."

(Editor's note: Some critics have maintained that the B61-11 is a new nuclear weapon, but the US has said all along that the B61-11 is not new, but a modification of older B61s to give the weapon an earth-penetrating capability to destroy buried targets.)

"I would assume that the treaty is no more binding or elaborate in that regard," Domenici said, "and we should be able to do that kind of thing if the treaty is ratified. There are some who already say that's not the case. Well, frankly, they will all know that that is the case, or it won't be ratified. Of that, I can almost assure you."

"I've studied it as carefully as I can during the short time we've had. [The President sent the treaty to Congress Sept. 22.] This is not a disarmament treaty. That's another misconception."

During a meeting with the media following his presentation, Domenici said he has not yet decided whether to vote to ratify the CTBT, but he is leaning in that direction. Although he never specifically linked his support for the treaty to achieving the \$4.5 billion for the Defense Programs budget for stockpile stewardship, some people believe he won't support the treaty otherwise.

More support for science?

Speaking about the support for science in general in the future, Domenici said this is a challenge our country continues to look at. "From time to time we boldly look forward, and at other times we sheepishly step back."

He noted he recently joined in cosponsoring the National Research Investment Act along with Senators Phil Gramm (R-Texas), Joseph Lieberman (D-Conn.), and Jeff Bingaman (D-N.M.). It states the intent of the US to double the civilian research budget over the next 10 years. "Many of you wrote to me encouraging this action by our nation, and I'm glad to be an original sponsor."

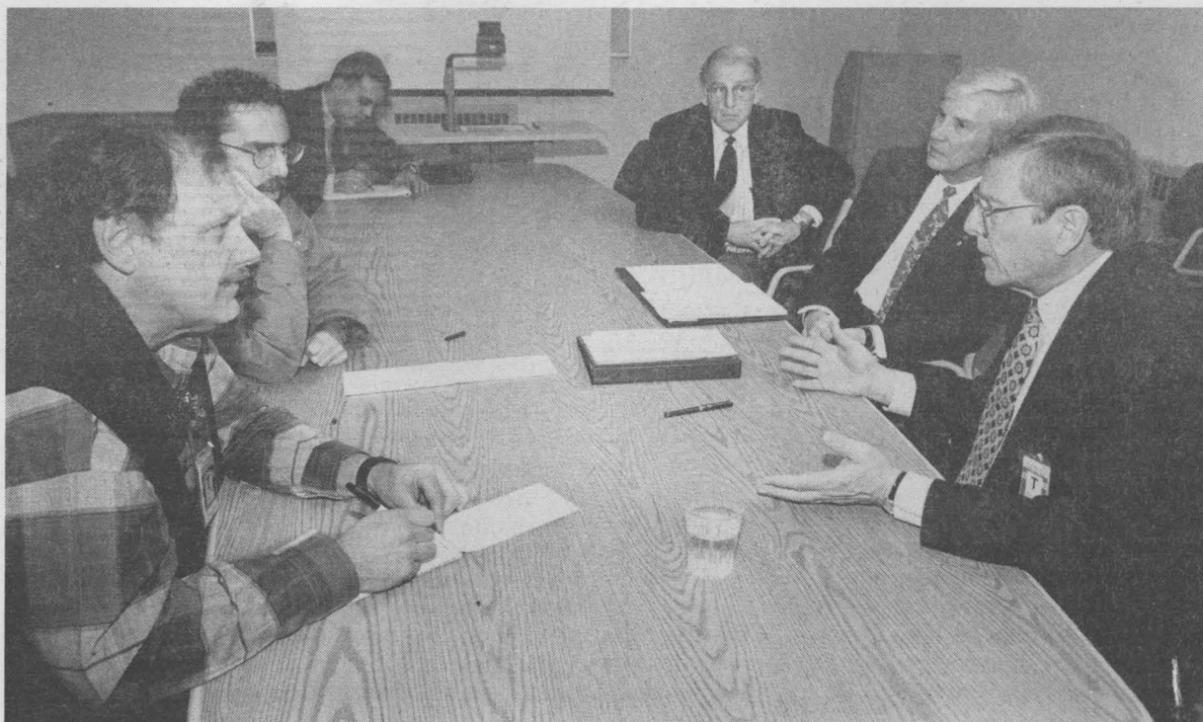
He acknowledged that accomplishing the goal of the act with actual appropriations will be tough, but that the healthy economy and a balanced budget should help.

Domenici touched on several ideas he has proposed as a "nuclear vision" in recent speeches at Harvard University and at the American Nuclear Society annual meeting in Albuquerque Nov. 17.

- He urged that the US and the world take another look at nuclear energy, especially because developing nations will need increasingly large amounts of electricity while the need to reduce harmful "greenhouse gases" grows.

- He said we should reexamine the need to bury nuclear waste in Nevada at the proposed Yucca Mountain repository, in the meantime moving to interim storage of spent fuel and conducting a serious review of accelerator transmutation of waste. In response to a question from the audience later, he said he does not personally intend to stop the Yucca Mountain project in next year's appropriations process, but that he's getting more concerned that "we'll ever get there."

(The full text of Domenici's American Nuclear Society paper, "Future Perspectives on



PETE TALKS TO THE PRESS — Sen. Pete Domenici (R.-N.M., right) talks to *Albuquerque Tribune* reporter Larry Spohn (left) and *Albuquerque Journal* reporter John Fleck (second from left) after Domenici's Nov. 21 Sandia talk. Domenici discussed several issues of interest to Sandians, focusing on the pending Comprehensive Test Ban Treaty and DOE's Stockpile Stewardship program. On the same side of the table with Domenici are Sandia Executive VP John Crawford (back) and President Paul Robinson (middle). Domenici's press secretary Chris Gallegos is in the left background. (Photos by Randy Montoya)

Nuclear Issues," is available by e-mailing Goldie Piatt in Sandia's Government Relations office: gmpiatt@sandia.gov. See summary on page 6.)

Craft strong partnerships for future

Looking to Sandia's future, Domenici said the world is changing rapidly and "I hope that the world can move away from security guarantees based on nuclear weapons. As that time approaches, a mix of programs at Sandia will evolve. To prepare for that future, I suggest that you should be increasing your efforts to work with other federal agencies, to broaden your involvement across the full spectrum of the Department of Energy, and to craft strong partnerships with US business and industry."

In response to a question about what can be done to maintain support for DOE's continuing management role in the nuclear weapons area, Domenici said, "The best thing we could do would be to get the Defense Department — the joint chiefs of staff and the other generals in charge of this aspect of defense — to openly and publicly acclaim DOE's management of this initiative through its laboratories."

He added that we moved slowly in a positive direction for DOE support in the early years of former DOE Secretary Hazel O'Leary. "Now we're getting a little stronger, and I think the military is gaining more and more confidence" in DOE.

Another questioner asked about Domenici's vision for continuing opportunities for the laboratories to spawn spin-off companies. He said he isn't sure "whether the Congress of the United States will take cognizance . . . of the successes of spinning out new start-up companies. We take that as a very, very important mission, and we're grateful to the leaders of the laboratories because they have joined in that."

"There have always

been some societal impediments, and there still are some," he continued. "Some people don't think we should do business that way, but I am very excited about not only the way it's moving in terms of spin-off ideas, but the way the laboratories are considering . . . helping experts and scientific successes move on to be business people, and to take a little bit of the risk away."

Domenici's talk was videotaped and can be checked out from the Sandia/New Mexico Technical Library. To reserve a copy, call Annette Chavez (4915) at 844-2738.



NRC VISIT — Commissioner Nils Diaz of the US Nuclear Regulatory Commission (right) and engineer T.Y. Chu (9735, left) examine a fracture in a hemispherical head of a simulated nuclear reactor vessel at the 9940 Explosive Dynamics Site in Area 3. Diaz visited Sandia on Nov. 18, hearing briefings on risk-informed regulation, safety implications of electric power deregulation, reactor safety aging research, and the Accelerated Strategic Computing Initiative. In addition to the tour of the 9940 site, he also visited the Direct Containment Heating and SURTSEY Facility.

(Photo by Randy Montoya)

Military liaison group celebrates its 50th birthday

Organization's mission predates Sandia, harks back to the Manhattan Project

By John German

Fifty years ago, in the aftermath of World War II, Congress and the President gave control of the US nuclear weapons stockpile — then only about 10 weapons strong but growing fast — to the Atomic Energy Commission (AEC), a civilian agency.

But it was the weapons users — the Army and Navy — who needed to know how to assemble, maintain, and deploy the sophisticated new weapons at military bases around the world.

It followed, then, that the people who designed and built the weapons should show the military services how to take care of them, and as the engineering branch of Los Alamos Scientific Laboratory, Sandia knew best how the weapons were put together, how they worked, and what their day-to-day maintenance needs were.

In 1947 the Armed Forces Special Weapons Project (AFSWP), the military remnants of the Manhattan Project, asked the "weaponeers" at Z-division to provide the field support, publications, and training the military needed to take care of US nuclear weapons in its custody. The Sandia group was named the "military liaison" (ML) project.

This week Military Liaison and Knowledge Management Center 5500 celebrates its 50th birthday. All current, former, and retired Sandians who played roles in the group's history have been invited to a Dec. 5 celebration at the National Atomic Museum.

Some assembly required

In the early days of the nuclear stockpile, "some assembly required" could have been stamped on nuclear weapons transported to military depots around the world. Sandia essentially built the weapons in New Mexico, but before they could be deployed, certain subassemblies had to be installed — including their nuclear "cores." Their batteries had to be tested and then installed. Hundreds of minor details had to be checked and rechecked.

"The early weapons were very labor intensive," says John Hogan, senior scientist in Defense Programs Knowledge Integration Dept. 5507. "You could spend a whole career checking detonator cables, for instance."

Because of the possible consequences of doing these tasks wrong, AFSWP wanted its personnel to be well trained. Sandia's military liaison group began to provide that training and compiled a set of technical user manuals outlining every required maintenance and deployment operation, as well as any foreseeable problem.

"During the Manhattan Project, everything was done in a laboratory mode of operation," John says. "After the war, the AEC labs and the military began to formalize nuclear weapons operations. Military liaison was a key part of that formalization."

A lifetime, unlimited warranty

Today the military liaison group — a team of about 35 veteran weaponeers and managers — operates something like the customer service desk at a new car dealership, honoring the equivalent of a lifetime unlimited warranty on

nuclear weapons.

It employs experts on each of the 10 nuclear weapon "models" currently in the stockpile. If a military user has a question about a weapon, the assigned military liaison "field engineer" serves as the stockpile "help desk." If there's a problem with a weapon — a scratch, a stripped bolt, a

Bldg. 892, ML uses full-size weapon mockups, weapon cutaways, and a vault of components and subsystems to train military instructors and technicians who oversee or perform nuclear weapon maintenance and deployment operations around the world. About 1,500 military and DOE personnel are trained at Sandia every year,

John says.

"There is no other place like this in the world," he says. "We have all the weapon facsimiles, components, carts, storage containers, tools — everything you need to train somebody in any aspect of nuclear weapon stewardship."

ML also keeps a database about and hardware from every nuclear weapon that has ever been in the US stockpile. "We recently pulled out a Little Boy mockup," he says, to answer a question about safety components.

In recent years, VP for National Security Programs Roger Hagenhuber (Div. 5000) has assigned the group responsibility for preserving the Labs' hard-won expertise in nuclear weapon design that is being lost every day as longtime weaponeers retire.

"A lot more has gone into designing these weapons than what we have documented," John says. "Typically what doesn't get documented are the unsuccessful approaches and hundreds of other small decisions — why somebody did something one way and not the other. That kind of knowledge may be valuable to us in the future."

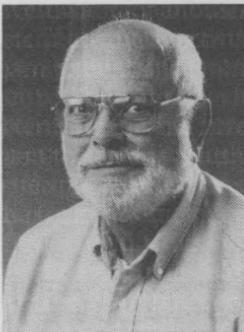
The Knowledge Preservation Project under Carmen Ward and Keith Johnstone (5502) attempts to fill in those knowledge gaps.

"Without any Phase 3's [design, prototyping, and testing of new weapons]," he says, "obviously we'll have to change how we're doing business" in coming years, including hiring young engineers and making them experts in particular weapons systems. Roger has asked ML to create a one-year internship or scholarship program for young, new weaponeers.

But realistically, ML might see an increase in its workload in coming years as weapons systems in the stockpile get older and require increasingly frequent component and subsystem changeouts.

"This may be the only organization at Sandia whose name and core mission have remained essentially constant for 50 years," says Mark Dickinson, Manager of Military Liaison Engineering Dept. 5513. "As long as there is an active stockpile, regardless of its size, military liaison's role will be required. ML has had a long and proud tradition of service to the nation's deterrent policy."

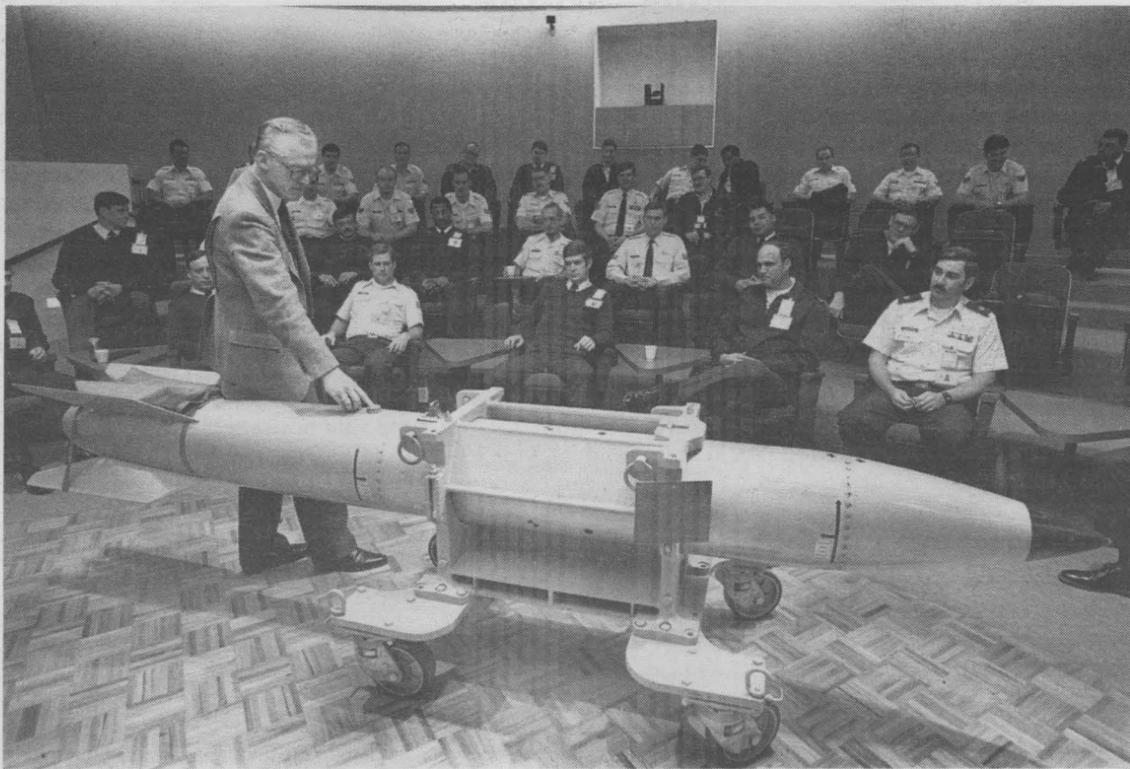
Recent Retirees



Charles Arning 40
6313



Donna Lambert 20
4212



AIR FORCE TRAINEES receive a briefing on the B61 from Don Benoist (ret.) in this 1990 *Lab News* photo. (Photo by Randy Montoya)

disconnected cable, a design flaw — the military submits a UR (for "unsatisfactory report"). Then it's up to the Sandia field engineer to develop a solution, working with other Sandians and the responsible nuclear design lab.

The primary concerns, says John, are: "Is the weapon OK?" and "Will the problem affect the



safety, use control, security, or reliability of other weapons in the stockpile?"

If a problem requires personal attention, an ML field engineer can travel to the scene to help solve the dilemma.

If a weapon modification or alteration is required, such as the recent upgrade of the B61-7 to the B61-11 or a changeout of an improved component, ML develops new field procedures in coordination with the nuclear design labs, validates the procedures, and trains the military users. It also develops procedures and publications for exchanging "limited-life components" — primarily those parts that must be replaced every few years because they contain tritium, which has a relatively brief half-life.

The Publications and Logistics Department under Chris Christensen (5512) develops, validates, publishes, and updates each weapon's "owner's manuals" and other technical documentation in coordination with the military and DOE.

And at Sandia's Weapons Training Center in

Taming the World Wild Web: New tool helps make sense of data about Labs' Web customers

By Bill Murphy

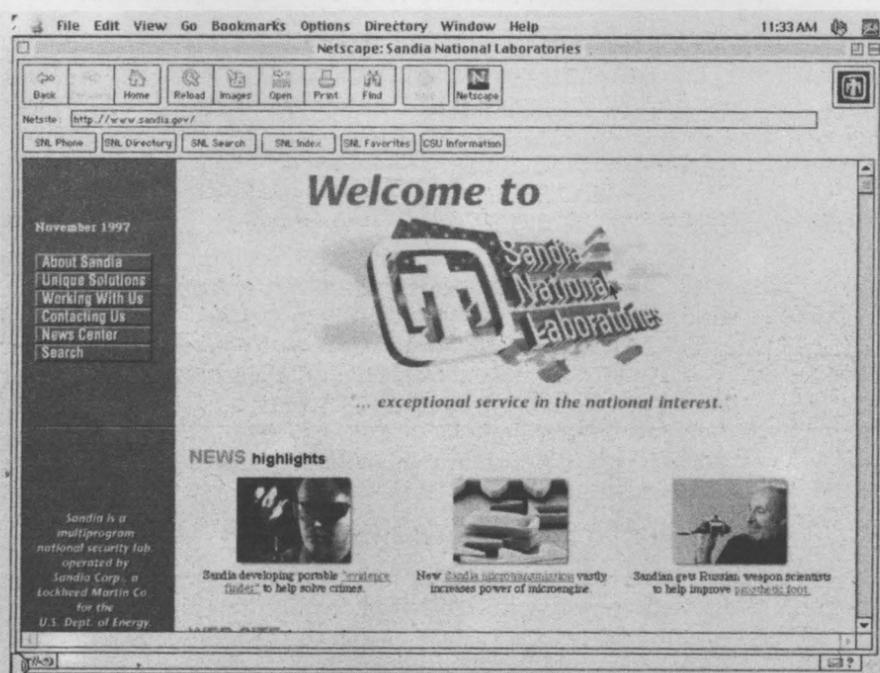
There's never been anything like the World Wide Web for distributing and sharing information. TV? Radio? Too passive. Too linear. Newspapers? Magazines? Books? Better, but static. With the Web, information flows back and forth, in and out, around and around. More than one cyber-wag has said it represents the most significant tool-using paradigm shift in human history since the taming of fire.

Like an out-of-control fire, though, the untamed Web is about as manageable as a force of nature. Information is just uncorrelated data bits, not knowledge, unless you have some way to make sense of it.

How to tame it, that is the question.

Now, using innovative WebTrends software (from WebTrends, Inc.) to analyze activity on Sandia's external Web server, external Web maven Manny Ontiveros and his staff in Advanced Communications Dept. 12690 are gaining insights into the hubbub of information that floods into the external Web server database in an incessant stream.

WebTrends, says Manny, analyzes the server's



CHECK OUT Sandia's external Web site. The home page URL is <http://www.sandia.gov>.

a tool to gauge how effective some of Sandia's promotional activities are.

When you look at "top entry" pages, he says, you find what you'd expect: Lots of users enter the site through the home page (www.sandia.gov) or through the page that features Mike Hannah's (4418) world-famous html reference manual. Mike's page (www.sandia.gov/sci_compute/html_ref.html) has a link from the Web Consortium site, the definitive site for heavy-duty Web developers and those interested in Web-related technical

issues. As such, you'd expect it to be a common gateway to the Labs' external server.

But here's where it gets interesting: You also find, thanks to WebTrends, that sites whose URLs have been featured in Sandia promotional materials are also among top entry points. Thus, a news release that gives the URL for Sandia's comet impact simulation becomes a major gateway. Likewise, a brochure about Sandia's robotics work features a URL that brings visitors to the Labs via the robotics page.

"With these data," Manny says, "we're getting a measure of the effectiveness of our promotional efforts. A lot of our materials have a follow-up URL, inviting users to come to our Web site for more information. The WebTrends stats show that we're getting that kind of follow-up."

Manny notes that WebTrends' data on most frequently downloaded files indicate that people are interested in downloading electronic versions of Labs brochures. For example, the electronic version of the brochure on the Revolution in Engineering — subject of a major Washington promotional event — has been downloaded in .pdf format several thousand times.

"I don't think electronic versions of brochures and other promotional items are going to replace printed documents for the foreseeable future," he says, "but they are becoming a more and more important alternative."

A comparison of data from a December 1996 pilot test of WebTrends with data from September 1997 shows a 50 percent increase in user sessions,

and, probably more significant, a 700 percent increase in the length of those sessions. This increase, says Manny, is an important indicator that visitors to the Labs' external Web are really "using" the site, not just passing through.

Indeed, WebTrends data show that among the most popular pages are the "search page," the "employee locator" page, the "contacting us" page, and the "about Sandia" page.

"It appears," says Manny "that people are looking for someone or something specific." Given that information, Manny says, the next phase of development for the Labs' external Web site will include expanded indexing of main topic areas, refinement of navigation aids, and modification of the "contacting us" page.

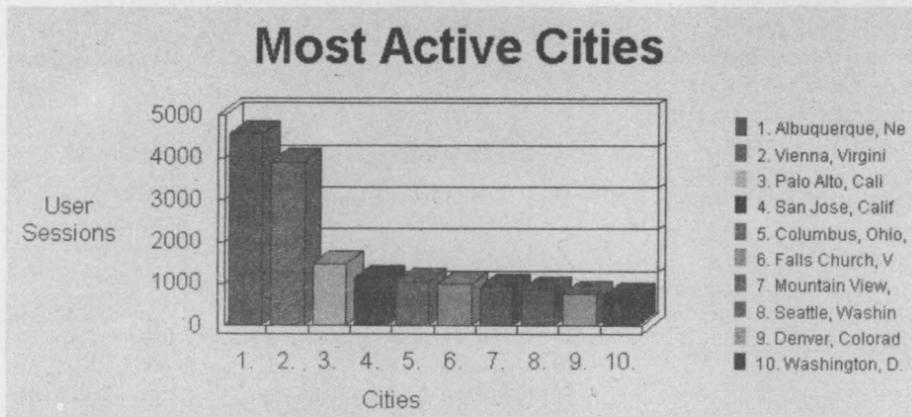
"We want to make it easier and easier for users to find the specific information they want," says Manny.

If Sandia's senior management could issue a wish list spelling out where they'd like external Web users to be from, they'd probably say "Washington" and "Silicon Valley," home to the Labs' main customers and some of its top potential industrial partners. Manny has some good news for them: WebTrends data indicate that the Washington area and several California cities are among the 10 most active points of origin for Sandia Web users.

Silicon Valley and Washington, D.C.

Tracking the shifting data on this subject reveals some interesting trends. For example, Washington D.C., didn't show up on the "Top 10" list in December 1996, but it did in September, after the Sandia Revolution in Engineering event in the nation's capital. Similarly, Mountain View and San Jose were not on the December Top 10 list, but showed up in September, close on the heels of the signing of a \$250 million cooperative research and development agreement with an industry consortium led by Intel. In the same time frame, the number of user sessions originating in Palo Alto, another Silicon Valley city, almost tripled.

Because the Web is a dynamic medium, users can expect changes in the external Web over the next few months, Manny says. For example, in accordance with a Lockheed Martin initiative, Sandia will feature conspicuously an "employment opportunities" link on the external home page. There's a good reason for this, Manny says: The Web is now the nation's number-one source of information for job hunters. Given that, he says,



log files; those are the files that are automatically generated to keep a record of every transaction handled by the server.

John Larson (4612) and Jim Muntz (4911) from the Integrated Information Services group have worked closely with Manny's team, providing the WebTrends software and access to the log files.

Who, what, when, and where

Using its built-in smarts, WebTrends crunches server log data and generates a variety of reports. The software tells you who is accessing the server, where they're from, what they're downloading, how long they're staying. It's pretty thorough, massaging the server log files in the cleverest of ways.

So what does WebTrends report? Here are a few of the things it can tell you:

- General server statistics: number of hits; number of user sessions (a better measure of use than hits, because a server counts each object downloaded to a client as a "hit." Thus a page with three objects would count as three hits.); length of the average user session; number of user sessions per day.
- Most-requested pages (and least-requested pages)
- Main entry points — What pages are the main gateways into the server?
- Top downloaded files
- Most active organizations — Are users coming from military, government, education, or industry domains?
- Most active countries (None of the top 15 countries are on the Department of State's "sensitive" list, by the way.)

And more, a lot more.

An analysis of the WebTrends data, says Manny, indicates that the external Web is accomplishing its mission of serving industry, university, and government customers. "Those users are definitely in the mix as the top three," Manny says.

WebTrends is proving to be especially useful as



"we want to maximize our opportunities to get the best people possible."

Also on the horizon: a direct link to the DOE Web site; a more direct link to information about the Laboratory Directed Research and Development (LDRD) program; a faster server; and design tweaks to speed up page downloads.

WebTrends, says Manny, is helping guide him and his team in its decisions on how to evolve the external Web.

"It's giving us the kind of specific information we've needed," he says.

Reengineering diet a work in progress, says VP Dan Hartley, but we're past the hard part

'Reengineering is not a forever thing'

The first few days of a diet are the most difficult. You pass on dessert. You return a midnight snack to the fridge. You groan at the thought of a jog, but you go. It takes willpower, self-restraint, and commitment. And after a few days, it gets easier.

So it is with corporate belt tightening. When Sandia committed itself to an all-out corporate reengineering regimen in FY94 as the way to a leaner and meaner lab, a little extra effort was necessary to initiate the long-term behavior changes that would bring about significant, Labs-wide fitness gains. The Laboratory Process Reengineering (LPR) team became our corporate conscience, responsible for getting us off the couch, urging us to cut out any unnecessary, and weighing our progress periodically.

And today the results of our hard work are starting to show, says Dan Hartley, VP of Laboratory Development Div. 4000. Most human resources functions have been converted to PeopleSoft, an all-commercial software system. Preparations are under way to implement its financial counterpart, Oracle, by the beginning of FY2000.

"Those are the big changes," he says. "We're no longer using homemade software. And because these commercial software packages are based on best business practices, the transition to them is requiring us to make dozens of other smaller changes."

Countless other reengineering projects in administrative and support organizations, from facilities to purchasing, have brought about measurable efficiencies large and small in the form of cost savings, cycle-time reductions, and effort savings: property inventory, electronic vouchering, policy reductions, electronic timekeeping, etc. (See "How LPR has measured up" at right.)

Not a forever thing

And now that various major LPR projects are set in motion and many are complete, says Dan, the Reengineering and Performance Improvement Center has disbanded.

"Reengineering is not a forever thing," he says. "A few years ago we identified a group of major, abrupt changes we wanted to take place, and we made a corporate commitment to do that. But once those changes are in motion, what you're

doing is continuous improvement — quality. Quality is a forever thing. A centralized corporate reengineering organization wasn't really required anymore."

Most of the reengineering center's people have transferred into line organizations or to quality-related positions in Laboratory Effectiveness Dept. 4506, says Len Hiles, the group's former director. (Len is now director of Outreach, ES&H, and Security Center 8800.)

"These people take a lot of powerful tools with them to their new organizations — quality, reengineering, facilitation skills," Len says. "The intent is that they'll mentor other folks in those skills and inspire more changes."

A major impact on our business

In its four years, Len believes, Sandia's centralized, corporate reengineering organization was instrumental in fostering a greater corporate focus on business results and customer satisfaction. "Those were the key things John Crawford and Dan Hartley wanted to have happen," Len says. "It's had a major impact on our business."

A good example of ongoing, successful reengineering is the automation of tech area security gates, says Dan. "Once you rethink the way you've been doing something and then design and install the first gate, it's not reengineering anymore — it's a facilities job. And the investment you made in rethinking the first new gate is repaid in savings each time you install another one. That's what reengineering is all about."

The reengineering projects that are under way in various line organizations will continue, Dan says, and as desirable new business practices are identified, they will be acted upon at the division, center, and department level. Corporate Planning and Strategic Business Development Center 4500 will track the progress of ongoing projects.

And although the centralized LPR organization has vanished, reengineering's principles — looking at your work as a system and making rapid, drastic changes that affect the whole system — remain. Reengineering's emphasis now shifts to the Labs' technical work, says Dan, albeit under a different name: modeling- and simulation-based life-cycle engineering.

"It's really the same idea," he says. "We've looked at our administrative functions from a Labs-wide perspective and set some major changes into motion. Now it's time to look at our technical work from that distance to see how our products and engineering processes can benefit from radical changes."

Those benefits, he says, will come primarily from putting the tools of the information age — computer modeling and simulation, technology-rich manufacturing, information sharing and networking, etc. — to work in many places where trial-and-error prototyping, field testing, and redesign were once mainstays in fulfilling the Labs' nuclear weapons missions.

By applying these new tools during a product's entire life cycle — including its conception, research and development, design, prototyping, test and evaluation, production, deployment, and ultimate disposal — scientists, engineers, manufacturers, suppliers, and users can find ways to improve the product, speed its development and fabrication, or reduce its overall life cycle costs in ways never before possible, he says.

"I think this is where the big savings are going to come from," Dan says.

Watch future issues of the *Lab News* for more about life-cycle engineering and product realization.

—John German

How LPR has measured up

A few "reengineering status" indicators compiled by the former Reengineering and Performance Improvement Center 4020 for a February 1997 briefing to Executive VP John Crawford:

- Thirteen reengineering projects in the five indirect process areas (finance, information enterprise, human resources, site management, procurement) have been implemented and resulted in significant gains in efficiency, cycle time reductions, productivity gains, customer satisfaction, and estimated cost savings. Primary examples: staff augmentation, electronic timekeeping, new property inventory processes, customer-funded facilities, low-value procurement, PeopleSoft software implementation, information infrastructure emplacement, etc.

- Productivity gains, which are difficult to measure but can result in reduced costs and personnel requirements, are projected at about \$128 million through FY99. The number of total employees working in the five indirect process areas has decreased by about 17 percent since the beginning of FY94.

- Of the 47 major recommendations furnished to Sandia by red teams, 96 percent have been implemented or are now in the process of being implemented.

- In addition, says Virgil Dugan, Director of Corporate Planning and Strategic Business Development Center 4500, reengineering, streamlining, and budget cuts have put Sandia ahead of its Curtis Commitment (to reduce indirect costs by \$250 million in five years, FY96-FY2000). According to Jennifer Crooks, Manager of Financial Management and Information Services Dept. 10401, indirect savings so far have totaled \$54 million (\$24 million for FY96 and \$30 million for FY97), \$4 million more than planned for those two years. As scheduled, indirect savings of \$60 million must be realized each year in FY98, FY99, and FY2000 to reach the \$250 million goal.

- In addition to the indirect savings, direct line organization savings attributed to reengineering are projected at about \$50 million through FY99.

Feedback

Q: Why is it so difficult to get forms on the [Internal] Web? I went to the Purchasing home page to try to fill out a simple purchase requisition (PR) and could not figure out from the 20 choices how to get a simple PR form. If you try buying a computer instead of leasing one, you need the "nonstandard PC/MAC requisition form" mentioned multiple times in the PC lease program Web pages. With no link to get the form, I searched many times and could not find this form on the Web. I have not yet succeeded in finding a "disclosure of technical advance" form. These are just a few examples of how difficult it is to navigate the Web. The organization has no logical flow.

A: We have reviewed your concerns and will make the following changes to the Procurement home page and will request changes to the forms we have no control over.

1. We will add the "Non-Standard PC/MAC Requisition Form" to the Procurement forms link at http://www-irn.sandia.gov/organization/div10000/procurement_ctr/htmldocs/forms.htm.

2. We will add the "Non-Standard PC/MAC Requisition Form" to the JIT (Just-In-Time) section of the Procurement home page at http://www-irn.sandia.gov/organization/div10000/procurement_ctr/htmldocs/jit/jitforms.htm.

3. We have changed the wording on the Procurement home page from "Sandia PC Leasing Program" to "Sandia PC/MAC Leasing Program"

at http://www-irn.sandia.gov/organization/div10000/procurement_ctr/htmldocs/homepage.htm.

4. We have asked Webco to change the wording on the link on "Computer Leasing Home Page" from "Non Standard Acquisition Justification Form" to "Non Standard PC/MAC Acquisition Justification Form," which is the name of the form itself, at http://www-irn.sandia.gov/organization/div1/comp_std/compleas.htm.

5. We have asked Dave Barton, Recorded Information Management Dept. 15102, to add the "Non Standard Acquisition Justification Form" to the Corporate Forms home page at <http://www-irn.sandia.gov/corpdata/corpforms/formhp.html>.

We could not locate any information regarding the form title "Disclosure of Technical Advance," since it is not under the purview of Procurement.

We did, however, contact Dave Barton, and he did not know of the form either. He did indicate that if the form is sent to him along with a form number, he would add the form to the Corporate Forms home page. Dave can be reached at 844-5152 or djbarto@sandia.gov.

If you would like to see additional changes to the Procurement home page, please contact Frank Lujan III at 844-5919 or lujan@sandia.gov.

— Dave Palmer (10200)

Sandia Classified Ads Sandia Classified Ads Sandia Classified Ads Sandia Classified Ads

MISCELLANEOUS

- RUSSIAN MAKAROV .380 automatic pistol w/3 magazines, holster, trigger job, excellent condition, \$175. Montoya, 296-4268, before 9 p.m.
- SKIS, 170cm & bindings, \$50; boots, size 8, \$25; boots, 25cm, \$25; gutter-mount roof rack, \$5. Hudson, 884-7621.
- GRAPE CRUSHER, motor-driven, geared, aluminum crushers mounted on frame w/hopper, does not crush seeds. Brion, 298-1761.
- FREE KITTENS, to good homes, red tiger, gray tiger, & patterned white. Crafts, 831-5234.
- LARGE HUTCH (light wood tones), w/6 doors plus pull-out desk drawer, good for home or shop, \$75 cash. Montoya, 896-4252.
- SQUARE GLASS & BRASS DINETTE, 4 mauve chairs, \$125; black & brass king headboard, \$85. Kelly, 237-9709.
- WASHER & ELECTRIC DRYER, Speed Queen, matched set, tan, large-size, good condition, \$350/both. Lyons, 281-9283.
- SOUTHWEST AIRLINES ROUND-TRIP TICKETS, 2 at \$275 ea., 1 expires 3/98, the other on 6/98. Baca, 299-4875.
- AUSTRALIAN SHEPHERD PUPS, NSDR registry, black & white, tricolor, & blue Merles, \$200. Watson, 281-9449.
- AUSTRALIAN SHEPHERD CROSS, playful puppy, very cute, male, 12 weeks old, shots, free; wooden desk, 7 drawers, oak/maple, \$40. Ruby, 821-0982.
- YAMAHA KX-W332 TWIN CASSETTE DECK, \$150; Apple Imagewriter II, \$100; Leitz Wetzlar microscope, w/power supply, \$250. Balsley, 254-0782.
- WHIRLPOOL ELECTRIC OVEN & MICROWAVE (dual unit), butcher-block island top, gas cooktop, cast-iron sink. Carlson, 897-1850.
- CONTOUR CHAIR, beige, newly upholstered, heater. Jensen, 256-0593.
- SOUTHWEST AIR ROUND-TRIP COUPON, any continental U.S. destination, by March 20, 1998, \$200. Neff, 292-2481.
- BLACK METAL FUTON, w/black mattress, \$150 OBO; woman's holiday dresses, size 7, short/red & long/white, \$20. Sanchez, 837-0565.
- CAMERA OUTFIT, Pentax Program Plus body, Tokina 35/200mm lens, Tokina doubler, Tamrac case, excellent, \$250. Stubler, 286-2946.
- NASA FINS, 22-in., for use w/booties. Hansche, 281-5623.
- PALMTOP HP COMPUTER 320LX, w/docking station, 4MB card, NiCad batteries, AC power supply, books. Johnston, 248-0650.
- YAMAHA ELECTONE C-40 ORGAN, 2 keyboards plus bass pedals, auto rhythms, bass, chords, real wood instrument, mint condition, \$1,100. Bieg, 821-4172.
- LATEST "AMERICAN GIRL" DOLL, "Josefina," brand new, never opened, w/book, collectible, big holiday item this year, \$95. Owens, 836-7802.
- NORDICTRACK, Pro model, great condition, \$350. Patton, 898-3524.
- OAK CHINA HUTCH, \$300; 4 oak chairs, \$100 or \$30/ea.; all excellent condition. Castillo, 828-9603.
- CREAM-COLORED SECTIONAL COUCH, w/full-size bed & recliner, matching chair, 1 year old, \$800. Sandoval, 866-6991.
- SOCCER GOAL, w/net, full-size, \$65; goalie shirts, \$5; GE self-cleaning electric range, black/chrome, needs thermostat, \$15. Kerschen, 821-2848.
- M-100 BAUER ROLLERBLADES, size 7, \$45; boy's ski bibs & jacket, size 14/16, \$45; Advantix camera, \$50. Williams, 344-7596.
- MADAME ALEXANDER "DAVID THE LITTLE RABBI," 8-in., \$80; maple rocking chair, \$175; mahogany secretary, \$850. Anderson, 296-3352.
- OUTDOOR/INDOOR FEMALE CAT, for adoption, save Maggie O'Hara from being eaten by coyotes or owls. Lord, 867-1252.
- KENWOOD CAR SPEAKERS, w/box, 300-watt amp, call for more details, \$350 OBO. Noriega, 867-8287, ask for Al.
- NORDICTRACK PRO, excellent condition, w/video, \$235 OBO. Kupferman, 265-7224, after 6 p.m.
- ARTS & CRAFTS FAIR, La Cueva High School, Sat., Dec. 6, 9 a.m.-4 p.m., 7801 Wilshire Ave NE (off Wyoming, north of Paseo del Norte). Ekman, 296-3758.
- WET/DRY VACUUM, Silver King professional canister, \$599. Simms, 345-4429.
- PIANO, cable, upright, 36-in., \$500; freezer, Kelvinator, 21.2 cu. ft., upright, \$150. Gurule, 296-5220.
- AT&T CORDLESS PHONE, model 4605, \$5; large potted peace lily, free to good home. Swahlan, 292-3598.
- SLEEPER SOFA, Drexel, queen-size, mauve, blue & cream, excellent condition, \$300 OBO; 25-in. console color TV, \$75. Lundgren, 281-1564.
- CAR JACK STANDS, 1 brand new pair still in box, 2-ton capacity ea., Lincoln brand, \$10. Vigil, 271-1328.
- SOFA SLEEPER, dark blue, 2 off-white rockers, w/ottoman, matching area rug, \$600 for all. Garduno, 237-1648.
- TIRE CHAINS, fit sizes F70/14 to 205/60R15, unused, \$20; camper jacks for small camper, \$30 OBO. Kepler, 296-0402.
- NORDICTRACK PRO, hardly used, paid \$650, asking \$490. Gutierrez, 247-1089.
- ELECTRIC TRAIN TABLE, 4' 5" x 8' 10", ideal accessory for new Christmas train, \$25; PC Jr., works, new monitor, printer, software free. Easterling, 298-7083.
- BABY CRIB & DRESSING TABLE, \$150; portable crib, \$40; more; all excellent condition. Gardner, 296-0274, after 6 p.m., leave message.
- WOODWORKING TOOLS: Craftsman industrial 4-in. belt sander, 5 x 9 pad sander, router, metal-storage cabinet, shop vacuum. Spray, 884-8453.
- CEMENT MIXER, electric, 5 cu. ft., old Sears model, \$50; camper jacks, 2 ea., homemade cable/winch-style, \$40. Phelan, 869-6094.
- SMALL SCHNAUZER MIX, 6 months old, male, lively but cute, free to good home. Casbourne, 268-3942.
- SCUBA COMPUTER, Oceanic DataMax Pro, air integrated, new in box, top rated, \$400. Ricco, 828-1997 or riccos@compuserve.com.
- YAMAHA KEYBOARD, full-size, 61-key, w/melody & rhythm patterns, battery-operated, great holiday gift, \$65. Cocain, 281-2282.
- FRANCISCAN WHITE STONEWARE, w/earthtone pattern, service for 8; w/6 serving pieces, \$125 OBO. Weitzel, 831-9454, after 5 p.m.
- TIN GUTTERS, free. Carrillo, 296-7461.
- CALICO MANX, 4 yrs. old, spayed & shots, needs 1 animal household, no children, female, sweet disposition. Mills, 262-0554.
- BLOND DINETTE TABLE, 36 x 48, extends 36 x 60, 4 chairs, \$200. Moll, 299-6497.
- ROSENTHAL CHINA, "Japanese Blossom" pattern, for 6, w/additional serving pieces, classic modern design, w/platinum trim. Wagner, 823-9323.
- CAMERA, 35mm, Pentax ME Super, 50mm 1:2 lens, 1/2000 second shutter spd., \$155. Koenig, 294-2264.
- NORDICTRACK EXCEL MODEL, excellent condition, \$300. Woodworth, 884-3947.
- RUGS, NAVAJO, Yei-Bi-Chai, 2 Grey Hills & Ganado, Crystal, Tree of Life & others, will sacrifice. Locher, 323-0722.
- COCKER SPANIEL PUPS, 6 wks. old, purebred, 4 males & 1 female, \$125 ea. Lopez, 864-6145.
- ARTIFICIAL TREE, 6-ft., w/stand, \$15; Ergonomic kneeling computer chair, gray tweed fabric, like new, \$20. Iman, 856-6500.
- LABELING MACHINE, Brothers Model P-Touch XL, manual, \$125. Silverman, 298-1308.
- LABRADOR PUPS, AKC-registered, 7 wks old, 3 yellow, 1 black, champion bloodline, \$250 ea. Heald, 281-7885.

DEADLINE: Friday noon before week of publication unless changed by holiday. MAIL to Dept. 12640, MS 0165, FAX to 844-0645, or bring to Bldg. 811 lobby. You may also send ads by e-mail to Nancy Campanozzi (nrcampa@sandia.gov). Call Nancy at 844-7522 with questions. Because of space constraints, ads will be printed on a first-come basis.

Ad Rules

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

- TIRE CHAINS, fit most tires, \$15. Ewen, 836-3563.
- SUPER NINTENDO, 10 games, 2 controllers, Super Scope, like new, \$150. Kallio, 856-1350.
- S&W REVOLVERS, M65, stainless steel, 4-in., .357 magnum, excellent, \$225; M586, blue, 4-in., .357 magnum, excellent, \$275. Svenson, 898-3078.
- SOFTWARE, 100-yr. *National Geographic*, 30 CDs, text & photos, reviewed by *PC Magazine* 12/16/97, half-share \$75 or third-share \$50. Lagasse, 298-0977.
- CHEV. S-10 FACTORY MAGS, like new, 15-in., fit new & old 2WD series, \$350. Miles, 332-8364.
- HP LASERJET III PRINTER, 300-dpi w/resolution enhancement (pseudo 600-dpi), 8-ppm, serial/parallel, new toner cartridge, \$375. Schkade, 292-5126.
- QUEEN-SIZE WATERBED, waveless mattress, \$100; Jones Intercable Lobo Basketball Tournament tickets, 2 people, 4 games, Dec. 29-30, \$48. Gonzales, 294-2425.
- SUPER-SINGLE WATERBED, oak headboard w/shelves, new liner, mattress pad, \$120; oak dresser/hutched desk, \$195; GE 13.5-cu.-ft. upright freezer, \$65. Dawes 856-3435.
- PLAYER PIANO, electric, Musette, nice finish & condition, needs tuning, 32 rolls of music, \$950 firm. Gomez, 291-0691.
- GE ELECTRIC KITCHEN RANGE, self-cleaning oven, white, good condition. Schamaun, 298-5192.
- COMPAQ PRESARIO, 166-Mhz Pentium, 32MB RAM, 17-in. Monitor, 2.5-gig partitioned HD, \$1,650. Heath, 880-1392.
- COMPUTER DESK, black & blonde, solid maple top/doors, 2 yrs. old, \$200. Rellergert, 254-0613.
- CROSS-COUNTRY SKIS, 2 pr., \$45 ea., includes shoes & poles. Luikens, 881-1382.
- LATHE, precision, metal-working, approx. 24 inches between centers, 1/3-hp, 110V, belt-drive, w/bench, \$200 OBO. Taggart, 881-3864.
- HOT SPRINGS HOT TUB, Grandee model, 3 yrs. old, 2 moto-massages, extras, must sell, \$5,500 OBO. Rodger, 831-9212.
- CHEV. 350 V8, 4-bolt main, runs well, 112K, taken out of '72 C-10 pickup, \$100. Otts, 839-1268, leave message.
- BARBIE DREAM HOUSE, w/elevator, brand new, never removed from box, \$75; '97 Holiday Barbies, 1st issue w/mistake in photo, \$50. Connor, 293-2952.
- SEGA SATURN, 2 controllers, RF unit, 4 games, \$200. Ek, 291-8069.

WEDDING GOWN (size 10, straight style, chapel train) and 5 bridesmaids dresses; gown & dresses never worn. Gover, 296-3928.

TRANSPORTATION

- '94 MUSTANG COBRA, leather, CD, power everything, new tires, 5-sp., black, super condition, 43K miles, \$15,800 OBO. Kercheval, 864-6549.
- '86 DODGE RAM MAXI VAN B250, 8-cyl., 5.9 lts., AT, conversion pkg., low 70K miles, 4 captain's chairs, queen-size bed, dual AC, \$5,350. Loubriel, 268-1341.
- '95 MERCURY VILLAGER VAN, red, excellent condition, fully loaded, 24K miles, \$13,900. Siska, 884-4713.
- '94 GEO METRO STATIONWAGON, 5-sp., white, excellent condition, 41K miles, \$4,500 OBO. Boles, 883-3048 or 864-7854.
- '56 CHEV. PICKUP, V8, 4-sp., big tires, chrome wheels, mech. good, \$1,399. Nygren, 344-3332.
- '94 JEEP WRANGLER, 53K miles, soft top, AC, AM/FM cassette, good tires, \$9,000. Barraza, 856-7864.
- '94 FORD F150, extended cab w/camper shell, 6-cyl., 5-sp., 1 owner, very clean, \$12,100. Serna, 897-3204, ask for Mike.
- '94 FORD EXPLORER, Eddie Bauer, 4x4, fully loaded, excellent condition, 50K miles, extended warranty, book value \$18,174, asking \$15,495. Bragg, 275-3172.
- '88 FORD F250, 4x4, 7.3L diesel, XLT trim, AC, cruise, tilt, AT, fantastic condition, \$6,500. Blankenship, 281-2257.
- '94 FORD SPLASH PICKUP, vibrant red, 6-cyl., 5-sp., 4x4, 57K miles, cruise, power everything, lumbar support, \$11,000. Wallner, 836-5752.
- '85 FORD CROWN VICTORIA, 4-dr. sedan, excellent condition, low mileage, \$1,950. Keener, 298-0892.
- '94 INFINITI G20, burgundy; AT, leather, sun roof, alarm, tint, new tires/brakes, custom wheels, \$14,500. Bianchi, 299-0999.
- '92 CHEV. BLAZER, 4WD, Tahoe trim, 4-dr., 73,500 miles, V6-turbo, AT, ABS, leather, fully loaded, very clean. \$11,400 OBO. Borders, 239-6303.
- '83 PONTIAC 2000, 4-dr., AT, AC, low mileage, starts/runs well. \$1,200 OBO. Roberts, 293-3107.
- '89 CHEV. SUBURBAN, 4x4, PS, PB, PW, PL, front/rear AC/heat, van conversion, many extras, \$8,900 OBO. Reed, 897-1086.
- '85 F150, 92K miles, 6-cyl., 4WD, 4-sp., shell, short bed, premium wheels, good rubber, manuals, \$3,200. Krivitzky, 897-9104, evenings.
- '94 FORD TAURUS, 4-dr. sedan, loaded, company vehicle, perfect condition, book \$8,500, asking \$7,900. Kaplan, 797-2115.
- '94 FORD F150, 4WD XLT, 5.8L, 4-sp., AT, AC, ABS, cruise, CD, tow pkg., green on white, 25K miles, showroom condition, \$18,800. Lanes, 856-7738.
- '95 LEXUS ES-300, white, w/tan leather, excellent condition, moonroof, CD changer, security system, low mileage. Kirby, 821-3938.
- '85 CORVETTE, 53K original miles, black, leather, power, Bose, shop manual, \$10,900 OBO. Dybwad, 296-9047.
- '92 FORD BRONCO XLT, full-size, 302 V8, 52K miles, extended warranty, under book. Pritchard, 299-3543.
- '89 FORD F150, 1/2-ton, 4x4, great condition, 4.3L, 5th-wheel towing pkg., 98K miles, \$7,000. Luna-Casias, 865-5986.
- '82 MERCEDES BENZ 380 SL, 98K miles, new tires, muffler/tail pipe, battery, stereo speakers, headlights, \$13,000 OBO. Brown, 232-8502, ask for Dick.
- '89 FORD PROBE, AT, PS, PB, new tires, low miles, \$3,900. Bentz, 857-0728.
- '86 JEEP CJ-7, 304 V8, new paint, hardtop, full-cage roll bar, new tires, new suspension, & more, \$4,995. Bentz, 286-2558.
- '90 DODGE RAM 150 PICKUP, V6, 1/2-ton, PS, PB, radio, AC, 78K miles, \$4,000 OBO. Estill, 883-1531.

'86 TOYOTA CAMRY, very good condition, 125K, new tires & brakes, excellent interior, must sell, \$2,800 OBO. Verdozzi, 284-3503.

'95 FORD TAURUS, 37K miles, white, V6, AT, AC, ABS, all power, air bags, cruise, \$9,950. Werling, 298-5842.

RECREATIONAL

- GIRL'S BIKE, 16-in., \$25. Meeks, 828-9825.
- MOUNTAIN BIKE, Shimano Deore XT components, White Bros hubs, titanium spokes, seat post, handlebar stem, excellent condition, \$700. Dwyer, 271-1328.
- VIKING SPORT DECK BOAT, 16-ft., 90-hp Mercury, full power, trim & tilt, spent \$900 on engine, \$2,695. Martin, 296-8154.
- ALUMINUM BOAT, 14-ft., w/7.5-hp motor, \$850; Sears 10-in. radial arm saw, 2.75-hp, w/extras, \$375. Branscombe, 291-1970.
- '87 TOYOTA MICROMINI MOTORHOME, excellent gas mileage, self-contained, easy to drive, clean, comfortable, economical. Mikkelsen, 867-6446.
- ALUMALITE TRAVEL TRAILER, 31-ft., front kitchen, center bath, AC, refrigerator, 2-outlet TV hookup, loaded, excellent condition. Luna, 293-1632.

REAL ESTATE

- 2-BDR. MOBILE HOME, 16 x 60, '93, 1-bath w/luxurious tub, appliances, large deck, carport, awnings, AC, skirting, shed, landscaping, must sell. Castillo, 294-0766.
- NORTH ALBUQUERQUE ACRES, .89-acre lots, fenced, power, gas, dead-end road, \$95,000/acre OBO. Allen, 821-3612.
- 2-BDR. HOME, 1,300 sq. ft., newly refinished wood floors, fireplace, den, includes washer/dryer, refrigerator, close to base, \$86,500. Grafton, 254-4905.
- 4-BDR. HOME, pitched roof, remodeled kitchen, bathrooms, Sandia views, 2 living areas, dining, ceramic tiles, carpet, sprinklers, megastorage. Atkins, 298-5762.
- 3-BDR. HOME, NE Heights, 1,800 sq. ft., 1-3/4 baths, solar, security, 2 AC units, RV parking, backyard access, motivated, \$122,900 OBO. Rainey, 294-8642.

WORK WANTED

- HOUSESITTING, California, anywhere in Tri-valley, day/overnight, can handle pets, watering, mail/newspaper, specific instructions, mature, responsible, affordable. Yow, (510) 447-2687, ask for David.

WANTED

- TOTAL GYM, interested in someone who has one, looking to buy. Simon, 899-0109.
- CHILDREN'S-SIZE BACKPACK (prefer internal frame), for 3-day treks, must fit 4'6" person, carry 40 lbs. Gullett, 889-0613.
- WITNESSES, hit-and-run accident, black Probe, Mon., 11/17, Wyoming & Susan, approx. 5 p.m. Urioste, 897-1417 or 284-3975 daytime.
- SLEEPING BAGS. Carli, 298-9271.
- HOUSEMATE, for large home, near Alameda & Eubank, 1 child okay, \$600/mo. w/utilities. Smith, 828-3904.
- TELESCOPE FOR STARGAZING, Meade or Celestron, Newtonian, at least 6-in. diameter, f8, prefer Dobsonian mount. Barnette, 861-2451.

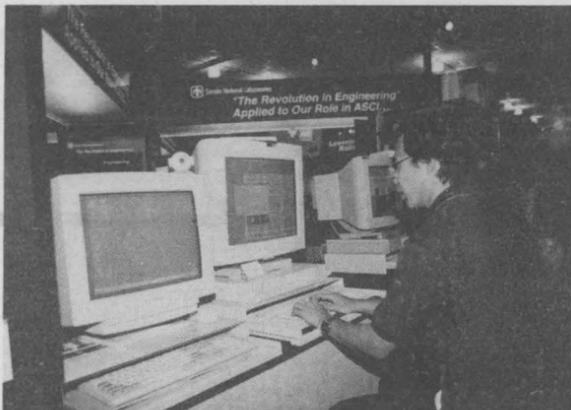
LOST & FOUND

- FOUND: Library book, *The Years of MacArthur 1941-1945*, by Clayton James, found south of Bldg. 956 on Nov. 24. Aguirre, 873-3032.

The SC97 supercomputing megafestival

SC97, the annual megaconference for everyone involved in supercomputing and related matters, this year was held in Silicon Valley and was chaired by Dona Crawford, Director of Distributed Information Systems Center 8900 (*Lab News*, Nov. 21).

Historical displays at the conference included a van used to carry a packet radio to transmit data in networking experiments and a wall display with a reader rail to explain key developments over the years. To view the historical display on the Web, point your browser to http://scxy.tc.cornell.edu/sc97/inet_history97.



SANDIANS demonstrated their work at the SC97 exhibit hall in San Jose in a booth that included Accelerated Strategic Computing Initiative collaborative projects from Sandia, Lawrence Livermore, and Los Alamos national laboratories.

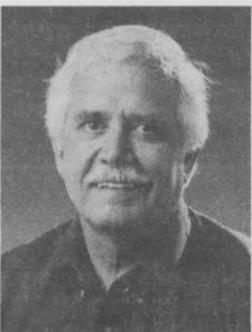
Recent Retirees



Bob Reed 40
2121



Doug McGovern 25
5841



William Costales 23
1486



Lawrence Lane 38
12326

Coronado Club

Dec. 4, 11 — Thursday bingo night. Card sales and buffet start at 5 p.m., early birds' bingo at 6:45 p.m.

Dec. 31 — New Year's 1997 at the Coronado Club. Entertainment by Bobby Buttram and the Trainmen. Members: \$30/couple, \$15/single. Guests: \$40/couple, \$20 single. Dinner menu: prime rib and fried shrimp, baked potato, vegetables, green chile stew, salad bar, coffee, tea, dessert. Cocktails (no host) 6-7 p.m.; dinner, 7-9 p.m., continental breakfast, 12:30 a.m. Tickets available at the C-Club. Reservations required. Limited seating available.

The Coronado Club will be closed Dec. 24 at noon through Jan. 2. The C-Club pool will be closed Dec. 24-25 and Jan. 1. The pool will observe holiday hours Dec. 22-23 and Dec. 26-31.



PIONEERS — Here SC97 officials take part in a news briefing. From left, Don Nielson, SRI vice president; Larry Roberts, who had been with the Defense Advanced Research Projects Agency; Len Kleinrock, University of California, Los Angeles (these three men are Internet pioneers); conference vice chair Dave Cooper of Lawrence Livermore National Laboratory; presenters Ken Kennedy and Richard Tapia, both professors at Rice University; and Dona Crawford.

Favorite Old Photo



DR. PRICE'S MEDICINES — Dr. James Russell Price, great-great uncle of Barry Schrader (8802), was a Chicago physician who cofounded the College of Higher Sciences there in 1893. He was also a lecturer, author, and entrepreneur who developed his own line of medicines bottled under the name "Doctor Price's Favorite Prescriptions." His best known book was *A Call for Fathers*, written in 1915. He died at age 83 in 1932 in the Estero Colony, a commune in Florida, where he had spent the last 11 years of his life. Barry has a copy, handed down from Dr. Price, of the *New York Herald* dated April 15, 1865, reporting on Lincoln's assassination

New undergrad program: Students now available during academic year

Science & Technology Outreach Dept. 3613 announces the launch of a new student program designed to accommodate technical organizations that need student researchers and interns during the academic year.

The Undergraduate Research Semester begins January 1998; students will also be hosted during the fall 1998 semester. Summer student internship programs will proceed as usual.

Students are solicited from across the nation. They must meet eligibility requirements that include US citizenship; a minimum 3.0 grade point average; be majoring in math, science, computer science, engineering, or technology; have sophomore-to-senior academic standing; and be interested in Sandia's research activities.

The program is funded by DOE. Participating students receive a salary commensurate with academic accomplishment, relocation to and from Albuquerque, transportation while in Albuquerque, and apartment housing (completely subsidized). Students must be able to work an entire academic semester; those on quarterly or trimester programs are accommodated.

Only 10 slots are available for the January 1998 semester.

Interested organizations should send candidate requirements to Dominique Foley Wilson (dfoley@sandia.gov or phone 844-1315). Students interested in applying should send a recent résumé, copy of transcript, and letter of interest to her at MS 1351.

Take Note

KNME TV 5's December pledge drive includes the "Colours of Infinity" on Tuesday, Dec. 9, at 7 p.m. In March 1990, aided by the new supercomputer at the IBM laboratories in New York, Benoit Mandelbrot made a discovery that some now rank with Newton's laws of regular motion. This discovery, known as the Mandelbrot Set, has led to the development of a new mathematical discipline — fractal geometry. Largely because it allows us to see the haunting beauty of the fractal universe, the M-Set has become the icon of modern mathematics.

Sympathy

To John Moyer (6313) on the death of his father in Lincoln, Neb., Nov. 3.