

The little engine that could: Sandia microengine gears up for real work driving external devices

Labs makes first micromotor to drive external gears and be built by microelectronic methods

By Neal Singer

Media and Employee Communications Dept. 12620

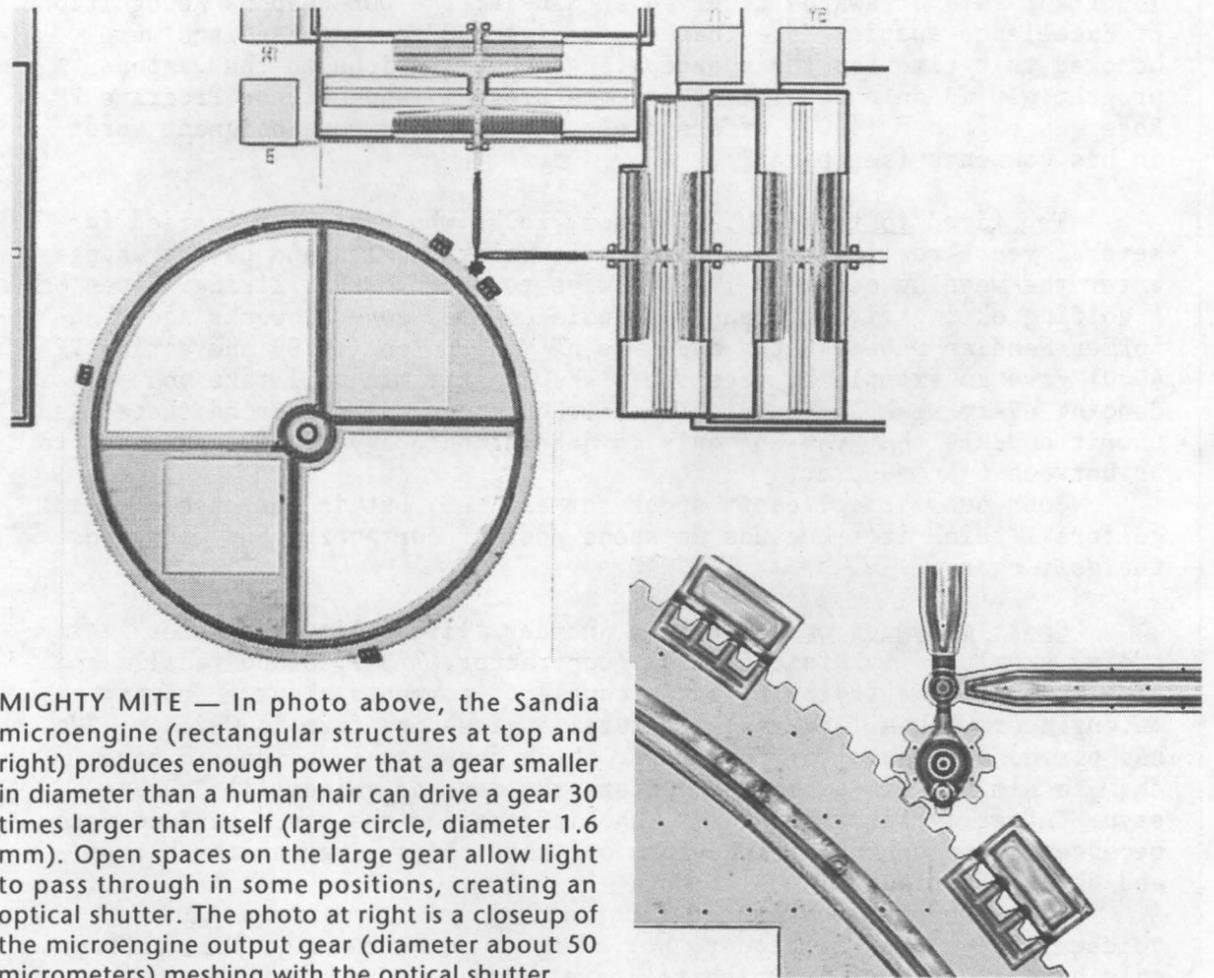
On videotape, a pollen-grain-sized gear meshes with one 30 times bigger and drives it. The pastel-colored gears, which lack shadow or fine detail, resemble a movie cartoon or computer simulation, but the wheels are real.

They are powered by the first micromotor to drive external gearing and be built entirely by microelectronic fabrication techniques, say Sandia researchers who designed and built the tiny motor and its gears.

"We believe we are the first to demonstrate a really good silicon micromotor that can connect up with a variety of devices," says Jeff Sniegowski (1325), the scientist who — with engineer Ernie Garcia (2641) and group leader and Dept. 1325 Manager Paul McWhorter — led

"We believe we are the first to demonstrate a really good silicon micromotor that can connect up with a variety of devices."

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MIGHTY MITE — In photo above, the Sandia microengine (rectangular structures at top and right) produces enough power that a gear smaller in diameter than a human hair can drive a gear 30 times larger than itself (large circle, diameter 1.6 mm). Open spaces on the large gear allow light to pass through in some positions, creating an optical shutter. The photo at right is a closeup of the microengine output gear (diameter about 50 micrometers) meshing with the optical shutter.

Gingrich talks with DOE lab directors, calls for labs to be on 'cutting edge'

By Ken Frazier

Lab News Acting Editor

The national lab directors' meeting with Speaker of the House Newt Gingrich, R-Ga., took place as planned last Friday in Washington — except that instead of the scheduled 20-minute session, it went for the better part of an hour. And the labs representatives were delighted that Gingrich expressed a strong vision for the labs to pursue breakthrough research and cutting-edge defense concepts.

"It was very intriguing and informative," says Deputy Director John Crawford, who represented Sandia at the meeting. "I thought it was very informative to get a chance to understand better the strategies and plans the Congress is developing."

Directors challenged to 'think bold'

Gingrich challenged the labs directors to be bold and innovative. "He encouraged us to think bold," Al Narath, former Sandia president and now president of Lockheed Martin's new Energy and Environment Sector, said. Narath spoke for 10 minutes on behalf of all the lab directors. Gingrich followed with a philosophical talk on his vision about the labs and the nation.

"He [Gingrich] talked on a strategic level for the labs and for the country," John told the *Lab News*. "He urged the labs to think strategically in the long term, to create standards of excellence on a global level."

The meeting was arranged by Rep. Steve Schiff, R-N.M., in part to enlist Gingrich's

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Sandia LabNews

Sandia National Laboratories

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Sandia, DOE, Intel announce plans to develop teraflop supercomputer

Computer capable of 1.8 trillion operations per second

By Chris Miller

Media Relations Dept. 12621

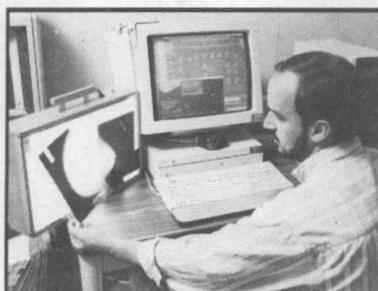
The long-sought teraflops supercomputer — by far the world's most powerful computing machine — should become reality by late 1996 under a joint \$46 million development contract announced by DOE, Sandia, and Intel Corp. Teraflops refers to the ability to carry out at least a trillion operations per second. (See "A new level of computing" on page 4.)

The computer, which will be 10 times as powerful as the fastest machine today, will be used primarily to simulate nuclear testing and to ensure the safety and effectiveness of the nation's nuclear weapons stockpile. It will be located at Sandia/New Mexico. Prototype early units will probably be set up in Bldg. 980

in Area 4, but the machine will be assembled permanently in Bldg. 880 in Area 1, according to Ed Barsis, Director of Computational & Computer Sciences and Mathematics Center 1400.

"This agreement marks the advent of a new era in high-performance computing that will significantly benefit our national security," said DOE Secretary Hazel O'Leary at the Sept. 7 announcement in Washington. "Computers of this scale will unlock the ability to confidently simulate nuclear weapons tests in the laboratory. This effort demonstrates a step forward for our scientific-based stockpile stewardship program. It emphasizes the department's commitment to maintain the president's goal of preserving a safe, secure, and reliable nuclear

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Labs' mammogram-screening software licensed by California company

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More than 150 Sandians honored with DOE 'Weapons Recognition' awards

This & That

Congrats to weapons award winners - As promised last time, this issue announces the recipients of traditionally one of the most important sets of awards received at Sandia: the DOE Weapons Recognition of Excellence awards. More than 150 active and retired Sandians were honored this time for their exceptional contributions to the weapons program. It is an unusual time for the program, and Defense Programs VP Roger Hagengruber (5000) offers profuse praise and some poignant words in his comments (see page 7).

* * *

Too tired to tango, Mike? - Most folks who have been married for several years realize that husband/wife relationships and habits change after the wedding ceremony - not always to their mutual liking. I was on a golfing outing with a group of Sandia couples several weeks ago when former Sandian Debbie Eaton and wife of Mike Eaton (13100 and acting VP-4000) gave an example by question: "Why is it a man will take you dancing every week and stay out late, but once you're married there's an unwritten rule that you can only go dancing once a year, and that has to be between 6 and 9 p.m.?"

Good question. I can't speak for all men, but in the case of avid golfers I think it's because we spend most of our energy and money on the golf course.

* * *

Short messages only - Here's another "life's little hassles" story, submitted by Diane Doliber (contractor, 7734): Diane recalls a time when she was trying to get a couple of comments about a drawing to an engineer with a large architectural engineering firm in Chicago. "We had played telephone tag for two or three days, so I decided to give them to him via his secretary (before the days of voicemail)," Diane says. "After my first few words, she informed me she could take no more because the telephone message form only had three lines at the bottom - and she was serious."

I can understand Diane's frustration, but in this age of voicemail I've been tempted to say on my recorded message that callers only have 30 seconds in which to leave messages. I listened to a message the other day during which the caller first told me what she was going to tell me, then she told me, then she told me what she had told me - several minutes of talking with about 6.2 seconds worth of useful information.

* * *

The importance of teamwork - Here's something from a Canadian company publication that I thought you might find interesting: Writer "Davx Skxlton" shows Alberta Calls readers (AGT Limited employees) what happens when just one member of a team fails. Using the letter "x" wherever an "e" is needed, he begins with the headline: "Your contribution is kxy." He summarizes, "So, if you think you arx just a small cog in a big whxxl, rxmxbxr it takxs all xighty-fivx kxys for your computxr to bx xffxctivx. And it takxs xach of us at AGT, working as a txam, to bx xffxctivx."

- Larry Perrine (845-8511, MS 0129)

More Sandians, contractors disciplined in Web misuse probe

Several more employees and contractors have been disciplined for using their Labs computers to view sexually explicit material through Sandia's World Wide Web server.

The Aug. 18 *Lab News* announced that Labs management had identified as many as 64 Sandia employees, contractors, and temporary hires who had repeatedly accessed Internet sites containing erotic and pornographic images during a nine-day period, from July 24 through Aug. 1. At that time, five contractors had been removed from their Sandia contracts and one Sandia employee had been placed on administrative leave pending a hearing before Sandia's Disciplinary Review Committee.

As of *Lab News* press time Wednesday, the following disciplinary actions against 29 staff members and 20 contractors had been determined:

- Five employees are serving four-week suspensions without pay,
- Twelve employees received one-week suspensions without pay,
- Five employees were given letters of reprimand,
- Seven employees will receive warning notices,
- Seven contractors were removed from their current Sandia contracts, and
- Thirteen contractors were disciplined by their non-Sandia employers.

These figures include the previous disciplinary actions reported in the Aug. 18 issue. No employee has been terminated for accessing sexually explicit material.

Appropriate Web use encouraged

Don Blanton, Director of Human Resources Center 3500, says although the investigation of Web misuse is continuing, "we think we've seen the bulk of the disciplinary suspensions."

A number of other employees whose violations appear to be less serious may still be subject to disciplinary action, however.

He says the severity of each person's disciplinary action is based on the frequency of Web access and amount of time spent viewing prohibited material during the monitoring period.

Disciplinary actions were considered on a case-by-case basis by the Disciplinary Review Committee prior to any employee's name being paired with the offenses. Senior management reviewed and approved the basic disciplinary approach. Ethics Center 12700, Auditing Services 12800, and Human Resources Center 3500 then continued the investigation, involved the appropriate line management, identified the employees or contractors involved, and followed through with the appropriate disciplinary measures.

Because of the number of people involved, Don says, such a corporate approach was necessary to ensure Labs-wide consistency and timeliness.

Computer Security has begun periodically monitoring Sandia Web transactions and is blocking accesses to some Internet sites that contain sexually explicit material.

But recent events shouldn't discourage Sandians from using the World Wide Web for work purposes, says Ethics Director Jack Dickey (12700). "The Web is a wonderful communication tool that Sandia employees are being encouraged take advantage of," he says. "We just need to be aware of the standards of conduct expected of us by the taxpayers, by DOE, and by Sandia."

For guidance on appropriate Web use, see the "Appropriate Web Use" link on Sandia's internal Web homepage. — John German

Sandia LabNews

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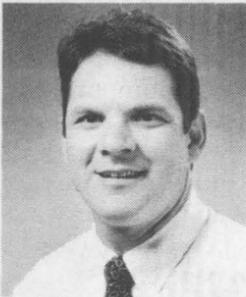
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LOCKHEED MARTIN

Employee death



MARK CALVIN

Mark Calvin of Energy & Environment Sector & Management Support Dept. 10403 was killed Sept. 2 in a mountain climbing accident on North Maroon Peak near Aspen, Colo.

He was 39.

Mark was an

MLS and had been at Sandia since 1980.

He is survived by his wife, Tana (2010), his parents, two brothers, and a sister.

A memorial will be established on Mark's behalf. Donations to the Mark Calvin Memorial can be made at the Sandia Laboratory Federal Credit Union, at either the Kirtland or Juan Tabo branch.

The *Lab News* is printed on recycled paper and can be recycled again along with regular white office paper.



California company licenses Sandia software for detection of breast cancer

Designed to identify virulent star-shaped lesions

By Julie Clausen

Media Relations Dept. 12621

R2 Technology Inc., a medical device company in Los Altos, Calif., has licensed software developed at Sandia for use in breast cancer detection.

R2 Technology expects to incorporate Sandia's software into its product — the ImageChecker™ — a computer prompting system for assisting radiologists in the reading of screening mammograms for all types of breast cancer lesions. The ImageChecker™ would flag areas of suspicion on mammograms for the attention of radiologists, allowing them to double-check their own evaluations.

Breast cancer will afflict one in nine American women, and it can be more successfully treated with early intervention. Mammograms — X-rays taken of the breast on machines specifically designed for that purpose — can detect cancers long before they can be detected in physical examinations. Recently, however, concern has arisen over the accuracy of mammography and of radiologists' ability to accurately read the films, especially when they may read 100 to 200 films a day.

The software is designed to scan digitized X-ray films for "spiculated" lesions. These spiky distortions in breast tissue represent particularly virulent cancer, and are one of the primary signs that radiologists look for during mammography screening. Star-shaped distortions in breast tissue are difficult to detect because of their subtle and varied appearance. The software analyzes digitized X-ray films for visual features common to cancerous lesions in the breast. If found, these areas are marked for further scrutiny by a radiologist.

The software, developed by Philip Kegelmeyer of Sandia's Scientific Computing Dept. 8117, originally arose from Sandia software developed for target recognition. Philip created the core screening algorithm after he observed how doctors spot cancers and translated their techniques into a method a computer could use.

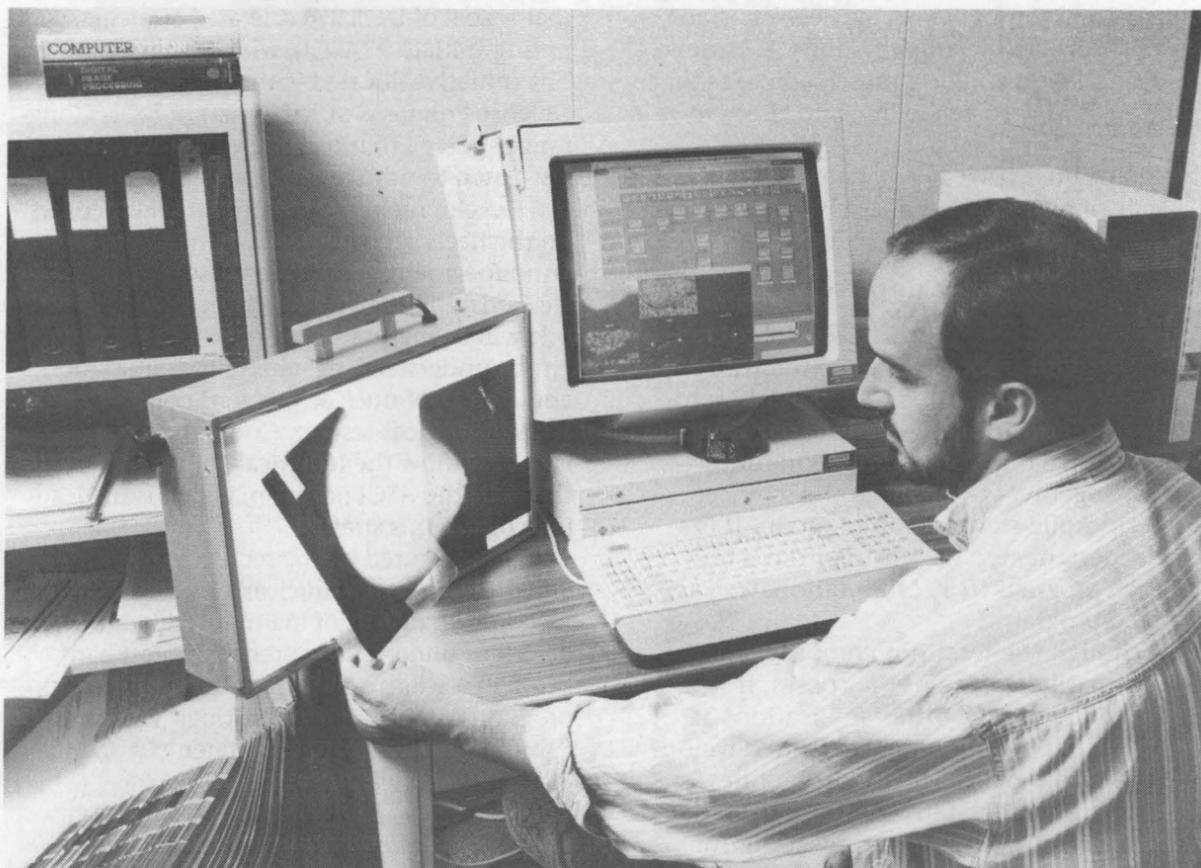
Sandia's software employs a new feature for recognizing such lesions and a different statistical method for analyzing image information. The core algorithm, ALOE (Analysis of Local Oriented Edges), is a powerful and new method for describing radial textures. Using these features, the computer is able to detect subtle changes in the visual texture of the image.

A retrospective clinical study of this technology, published in *Radiology*, indicated that it can help doctors find one additional cancer in 10 without calling for any additional biopsies.

"By improving the accuracy and efficiency of mammogram analysis, computers can help reduce costs and promote more widespread screening," said Philip. "This goes hand-in-hand with early detection, which is the most effective means of fighting this disease."

He says applying his knowledge to a procedure that can save lives was particularly gratifying.

Since developing the technique, he has been broadening the image analysis algorithm to detect the two other signs of cancer captured in mammograms, mineral deposits called microcalcifications and masses called circumscribed lesions. "The purpose is to have one solution for all types," Philip says. Postdoctoral



SCANNING — Computer software may soon assist radiologists in checking mammograms for suspicious lesions, with an algorithm licensed from Sandia to medical device company R2 Technology. The algorithm was developed by Philip Kegelmeyer of Scientific Computing Dept. 8117.

employee Bennett Groshong (8117) is central to this follow-on effort.

R2 Technology is a medical devices company founded in 1993. The company plans to market the ImageChecker™ in the US after

obtaining Food and Drug Administration approval. However, several European companies are negotiating with R2 Technology for distribution rights in Europe, and so it may become available there before it is marketed in the US.

Sandia California News

Sandia in the News

This is a periodic column listing a selection of recent print and broadcast news reports about Sandia. It is provided by Media Relations Dept. 12621 to give Sandians a sense of what is being said about Labs work in national and international media.

Nature's recent article about issues surrounding funding for technology transfer work at the national labs mentioned that Sandia has "a strong tradition of collaboration with industry." Warren Siemens (4200) was quoted, and a photo showed work being done on airbags for new cars.

A lengthy *R&D Magazine* article on the use of thin-film technologies to create new microsensing devices mentioned recent upgrades to Sandia's wide-range hydrogen microsensor, a 1993 R&D 100 award winner. The upgrades include analog and digital circuitry and sensor arrays.

Science News ran a cover story on cooperative research between US industry and the national labs. The cover featured a photo of Walt Disney fireworks with the caption "Funding Fireworks." The article reported on Sandia's work with Buena Vista Pictures to develop a faster, more precise way to ignite fireworks for Walt Disney Co.

An article on Sandia's segmented rail

phased induction motor (Seraphim) train also ran in *Science News*. There was a drawing of the train, and Barry Marder (1241) was quoted.

New Scientist ran an article on Sandia's work with San Juan Pueblo to develop low-cost solar dehydrators and solar-heated ovens.

Business Week recently included mention of Sandia/California in its "Developments to Watch" column. Specifically cited: Sandia/Cummins studies of how diesels burn fuel.

Several news organizations reported the appointment of Ruth David (1090) to the CIA post of deputy director for science and technology. Coverage included: the *Los Angeles Times*, *Newsday*, the *Chicago Tribune*, *The Washington Times*, and *The Associated Press*.

The New York Times ran a lengthy article on less-than-lethal weapons, saying that "law enforcement is emerging as a virtually untapped arena for high-tech wizardry. Laboratories are cooking up new weapons." Sandia's work developing sticky foam and the smart gun were discussed.

The Associated Press carried a story on Sandia's Science Advisors (SCIAD) program, quoting Sheri Martinez (3613), a Sandia program coordinator, and Lynn Ritchie (12913), a Sandia scientist and SCIAD instructor. The article discussed the program's hands-on teaching emphasis.

— Kathy Kuhlmann (12621)

Supercomputer

(Continued from page 1)

deterrent without underground testing."

"President Clinton is committed to ending underground testing," says Vic Reis, Assistant Secretary for Energy Programs at DOE. "Computer simulation will be a principal means for ensuring the safety, reliability, and effectiveness of the US nuclear deterrent. We are embarking on a 10-year program to advance the state of high-performance computing to meet national security objectives."

'Virtual' testing for deterrence

Adds Sandia Director C. Paul Robinson, "The teraflops computer is an extraordinary opportunity for the three weapons laboratories in DOE — Lawrence Livermore, Los Alamos, and Sandia national laboratories — to work together on behalf of the science-based stockpile stewardship program. It is a very important step in shifting from a test-centered program to a computational-centered program."

Although the teraflops computer will be used primarily for defense purposes, it will have a wide range of other applications as well. Those applications range from developing safer and more efficient automobiles, creating a better understanding of global climate change, finding new drugs to fight disease, designing molecules and developing new materials, to simulating natural disasters more quickly than in real time.

The need for computational weapons testing — virtual testing — stems from the moratorium on nuclear testing, termination of new weapons development, and the closure of many weapons programs facilities. This kind of simulation can reduce and sometimes replace

costly scientific and engineering experiments, yet provide scientists with the data necessary to understand the response of systems.

Accelerated computing initiative

Development of the teraflops-class supercomputer and the application software is a major goal of DOE's Accelerated Strategic Computing Initiative (ASCI), which begins in FY96. The initiative, located within the department's Defense Programs office, is part of DOE's long-range strategy to move nuclear design from a test-based to simulation-based approach.

Development of the computer also comes on the heels of the Clinton administration's announcement of a science-based stockpile stewardship program, in which the US stockpile will be maintained through enhanced scientific understanding, analysis, examination, and retrofit of nuclear weapons components without nuclear testing. Computing and simulation are now the technical approach and the thrust of the ASCI program, which is the leading edge of this strategy.

"I am assured by the secretary of energy and directors of our nuclear labs that we can meet the challenge of maintaining our nuclear deterrent under a [comprehensive test ban] through a science-based stockpile stewardship program without nuclear testing," President Clinton said in his Aug. 11 statement about ending all nuclear testing.

Sandia, Los Alamos, and Lawrence Livermore will develop the application software for the teraflops computer in order to conduct nuclear weapons simulations and stockpile evaluation. In addition to virtual testing, these computations are aimed at determining the effects of long-term aging on the nuclear stockpile. Most weapons require periodic maintenance, such as replacing limited-life components. Sandia is responsible for the design, certification, and assessment of the nonnuclear

A new level of computing

The teraflops computer will bring computing to a new level. Tera means trillion, and flops is floating point operations per second. Therefore, teraflops is a trillion floating point operations per second. Peak performance of the new teraflops computer actually will be about 1.8 teraflops, or 1,800,000,000,000 floating point operations per second. Today's most powerful computers are measured in gigaflops. Giga means billion. The current world record for computing speed is 281 gigaflops, achieved last December by a team of scientists from Sandia and Intel (*Lab News*, Jan. 6, 1995). The team linked two of the largest Intel Paragon computers to establish the record.

The difference between gigaflops and teraflops is represented by the difference between a round trip flight between New York and Boston and a round trip flight between Earth and its moon.

Says Gil Weigand, DOE's deputy for computing and manufacturing programs: "Development of such a machine is considered by some to be in the same category of importance as landing a person on the moon. It's a major step toward the larger challenge of virtual testing for nuclear weapons and other similarly complex problems."

components of US nuclear weapons and for the system integration of nuclear weapons with their delivery vehicles.

Also, it is impractical to physically test the response of weapons to different and simultaneous environments over a wide range of parameters such as a lightning strike during a crash and fuel fire. In these cases, computer simulations are the only means of comprehensive testing.

Sandia pioneered parallel computing

"The research partnership with Intel Corp. fits in very well with Sandia's long-term program in high-performance computing," says Ed Barsis. "Our program emphasizes applications software across a wide range of disciplines, algorithm development for large-scale parallel machines, and networking expertise for sharing the resource with our DOE partners. The DOE partners working together on science-based stockpile stewardship is a dynamite combination that promises to advance computational science in many disciplines."

Sandia has been instrumental in the development of parallel supercomputing and its applications. Sandia first captured national attention for its work in massively parallel processing in March 1988 when it won two supercomputing prizes: the Karp Award for demonstrating unprecedented speedups using processors working together compared to processors running separately; and the Gordon Bell Prize for achieving a thousandfold speedup on three engineering problems analyzed with 1,024 processors working in parallel.

Until that breakthrough by Sandia, most computer scientists believed using even thousands of processors could speed up problem-solving by no more than 50 to 100 times the rate of a single processor. Over the years, Sandia has demonstrated a particular expertise for developing mathematical methods, algorithms, and software that are required for large-scale parallel processing.

Two years ago, Sandia helped demonstrate
(Continued on next page)



SKY-WATCHER — Planetary astronomer Heidi Hammel of the Massachusetts Institute of Technology's Department of Earth, Atmospheric, and Planetary Sciences talks with science students at Adams Middle School in Albuquerque Sept. 8 in an informal visit arranged by Sandia's Education Outreach Dept. 3613. The students are participants in the Math, Engineering, and Science Achievement (MESA) program and the Earth Shuttle program, a corporate-sponsored science club. Hammel, head of the Hubble Space Telescope team that investigated Jupiter's atmospheric response to the collision of Comet Shoemaker-Levy 9, came to Sandia Sept. 7 to deliver a colloquium on that catastrophic collision. Mark Boslough (1433) and Bill Tedeschi (5161) hosted the colloquium. She gave a lively, first-person report and showed photos demonstrating what she called a "remarkable" correspondence between Sandia's computer predictions of visible plumes from the collision and her team's space telescope images of the plumes. Hammel was lead author of the report in *Science* (March 3, 1995) on imaging of atmospheric phenomena from the impact and was featured in *Parade* magazine's July 16, 1995, cover article "The Women Who Watch the Sky." She also has a guest editorial in the current *Sky & Telescope* about how the comet impact has helped instill interest in science among young people, especially young women.

Tiny engine

(Continued from page 1)

the effort to build the millimeter-square engine and its even tinier gearing.

"Our idea here was to develop a generic micromotor that has a gear output, so people see there is a power source they can hook up an application to," says Jeff. "This device works, and works well."

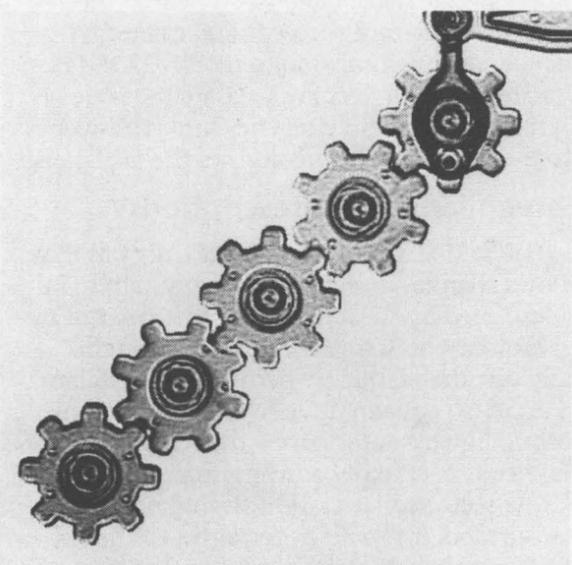
This is just the latest pioneering advance in micromachines from the group. Late last year, they reported creation of the world's fastest engine (*Lab News*, Dec. 16, 1994). Two years ago their creation of a micromechanical actuator that was the world's smallest steam engine (*Lab News*, Sept. 3, 1993) generated international interest.

Smaller than a human hair

In the video of the new micromotor, the large wheel, which has two holes, functions as an optical shutter because a beam of light can pass through its openings in some positions but not others.

In other video footage, the smaller gear — smaller than the diameter of a human hair — turns two similarly sized gears at the rate of 200,000 revolutions per minute.

Driving multiple gears, Jeff says, is "a reasonable demonstration that we can drive other structures. I'm hoping that in the next several months, we'll have a reliable enough micro-engine that when you want it to start up, it



THIN ENGINE — A microengine-driven gear train. Each of the gears is a hundredth the thickness of a sheet of paper. The microengine devices are built entirely by microelectronic fabrication techniques at Sandia.

(Continued from preceding page)

that an accident resulting in an exploding rocket motor from the Trident delivery system would not cause a nuclear detonation safety problem. This year the work was extended to include the effects of extensive fragmentation — a problem generally considered to be intractable on anything but the most powerful massively parallel computers.

Last year, Sandia's calculations on the Paragon massively parallel computer were credited with alerting the astronomical community that the impact of comet Shoemaker-Levy on Jupiter would be visible from Earth. Sandians also developed supercomputer models that suggested that very large eruptions of basaltic lava in Earth's past could have been caused by a large interplanetary body striking the planet at a point exactly halfway around the globe. Sandia also received a second Gordon Bell Prize for supercomputing last year.

The teraflops computer hardware will consist of about 9,000 (two at each of 4,500 nodes)

How the micromotor is built

The Sandia microengine and gearing extend a micromotor construction technique first developed at the University of California at Berkeley.

The basic batch process — which, when perfected, should leave behind thousands of fully assembled, operational microengines — begins on a silicon substrate.

Researchers deposit a layer of electrically insulating material and then a film of polycrystalline silicon — patterned to form electrically conducting lead-ins. Atop these is a layer of "sacrificial" silicon dioxide, so called because it serves as a support layer only while the remainder of the structure is built. When the silicon dioxide is removed by sev-

eral etching processes, openings through the oxide allow the next applied layer of polysilicon to anchor to the insulating layer on the substrate.

The process forms vertical axles for gears and elastic supports for the engine. Other layerings and removals of the oxide free gears and linkages. During these steps, researchers add another substance, silicon nitride, which is hard but smooth and functions as a kind of grease to let the gears turn more freely.

As a final step, researchers add hydrofluoric acid to remove all the sacrificial silicon dioxide supporting layers.

runs, and it runs with a useful long life." So far, several hundred million rotations have been demonstrated by the smaller gears.

The motor, which develops 0.5 microwatts of power delivered through a gear 50 microns in diameter, could be used to operate tiny micromedical pumps that function as drug delivery systems internal to the body, and to act as low-cost, high-performance gyroscopes that could have a dramatic impact on the design of future automobiles and military systems.

By intention, researchers built the micromotor with etching processes and silicon materials already in use by the microelectronics industry, so that mass production of the motor should be relatively easy.

Not easy meshing gears this tiny

"We're using microelectronic facilities. We just create mechanical in addition to electrical devices," Jeff says. "Batch fabrication, with parts fully assembled by the end of the process, is what we've achieved."

The device is the first micromotor to be built with three levels of polycrystalline silicon — a jumbled version of ordinary silicon. The first level contains the engine, the second the gears that the engine drives, and the third the linkages that connect the engine to gears or other linkages, said Ernie, a primary designer of the electromechanical components.

"It's not easy, meshing gears that are that tiny," Paul says. "Imagine trying to make gears out of something a hundred times thinner than a sheet of paper and aligning them to the right height to turn each other."

Because the Lilliputian motor and gearing

has much less mass than its macro-world counterparts, it can survive impact better and thus has defense applications, Ernie says. The research is supported by a DOE Defense Programs grant.

Microworld friction different?

"Our next step is to get a lot more detailed characterization of the mechanics of operation," says Paul. "At this small a scale, we not only don't know the 'coefficient of friction,' for example, we don't know whether science's usual model of friction holds up." In the macro world, "coefficient of friction" refers to a predetermined number that helps quantify the friction value of a material.

Other micromachines exist that are able to turn gears at a distance, but the machines are fabricated by more complex means than simply etching silicon. They also may require inclusion of other production techniques such as plating and assembling. The additional procedures would hinder rapid production and possibly make the result less reliable in performance.

Still other laboratories have attached mechanisms that function as part of the motor and can do specific tasks. This is different from a self-contained motor that, choiceless as a purchase from a hardware store, can be hooked up to perform any task within its power range.

Other micromachines drive rods by a succession of impacts. The rods function as pistons. Because these pistons are not directly linked to the motor, when a load is applied — a wind, an impact, or an increase in friction — they may fail to deliver steady, continuous power.

Millimotors, which power disk drives, are bigger by several orders of magnitude than the Sandia micromotor.

The motor consists of two tiny silicon combs with a shuttle placed between them. The edges of the shuttle form combs with teeth that interdigitate with those of the stationary combs. The stationary combs, energized by on-off electric voltages, alternate pulling the shuttle by an electrostatic attraction similar to that which causes a balloon to stick to a shirt, or dust to a TV screen.

An attached shaft turns a drive gear a quarter circle during the shaft's power stroke. Another comb-drive engine, at right angles to the first, is timed to turn the gear on the second quarter of its rotation. The two drives, alternating their forces, turn reciprocating motion into rotary motion to drive the gear completely around.

Electronic circuits that are not part of the micromotor chip drive the motor. Sandia researchers are working to place control circuitry next to the microengine, and to develop a single chip with circuits and machines fabricated side by side.

P6 processors, Intel's forthcoming microprocessor and successor to the company's Pentium chip. The P6 is a scalable processor that will be used in desktop systems, workstations, and large-scale parallel servers. The computer will have 262 gigabytes — more than a quarter of a terabyte — of system memory. This is the equivalent of about 200,000 books. The larger the memory the larger the problems that can be tackled. The total processor-to-memory bandwidth is sufficient to enable the equivalent of 300 million simultaneous telephone calls, one by every person in the US at the same time.

Within the next four weeks Sandians will participate in tests on prototype boards at Intel's supercomputer facility in Beaverton, Ore., and in about three months the first small assemblage of processors will be linked together and checked.

"I think it's exciting," Ed says.



Crawford, Narath testify on behalf of labs in Washington

'The best scientific and engineering labs in the federal government, perhaps even in the world'

New Sandia Deputy Director John Crawford and immediate past President Al Narath spoke out strongly on the value and vitality of the national laboratories in invited testimony in Washington Sept. 7 to two subcommittees of the House Committee on Science.

Both strongly defended the multi-program model for the labs and warned against overly proscriptive limitations that might diminish their ability to flexibly tackle important problems.

The joint hearing by the Subcommittee on Basic Research, chaired by Rep. Steve Schiff, R-N.M., and the Subcommittee on Energy and Environment, chaired by Rep. Dana Rohrabacher,

R-Calif., was held in response to four House bills that chart vastly different possible futures for DOE and its national labs. DOE Deputy Secretary Charles Curtis and proponents of each of the bills —

several of which would abolish or drastically curtail DOE — also spoke. So, too, did the directors of the other two DOE nuclear weapons labs.

"In all the criticism that has been leveled at DOE and its laboratories," said John in his subcommittee testimony, "the quality of their technical work has never been at issue. The Department of Energy still maintains what are widely regarded collectively as the best scientific and engineering laboratories in the federal government, perhaps even the world."

He urged caution in considering proposals for changing or restructuring the labs.

Whatever strategic realignment is made in the DOE laboratory system, John urged that two principles be kept in mind: the importance of the multiprogram model of research and development (R&D) management, "which adds synergy and depth to the R&D environment," and the "imperative" of collaborations and partnerships with industry and academia.

Labs' role unique

He also urged the subcommittee members to consider the "unique role" of the DOE laboratories in the federal R&D system: "No other set of agency laboratories in the federal government succeeds so well in integrating the spectrum of research, development, design, and production support as is routinely done in the DOE laboratories," he said.

"Our record of technical innovations and

Four bills, four vastly different futures

The four bills being considered by the House Science Committee's Basic Science and Energy and Environment subcommittees offer different plans for achieving a strategic alignment of the DOE laboratory system. Here are the four bills, with Al Narath's thumbnail description of their central tenets:

H.R. 1510, the "Department of Energy Laboratories Efficiency Improvement Act," would mandate a workforce reduction of one-third at the DOE laboratories within 10 years. H.R. 87, the "Department of Energy Laboratory Facilities Act," would create a commission to review and modify (if it sees fit) recommendations by the secretary of energy for laboratory reconfiguration and closure. Title II of H.R. 1993, the "Department of Energy Abolishment Act," is similar to H.R. 87 in this regard, but it stipulates further that privatization may be considered as an option for the laboratories, in addition to reconfiguration or closure; and, as the bill's title implies, these actions would be taken as part of a larger plan to dismantle the Department of Energy altogether. Finally, H.R. 2142, the "Department of Energy Laboratory Missions Act" (sponsored by Steve Schiff), would permit the secretary to streamline the laboratory system in the context of a comprehensive analysis and reassignment of missions to facilities.

integration to provide system solutions to important national problems is unrivaled. This is a unique attribute that you should seek to enhance, rather than diminish, as you ponder options for the DOE laboratory system."

Al Narath, testifying for the first time as President of Lockheed Martin's new Energy and Environment Sector (which oversees the company's management responsibilities for Sandia and Oak Ridge national labs and Idaho National Engineering Laboratory), said any realignment of the labs should be based primarily on consideration of their missions, not management efficiency issues.

He said DOE is making "good progress" and achieving "encouraging results" in cutting costs, eliminating layers of management, and reforming its directives system. The latter effort,

And, says John, he urged the labs to focus on adding value — as defined by their customers.

Since these are all goals that resonate well with how the labs see their own role and future, John and the other lab representatives were pleased.

"I came away with the impression that there is strong support for science in Congress and that the labs are respected, but that they are expected to become much more cost effective in the future," John says.

In addition to Narath and John (filling in for Sandia Director C. Paul Robinson, who was in Europe), the directors of Los Alamos, Lawrence Livermore, Oak Ridge, Argonne, and Idaho national labs all participated. So, too, did several congressmen, including Schiff and Rep. Bill Baker, R-Calif.

he said, "is likely to achieve real success in reducing onerous and inefficient regulations."

'Externally directed approaches'

"In short, I cannot agree with those critics who assert that DOE is incapable of improving itself," Narath said. "The changes we are beginning to see belie this claim. . . . Externally directed radical approaches are unlikely to achieve the desired outcome," he emphasized. "I think it makes sense, for the time being at least, to let DOE continue to push its program of internal change."

Narath reminded the panel members he had appeared before them in March and June as Sandia's president. He said Lockheed Martin's perspectives are consistent with views he gave at that time. He offered what he called "candid views" on the four bills (see "Four bills, four vastly different futures") and other issues on which his opinion had been solicited.

Of the bills, Narath, like John Crawford, voiced strong preference for H.R. 2142, "the only bill that makes an attempt to explicitly define the core missions of the DOE," Narath said. (Those missions: national security, energy R&D, basic research, and environmental R&D and technology.) The bill would give the secretary of energy "the opportunity to succeed or fail based on the merits of his or her own initiatives and proposals," Narath said. Two of the other bills, he said, "tacitly assume that the department cannot succeed" and call for an independent commission to modify DOE's plan.

He called for keeping separate the issue of DOE's management efficiency and effectiveness from the issue of the missions of the DOE labs.

Forego 'arbitrary prescriptions'

He said H.R. 2142 is also the only bill that allows changes to the laboratory system to be determined by "best business practices, not by an arbitrary prescription." And it's also the only one that explicitly permits the DOE labs to establish collaborative relationships. "The technology bases for government and commercial needs are rapidly converging," he said. "Cross-sector collaboration should not only be encouraged, it should be required. . . ."

Nevertheless, Narath expressed at least one reservation about H.R. 2142 — a requirement that specific missions be assigned to each laboratory. "I fear this exercise may result in rigid and impenetrable barriers between the laboratories such that they cease to continue progress toward becoming an effective 'System of Laboratories,'" Narath said. Mission assignments "must not be overly detailed and proscriptive."

He said Congress should provide general mission guidance, but laboratory mission assignments should be made by "those who are directly responsible for managing the laboratory system," not by an independent facilities board.

Narath also voiced strong opinions about a proposal (Title V of H.R. 1993) to move the DOE defense programs laboratories to the Department of Defense. He called the proposal "very unwise." The dual-agency process for developing nuclear weapons has served the nation well, he said. "This independent role has allowed the civilian agency and its laboratories to be advocates of safety and other improvements, even when opposed by a reluctant military."

"If we observe these principles as we make changes in the laboratory system, I believe the DOE national laboratories will continue to perform to the highest world standards of research and development in the decades ahead," Narath concluded.

— Ken Frazier

Gingrich

(Continued from page 1)

support for DOE and its national laboratory system, both under strong political attacks from certain members of Congress. It came one day after joint congressional hearings, chaired by Schiff, about the future of DOE and the national labs (see story above).

John says Gingrich concluded with "four challenges for the labs and for the country":

- Be on the cutting edge on defense
- Be on the cutting edge on knowledge
- Systematically bring science to government
- Maximize our speed in getting science to product

Rear Admiral Charles Beers presents DOE weapons awards to more than 150 Sandians

More than 150 on-roll and retired Sandians were honored at the DOE Weapons Recognition of Excellence Award ceremony Aug. 15.

This award was established in the early 1980s by Maj. Gen. Bill Hoover, Deputy Assistant Secretary for Military Applications (DASMA) at DOE, to give special recognition to people exerting extra effort to modernize the stockpile. "Traditionally," says Roger Hagen-gruber, Vice President of Defense Programs Div. 5000, "a DASMA flag officer presents these awards to people who have made exceptional contributions to the day-to-day operations of weapons programs."

Sandia Lab Director C. Paul Robinson, as one of his first official duties as Sandia's top official, delivered the opening comments at the ceremony and said he was delighted that people who have committed their lives and careers to the weapons program were being honored.

Roger gave his views of the DOE Weapons Recognition of Excellence Program to the *Lab News*:

"These are tremendously challenging times for the nuclear weapons programs. The budgets have dropped by some 50 percent. We have not had a weapons development activity underway for several years now. Plants have been closed, colleagues have retired, and the future is murky.

"But the one thing that is clear is that Sandia and the other laboratories are expected to stand strong in support of stewardship of both the stockpile and the human expertise. These awards serve, then, two purposes: (1) They reward exceptional contributions in stewardship of the stockpile, and (2) they remind us of the singular responsibility and importance of the work that we do for our neighbors and our country.

"I am especially proud to be associated with people of the quality that we find in the weapons program, and I believe the Labs should be proud of the value and the contributions they have made."

Rear Adm. Charles Beers, Deputy Assistant Secretary of Energy for Military Applications and Stockpile Support, was the special guest of the event and presented the awards. "You should all be extremely proud of your achievements," Beers told recipients. "You are the cornerstone of success of this complex, and this nation owes you all a great debt of gratitude." Beers will be leaving DOE soon to return to the Navy as Commander of Submarine Group 10 (a Trident group), and presenting the DOE awards last month was one of his last official DOE duties.

For weapons work done in FY93, the following people were recognized:

- For providing critical glass and averting production shutdown: Ernest Apodaca (2481), Raymond Baldonado (8414), Edwin Beauchamp (1845), Kathryn Blumberg (8411), James Brangan (1824), Richard Brow (1845), Robert Chambers (1517), William Chambers (1824), Carla Chirigos (2403), Eric Detlefs (14466), Patrick Farina (ret.), Frank Gerstle (2476), David Goy (14081), Peter Green (1845), James Handrock (8742), Larry Kovacic (2476), Robert Lewandowski (former Sandian), Von Madsen (2507), John Matsko (ret.), Howard McCollister (14466), Ted Montoya (2476), Roger Moore (2476), Don Oatley (2476), John O'Connor (8414), William Packer (14081), Carol Phifer (4112), Richard Pike (2561), Scott Reed (2476), Steven Rospopo (2476), Ronald Snidow (ret.), Ronald Stone (2476), Edward Thomas (12323), Daniel Tichenor (8413), Anton West (8414), Anthony Wingate (14308), and Jude Worden (2481). Other recognized team members from Martin Marietta Specialty Components Plant in Pinellas



QUENTON MCKINNIS, of Advanced Weapon Systems Engineering Dept. 5354, receives the W89 Instrumentation System Team's award from Rear Adm. Charles Beers at the DOE Weapons Recognition of Excellence Award ceremony last month. The 46-member team, mostly from Sandia/California's Electronic & Mechanical Engineering Center 8400, was recognized for "excellence in quality of design and implementation of the W89 Instrumentation System."

Fla., included current employees Fred Alberg, Juan Cubero, Walter McCracken, Peter Pfannerstill, and former employees Henry Bundy, Ray Cole, Melvin McKeel, William Royals, and James Taylor.

- For an original neutron tube aging theory that has impacted both stockpile performance and Complex 21 planning: Gerald Smith (2564).

- For significant achievement in realized cost savings while providing increased quality in the STRATCOM Secure Recode System: Janet Bauerle (5121), James Buttz (5123), H. Daniel Caton (2612), Chester Claghorn (5123), Manuel Contreras (ret.), Thomas Denman (5123), David Gelet (2612), Richard Guilford (ret.), Charlie Jenkins (9249), Ronald Kulju (2612), Shawn Leslie (2612), J. Douglas Mangum (5121), James McCoy (2612), Randolph McWilliams (2612), Nadine Miner (2121), Robert Reed (5121), and John Tenbrink (ret.).

- Individual award for her service as a chemist and materials compatibility expert in the support of nuclear weapons development and production for the past fifteen years: Bernice Mills (8713).

- For excellence in quality of design and implementation of the W89 Instrumentation System: Vern Barr (8417), John Becker (8416), Bob Bedford (ret.), Mike Bell (8416), Jim Berg (8411), Scott Carichner (8111), John Chavarria (8644), Dean Clark (8416), Curt Cofield (8413), Chuck Comroe (8413), Ken Condreva (8416), Mike Daniels (9427), Everitt Davis (8417), Tim Eklund (former Sandian), Bill Forbes (8413), Bob Franssen (5364), John Freie (8416), Steve Gray (8632), Art Hull (8416), Les Jones (ret.), Gary Kirchner (8411), Trish Larson (8644), Rigo Ledezma (8417), Mark McConkie (8413), Quenton McKinnis (5354), Jamie Meacham (former Sandian), Bob Miller (8416), Glenda Mohrman (8417), Jeff Moore (8533), Glenda Muir (ret.), John Nash (8416), Ken Nunez (5362), Bill Peila (8411), Jim Reitz (8417), Chuck Sage (8417), Max Schell (8416), Steve Schwegel (8271), Gary Simpson (8417), Mike Stewart (former Sandian), Dave Stimmel (8413), Joe Trembl (ret.), John Warmouth (8417), Rick White (8411), John Williams (ret.), June Winter (8416), and Dan Yee (8417).

- For exceptional performance as a project leader in nuclear weapons system design: Mark Rosenthal (5167).

- For a major teaming effort for the design, testing, certification, and fabrication of the AL-SX tritium reservoir container system: Myra Chavez (9900), Lynn Fitzpatrick (10233), Jerry Freedman (5165), Dale Hill (5165), Dave Humphreys (5165), Brian Joseph (5165), Mark Kincy (2172), Ramon Pacheco (5165), Robert Stinebaugh (5165), Allen York (5165), and Vincent Zarrella (2486).

For weapons work done in FY94, the following people were recognized:

- For the design, development, and stockpile stewardship of the Integrated W88 Nuclear Warhead/Mk5 AF&F: Donald Tipton (5151).

- For outstanding support of the DOE Nuclear Weapon Complex Reconfiguration Planning Activity: Frank Bacon (ret.), Gary Beeler (14000), Bill Cleland (10402), Tom Cutchen (2506), Dick Damerow (2564), John Gronager (5206), Ken Grothaus (2523), Carol Meincke (7913), Larry Pope (14466), Gerry Record (10250), Harry Saxton (5400), Ron Snidow (ret.), and Charlie Spencer (2561).

- For conducting a nuclear weapon stockpile life study: Garry Brown (4111), Frank Muller (4101), James Parvin (4112), Robert Paulsen (4117), and Tommy Woodall (4117).

- For magnetically insulated transmission of high-power electromagnetic pulses technology: Dillon McDaniel (1273), Clifford Mendel (1273), James Poukey (1241), Mark Rosenthal (5167), David Seidel (1241), Steven Shope (1221), Stephen Slutz (1241), Regan Stinnett (1205), and Pace VanDevender (4700).

- For excellence in conducting US DOE neutron vulnerability tests on nuclear weapons fissile components in the Sandia Annular Core Research Reactor: James Bryson (14602), Larry Choate (5151), Richard Coats (14600), Philip Cooper (contractor), Theodore Luera (14604), and Jeffrey Philbin (14605).

- For the development of a quality process to establish the compatibility of nuclear weapons with required carrier aircraft: Lawrence Johnson (9621), Kenneth Payne (9621), and Andrew Rogulich (5147).

- For implementing conduct of operations and quality principles in the Radiation Test Program: Gerald Zawadzka (9302).

- For the timely and successful solution to the W79 "sticker": Edward Cull (8415), Jerry Fordham (8284), Danny Mitchell (5362), Richard Shimada (5362), and Karl Wally (8111).

- For outstanding contributions in support of the Deputy Assistant Secretary for Military Application and Stockpile Support, and the Office of Weapons Surety during the conduct of the DOE Assessment Project: Mark Bleck (5123), Dick Burcham (5123), Douglas Cotter (5161), Byron Gardner (5845), Sally Kalembe (12333), Gary Richter (8114), and John Vonderheide (5931). Other non-Sandian team members: Peter Armstrong, Arnold Baker, and Richard Devine (all, DOE/Albuquerque Operations Office), Lester Luehring (Los Alamos National Laboratory, WX Division), John O'Brien and Richard Phillips (both DOE/Amarillo Area Office), Attila Papp (Battelle Pantex, Amarillo), Dennis Quinn (DOE/Nevada Operations Office), and William Tomany (Lawrence Livermore National Laboratory, L-777).

JIT completes tenth year, saves \$10 million annually

Many transparent 'value-added services' benefit customers

As Sandia's Just-In-Time (JIT) purchasing system marks its tenth anniversary, it is in a curious situation: It has been an overwhelming success, but not everyone realizes that. "The JIT system, even with its direct fees per transaction," says JIT Manager Billie Weatherly (10224), "continues to be less burdensome administratively [than other Sandia purchasing systems] and, therefore, is actually a better deal for the company overall."

Just-In-Time is a purchasing system that essentially commits Sandia to buy a line of items exclusively from one vendor; the vendor, in return, promises to stock and deliver the items as they are needed, often within a day of the request. Establishing JIT contracts streamlines requisitioning, buying, stocking, paying, and receiving processes; inventory is cut, and the productivity of the buyer and supplier is increased.

Sandia orders a wide range of products through JIT, including office supplies, chemicals, janitorial supplies, electronic parts, copy machine paper, plumbing materials, safety supplies, raw stock metals and plastics, general industrial supplies, and personal computers — workstations and peripherals.

Billie estimates JIT saves Sandia more than \$10 million annually in product and administrative process costs, compared with the old (pre-1985) General Stores system and the conventional Purchase Order (PO) system. JIT has placed 43 contracts and is considering 10 more. The system processes about 180,000 material requisitions valued at about \$52 million annually, and the vendors maintain an average 95 percent on-time delivery service level.

Also vital to JIT's success, says Dolores Hoffman, Director of Logistics Management Center 7600, is Sandia's Receiving/Distribution Services Dept. 7613, which always gets materi-



JIT ENTRY CLERK Martha Bertsch (10224) takes a phone order for JIT materials. Sandians can also place orders by "remote ordering" — ordering electronically by using the new keyword lookup system, which quickly searches contractors' stocklists and automatically inserts information onto a JIT order form. Remote ordering is gaining popularity with Sandians: it accounted for 23 percent of all orders placed two years ago and now accounts for 52 percent of all orders. JIT contractors may also accept orders directly from Sandia JIT customers.

als to recipients within 24 hours of receiving them. "We don't have a warehouse — JIT gets delivered to Building 957 today and delivered tomorrow," says Dolores.

Operation costs

Since 1993, funding for JIT has been excluded from Sandia's overhead, and JIT has needed to recover its whole operating budget from customers. JIT adds a \$16.50 transaction fee to each order (or \$12 for "remote orders" — orders the customer places directly via personal computer). JIT contractors are not receiving any part of the transaction fees, says Billie.

Many customers use alternate procurement methods, for example, their credit cards; then they voucher expenses to avoid paying the JIT transaction fee. "While some systems may appear 'free' because there is no transaction fee to the user, no system in which

administrative personnel are processing transactions, for example, vouchers, is actually 'free,'" says Billie.

Non-stock JIT items — ordered less frequently than stock items — pose a special problem: the JIT computer program, developed before the chargeback system was implemented, limits the JIT Material Requisition to a single non-stock item. Customers with multiple non-stock items should consider their total costs, including the cost of ordering, when deciding whether to order non-stock items through JIT or by Purchase Requisition (PR).

Chemicals and compressed gas cannot be ordered with a PR because all chemical and gas orders are channeled through the JIT contractor to support Sandia's Chemical Information System.

The JIT staff is evaluating the non-stock issue; the goal for new and re-competed contracts is to obtain more stock items, thereby reducing non-stock items.

How JIT saves Sandia money

In 1985, Kay Danforth (retired Sandia Procurement Manager) introduced the Just-In-Time purchasing system to Sandia.

Since then, much of the \$10 million annual savings can be attributed to:

- Elimination of warehousing — savings in space, inventory maintenance, inventory obsolescence, and inventory shrinkage costs.

- Elimination of invoice processing — JIT contractors are paid weekly using an automated, no-invoice process. "When comparing the JIT payment system to the countless invoices processed via a conventional Purchase Order system, the savings are quickly identified," Billie says.

- Automated receiving — The JIT system generates bar-coded labels applied by JIT contractors, which allow automatic identification of orders as they are received. "This allows twice as much JIT material to be processed by half the number of people versus the Purchase Order system," says Billie.

- Elimination of buyer intervention for normal transactions — Once a JIT contract is established, Sandians can place orders electronically (using the Laboratory Information System; see the July 3 *Weekly Bulletin* for information on the recently implemented keyword lookup system, which quickly searches contractors' stocklists and automatically inserts information onto the MR form), phone orders to JIT order entry clerks, or contact the JIT contractors directly to place orders. Buyer or contract administrator intervention is required only in exceptional situations.

- Redeployment of staff — "We now need half as many people to support the JIT system as supported the General Stores," says Billie.

JIT future plans

The JIT system is being used to solve some unique problems at Sandia, says Billie. It's helping track hazardous materials from-cradle-to-grave with the Chemical Information System. It will soon be used for ordering cellular phone hardware and phone air-time.

"PC training courses, such as Word, Excel, (Continued on next page)

Value-added services

"Sandia's JIT is a paradox: It's a system that just about everyone at Sandia recognizes by name but few people really understand," says Billie Weatherly, JIT Manager.

Many customers try to compare JIT pricing to prices available from mail-order houses, cash-and-carry warehouses, and other types of suppliers. "What most customers often don't consider are the value-added services inherent in every JIT contract," says Billie. "The goal of JIT is to obtain fair, reasonable, competitive pricing, but not necessarily the lowest price available anywhere in the market place."

JIT is operated on the concept of lowest effective cost, factoring in all value-added services the contractor must provide to accommodate the system. All JIT contracts are placed on a price competitive basis with at least 40 percent of the contract award being based on price and the balance being placed on the contractor's ability to perform (technical ability).

For example, all JIT contractors are required to provide at least one dedicated

contract coordinator who is available during Sandia working hours to assist customers. Most JIT contractors must commit to carry an inventory of stocklist items, some available in one day or less. Many JIT contracts are established with value-added services such as extended warranties, on-site or telephone technical support, and liberal, streamlined return policies. JIT contractors must produce and distribute stocklist catalogs at their own expense, and some provide full-time, on-site technical staff to assist requesters in determining their requirements.

"Also, many JIT contractors have partnered with Sandia to solve unique problems," says Billie. For example, Fisher Scientific (a laboratory chemicals supplier) and Tri-Gas (a compressed gas contractor) provide direct delivery of their products to reduce the rehandling of hazardous materials, bar code their materials, and enter data in support of Sandia's Chemical Information System. Albuquerque Valve and Fitting provides Sandians with required ES&H Pressure Safety Training at no charge.

Optional Long-Term Disability Plus benefits plan to be offered

Along with the Dental Deluxe Plan (Aug. 18 *Lab News*) and Long-Term Care Insurance (Sept. 1 *Lab News*), Health & Work / Family Benefits Dept. 3343 is announcing a third optional benefits plan for nonrepresented Sandians — Long-Term Disability Plus (LTD+).

These three new optional plans, along with the new Triple Option Plan (July 21 *Lab News*), are called Benefits Choices '96, says Dorothy Melloy (3343). The three optional plans considered separately make up the "+ Choices" part of Benefits Choices '96.

Long-Term Disability Plus offers additional benefits to replace part of a Sandian's pay if the Sandian becomes totally and permanently disabled, says Dorothy.

The current plan (the disability insurance paid by Sandia for all regular full-time and part-time employees) provides coverage for employees to receive a 50 percent monthly base salary benefit, offset by other income, if the Sandian becomes eligible for disability compensation.

The LTD+ plan gives employees the opportunity to purchase (through

employee payroll deduction) coverage to receive an additional 10 or 20 percent of their base monthly salary; this benefit is not offset by any other income such as Social Security, Sandia pension, etc.

During Open Enrollment — Oct. 20-Nov. 9 — nonrepresented, regular full-time and part-time Sandians with six months of service will be offered the option to purchase LTD+, says Dorothy. This plan will not be available to retirees. Represented employees are not eligible to participate in LTD+ at this time; any plan changes must be negotiated with their bargaining units.

This chart shows how LTD+ compares with current LTD coverage:

	Optional Long-Term Disability Plus (with 20 percent buy up)	Optional Long-Term Disability Plus (with 10 percent buy up)	Current Long-Term Disability Plan
Employee's monthly cost, deducted in weekly payments	30 cents per \$100 of monthly salary*	15 cents per \$100 of monthly salary*	None
Maximum monthly benefit	\$10,500	\$9,000	\$7,500

* Example: An employee with a \$35,000 salary would pay \$4.38 per month to participate in the Long-Term Disability Plus plan with a 10 percent buy up. Payments of about \$1.10 would be automatically deducted from each weekly pay.

(Continued from preceding page)

and Powerpoint, will soon be available to order directly from a JIT contractor at significant savings," says Billie. "The contractor pro-



EUGENE OWENS (7613) uses a bar-code scanner to check in JIT deliveries. JIT contractors apply bar-coded labels to their products, allowing the JIT computer system to automatically identify incoming orders. This system allows twice as much JIT material to be processed by half the number of people needed for the conventional Purchase Order system. JIT Manager Billie Weatherly (10224) estimates JIT saves Sandia more than \$10 million annually and says using bar-code scanning has contributed greatly to those savings.

viding the training will register students, provide the training facilities and equipment, and keep up with the latest computer technologies, which will free up valuable Sandia resources." Sandians can expect to see JIT-offered PC training by October.

Information about JIT is available by calling Sandia Line. See "Sandia Line Quick Dial Codes for JIT Material Requisition (MR) information."

The JIT department is working with the property organization to develop a system whereby contractors can tag items; this system will reduce the delivery cycle time for property-controlled items by at least one day. Sandians will see more JIT contractors accepting Sandians' orders directly. And the JIT staff will continue to ask customers to help identify stocklist requirements, technical support needs, and other value-added service requirements for the next generation of JIT contracts.

Sandia Line Quick Dial Codes for JIT Material Requisition (MR) information

- Call Sandia Line on 845-6789.
- Enter Quick Dial Code: 9, plus four-digit code (below), plus pound sign (#).
- General information:
 - Chargeback rate info — 1566
 - Fax of chargeback rates — 1567
- Fax of contractor index — 1568
- Fax of catalog order form — 1569
- Get status of MR — 1580
- How to place an emergency MR:
 - Emergency MR info — 1581
 - Fax of emergency MR info — 1582
- How to return or exchange MR material:
 - Return or exchange info — 1583

New Benefits Hotline

Dialing 844-9983 will now connect Sandians to the new Benefits Hotline, offered by Health & Work / Family Benefits Dept. 3343 to answer Sandians' questions about the new Triple Option Plan (TOP) and optional benefits plans (Dental Deluxe Plan, Long-Term Care Insurance, and Long-Term Disability Plus).

Thursday mornings a Prudential representative will be on-site, 9 a.m.-noon, in MO153 (east of Bldg. 832) to answer Sandians' questions on the Hotline and in person, says Dorothy Melloy (3343). As Open Enrollment (Oct. 20-Nov. 9) approaches, the representative will be on-site for more hours; this schedule will be updated in upcoming *Lab News* issues and *Weekly Bulletins*.

Meetings scheduled for TOP medical plan pre-open enrollment

To explain Sandia's new medical coverage options available in the Triple Option Plan (TOP) — which goes into effect Jan. 1, 1996 — Health & Work / Family Benefits Dept. 3343 will be holding the following pre-Open Enrollment meetings for Sandia retirees and spouses of on-roll Sandia employees.

Pre-Open Enrollment meetings for on-roll employees were held Aug. 28-Sept. 13, but employees and their spouses are welcome to attend the spouse meetings listed below. On-roll employees and retirees who cannot attend these meetings are encouraged to attend Open-Enrollment meetings, which will be held Oct. 18-Nov. 8. The schedule for these meetings will be included with the Open Enrollment materials Sandians will be receiving in early October and in upcoming *Lab News* and *Weekly Bulletin* announcements.

For more information, call the new Sandia Benefits Hotline on 844-9983.

Date	Location	Time	Audience
Sept. 18	Coronado Club Coronado Room	9-11 a.m.	Retirees
Sept. 18	Coronado Club Zia Room	6-8 p.m.	Spouses
Sept. 19	Coronado Club Coronado Room	9-11 a.m.	Retirees
Sept. 20	Coronado Club Coronado Room	1-3 p.m.	Retirees
Sept. 20	Coronado Club Zia Room	6-8 p.m.	Spouses
Sept. 21	Coronado Club Coronado Room	1-3 p.m.	Retirees
Sept. 22	Coronado Club Coronado Room	9-11 a.m.	Retirees
Sept. 25	Sandia Credit Union Juan Tabo	5-7 p.m.	Retirees
Sept. 26	Sandia Credit Union Juan Tabo	6-8 p.m.	Spouses
Sept. 27	Sandia Credit Union Juan Tabo	5-7 p.m.	Retirees

Sandia/California will be holding a pre-Open Enrollment presentation Wednesday, Sept. 20, 9-10:30 a.m., in the Bldg. 904 auditorium. Retirees and their spouses can learn more about TOP at the Wednesday, Oct. 11 retirement dinner. For more information, call Jo Sandelin, California Site Human Resources Dept. 8522, on 294-2073.

★ Congratulations

To Cathi (7714) and Bill Mairson (12650), a son, Christopher Ryan, Aug. 17.

Sandian's book offers advice on engineering careers

Book designed as interactive tool to help students make proper career choice

For most brothers, growing up with a sister with a talent for breaking things would be a nuisance, not a blessing in disguise. But for John Garcia, having a destructive sibling was a key to his early awareness that he would become an engineer.

"I knew at a very young age that I wanted to be an engineer," John writes in his new book. "I was fortunate to have a sister who liked to break things, which I fixed before my mom discovered them. Once, my sister broke my Fisher-Price dial-a-sound toy. I didn't want to tell on her, so I assessed the damage, studied the inner workings, and repaired the toy."



JOHN GARCIA

Twenty-five years later, John is Manager of Mechanical and Climatic Testing Dept. 2742 and author of *Majoring in Engineering*, published this month by New York publisher Farrar, Straus, and Giroux. The 134-page book guides prospective engineering students from their freshman year to their first job.

From the "Oatmeal Optimization Routine" to the "Garcia Childhood Experience Principle," the book educates and entertains its way through the ins and outs of deciding on an engineering discipline, selecting an engineering school, working part-time, practicing good study habits, and finding a job. But John says the book's most important aspect is its focus on

aptitude awareness.

"I put a lot of effort into making the book as interactive as possible, including lots of worksheets and thought-provoking exercises," he says. "If this book is used as it's intended to be, with pencil and paper in hand, it can be a very useful tool in helping prospective engineers decide if this is the right field for them."

John says he agreed to take on the project for a number of reasons. As he acknowledges in the book, one reason was to tune-up his writing skills. More important, he thought writing it was a good opportunity to help young people make difficult career choices.

"Certainly, writing the book was an interesting and challenging prospect for me," he says. "But the main reason I wanted to write it was to give students some concrete ways to decide if they have the ability and interest necessary to become successful engineers. Rather than relying on the haphazard way many of us find our niche, the book presents a scientific approach to making a career decision."

The book also offers students helpful hints on how to survive engineering school. John encourages students to form study groups, choose a mentor, and join honor and professional societies for engineers. He also suggests participating in



activities unrelated to coursework to relieve the stress of school.

"Your coursework at times will seem extremely hard and burdensome," he writes. "To relieve your stress and mental fatigue, you need a 'pressure relief valve.' All of my colleagues recommended some form of outside activity that not only keeps you sane but also makes you a well-rounded person. These outside experiences will give you a sense of balance in your life; it's so easy to wrap yourself in the engineering school world and lose your proper perspective on life."

Other Sandians contributed

Much of John's research entailed interviewing and reporting the experiences of other young, working engineers, including several Sandians. Some of the Sandians quoted are Tommy Goolsby (9611), Dave Kozlowski (2172), Dennis Roach (2752), Jon Rogers (4112), Keri Sobolik (12333), Steve Sobolik (6313), Walt Witkowski (1434), and Mary Young (6413).

"I relied heavily on the interviews and suggestions provided by my colleagues and peers," John says. "After two years of researching, writing, and revising, I think the finished product provides prospective engineers with some of the best advice and counseling available. It's something many of us could have used when we started engineering school."

Majoring in Engineering is one of three books in a series called "Majoring in Your Life." The others are *Majoring in Law* and *Majoring in the Rest of Your Life*, which helps students explore a variety of career options.

— Mary Hatheway

New Mexico Tech / Sandia EE program seeks enrollees

By Tammy Locke

Lab News Staff

Sandians working toward a bachelor of science degree in electrical engineering (EE) face tough challenges — but fitting classes into a tight work schedule shouldn't be one of them.

So Sandia and New Mexico Tech (New Mexico Institute of Mining and Technology in Socorro) joined forces to provide "an efficient path to gaining a meaningful degree in electrical engineering," says Ed Graham, Director of Facilities Operations & Maintenance Center 7800.

Electrical technicians, engineers, or other interested Sandians with a technical (associate) degree can earn a bachelor of science degree in electrical engineering through Sandia's Cooperative Electrical Engineering Bachelor's Program with New Mexico Tech. Forty-six Sandians have taken courses under the program.

The program is designed to take about five years to complete for electrical technicians or engineers who have an associate degree from an accredited university. Sandia pays full tuition for students with a C average or above, says Ruth Brooks of Corporate Education Programs Dept. 3525. The students pay for books.

Some classes are taught at Sandia, and others can be taken through a video link from New Mexico Tech classrooms to Sandia's Distance Learning Facility in Bldg. 856. Students can interact with professors during instructional television (ITV) classes through a two-way audio system. "We also communicate with e-mail for homework assignments and for students' questions," says Bill Rison, Chair of the Electrical Engineering Department at New Mexico Tech. All ITV classes are videotaped, so students with other commitments can catch up on classes they miss.

As part of the EE program, Sandia instructors teach "bridging courses" — specially tailored classes for Sandians that bridge the gap between Sandians' previous training and New Mexico Tech's requirements. For example, Sandians receive partial credit if they completed noncalculus-based physics in their associate's degree program. "The abbreviated physics bridging class adds the calculus aspects to the students' physics background," says Rison.

Enrollment in the Sandia/New Mexico Tech EE program has gone "below critical mass," says Ed, who is trying to generate interest to keep the program alive.

One problem students in the program were experiencing is that they couldn't plan their "road map leading to a degree," Ed says. Class descriptions became available to students just before classes began, preventing long-range planning. Last month, New Mexico Tech agreed to provide a tentative long-range class agenda. Ed believes this class agenda will help stabilize student enrollment.

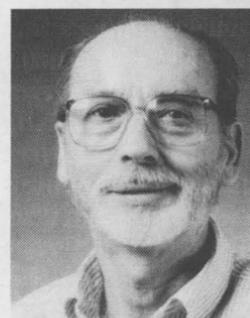
Rison agrees and describes the "Catch-22" situation he's in: New Mexico Tech can develop a long-range course schedule if enough students enroll in the program; students are more likely to enroll in the program when they can work with a long-range schedule.

How will earning their bachelor's degree in electrical engineering benefit electrical technicians and engineers at Sandia? "Although it is expected to improve current job performance, we offer no promises for career advancement," says Ed. "But it [the degree] opens up another door." For more information on Sandia's Cooperative Electrical Engineering Bachelor's Program with New Mexico Tech, call Ed on 844-5555.

The program has also received strong support from New Mexico Tech President Dan

Lopez. "We have a real opportunity to collaborate with a high-quality organization and provide some educational support." He says the program enrolls "more mature students, already employed," so the faculty and students can enjoy "a two-way street in the exchange of information." As for the program's future, Lopez says New Mexico Tech has a long tradition in providing these types of programs. "As long as we get a decent number of students, we can keep the program going."

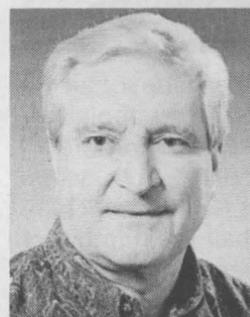
Recent Retirees



Kenneth Ream 35
5849



Leroy Thomas 30
9215



Ed Graeber 39
9614



Wes Estill 38
8412

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

MISCELLANEOUS

- TWO-WAY SPEAKERS, Snell II-K, black oak w/black grill, excellent for jazz, classical or surround sound, \$175. Norton, 266-3417.
- RUGER RIFLE, Model M77, 25-06, w/4-9x40 scope, \$300; queen-size futon, excellent condition, \$75. Hughes, 823-2353.
- GAS STOVE, white, good working order, \$135; bassinet, handmade oak, \$95; APC 380 backup handgun, \$125. Crafts, 831-5234.
- YAMAHA GENERATOR, 600-watt, AC outlet, 10-amp., DC outlet, like new, \$400. McMurtrey, 881-0390, afternoons.
- TWA TRAVEL COUPONS, expire 12/31/95, \$20 ea. or \$35 for both. Wagner, 823-9323.
- KING-SIZE WATERBED, w/captain's pedestal, 8 drawers, new liner, mattress, heater, mirrored headboard, \$375 OBO. Castillo, 242-9601.
- CRAFTSMAN, 6-in. belt & disk sander, like new condition, \$200. Hanson, 298-2120.
- BEDROOM SET, girl's twin canopy bed w/mattresses, desk, hutch, dresser & lingerie chest, excellent condition, \$500. DuBois, 256-9165.
- ELECTRIC LAWN MOWER, rear bagger, works perfectly. Vigil, 271-1328.
- COMPUTER PARTS: 486DX33 processor, w/motherboard; 386SX16, w/motherboard, 80 nsec, 1MB SIMMs (2), best offer (all or part). Weiss, 856-1649.
- ANTIQUA SECRETARY DESK, slant-top w/shelves, \$250; antique English oak armoire, \$375; 4-stack lawyer's bookcase, \$400. Martin, 296-8154.
- BABY CRIB, w/mattress; boy's clothing, sizes 2-6; molded swing; musical mobile; assorted toys. Altherr, 881-6987.
- MOVING SALE, Kenmore washer, \$100; Maytag dryer, \$150; baby things; Hoover vacuum, \$50; dresser, \$50. Baca, 298-0733.
- COMPUTER TABLE; oak coffee table (square w/glass triangles); king-size bed; 2 pair wrestling shoes, sizes 10 & 12, best offer. Frytz, 836-6743.
- SERGER, Bernette 234, w/rolled hem attachment, excellent condition, \$200. Saucier, 299-9181.
- COMPUTER, IBM-compatible, 486DX33, 8MB RAM, 300MB HD, SVGA card & monitor, Windows Microsoft Office, \$750. Burstein, 899-8971, after 6 p.m.
- AM/FM STEREO RECEIVER, 2 speakers, \$35. Hunter, 266-6579.
- HITLER'S CROSS, by Lutzer, \$10; picture frames, \$7; Rainbird oscillating sprinkler, deep-root waterer; patio broom, \$10. Krahling, 268-8126.
- GUITAR/AMPLIFIER COMBO, great for beginners, \$110; 14-in. rims (4), w/chrome rings (3), five hole, \$60. Cain, 291-1760.
- CEMENT MIXER, Sears, w/electric motor, \$85. Aden, 296-9787.
- FIREWOOD, free, you cut & haul, felled trees, 20 minutes from Tramway/140, permit. Atkins, 298-5762.
- COLOR TV, 19-in., wood console, w/radio, VCR, \$150 OBO. Healer, 298-6967.
- AUTOHARP, by Oscar Schmidt, w/case & tuner, \$85; sewing machine, Singer, freearm, excellent condition, \$85. Aragon, 888-3473.
- ANNUAL GARAGE SALE, multi-family, Saturday, Sept. 16, 9 a.m., Ridgecrest & Kathryn SE, tools, furniture, clothing, miscellaneous. Cook, 266-6088.
- TWIN BED, good condition, \$100; 35mm camera, w/2 lenses (telephoto, regular), \$150; upright vacuum, \$15; Mighty Mite vacuum, \$25. Doran, 255-9321.
- POOL TABLE, Brunswick Windsor, regulation size, w/balls, cues & light, \$550. Vine, 293-0940.
- KITCHEN SINK, stainless steel, under-coated, 22" x 32", self-rimming, w/single handle faucet & pullout spray, \$45. McGirk, 884-4592.
- ANTIQUA DRESSER, 4-drawer, dark wood, 42-in. wide, good condition, \$300; white bookcase, w/lower doors, \$75. Krauss, 828-1368.
- COMPUTER MEMORY CHIPS, two 1MB, 30-pin SIMMs, originally \$150; will sell both for \$35 OBO. Chavez, 275-0490.
- COMPUTER SOFTWARE, for MS Windows (CD ROM): King's Quest VII, Outpost, the PageMaster, \$20 ea. Dobranich, 298-4547.
- GERMAN CLUB, next meeting at Rio Rancho Oktoberfest, Sept. 30, 5:30 p.m., meet at entrance to tent. Ruby, 821-0982.
- ELECTRIC RANGE, double oven, self-cleaning, excellent condition, many extras, \$225 OBO. Deller, 298-5705.
- WASHING MACHINE, Montgomery Ward, works perfectly, \$50. Dwyer, 271-1328.
- LUGGAGE, used twice, Samsonite "Piggyback," hardsided, matched set, pullman w/wheels & retractable handles, \$175 (paid \$300). Seyfer, 292-0179.
- SOFTWARE for converting CPM files into DOS files. Elliott, 839-4042.
- HAMMOND ORGAN, 2 full keyboards, 2 octave pedals, beautiful wood, 40 stops, 10 presets, bench, \$700. Farnsworth, 865-6160.
- SMALL HUTCH, shelves, 2 doors, hearts cut into doors, cute, 36"W x 12"D x 60"H, perfect for apartment, \$175 OBO. Kribs, 294-8408.
- TREADMILL, PROFORM 920, 1.5-hp, 0-8 mph, auto-incline, ACCUSMART Motivational Fitness Monitor, new, \$400. Ward, 892-1956.
- CAMPER SHELL, 4'8" x 6'1" inside, \$150; large iron birdcage, on stand, \$45. Brooks, 255-7551.
- QUEEN-SIZE WATERBED, excellent condition, mirror & lighted headboard, Hybernation series mattress, padded side rails, \$300 OBO. Smith, 837-1752.
- DANSK STONEWARE SET, (Mesa White Sand), 8-place settings w/accessories, priced over \$750, asking \$275. Lininger, 897-9418.
- DINING SET, wrought iron/glass, Mossman, sun design; bedroom set, full/queen headboard, dresser, nightstands, immaculate. Whitham, 266-9313.
- CROSLY FRAME, w/drive train, shocks, bumpers, 2 rims, missing front end, make offer. Greer, 281-4688.
- COLOR TV, 19-in., w/stand, \$110 OBO; 30" x 75" trundle beds, \$100 OBO; small ShopVac, \$10. Cooper, 881-2806.
- ENTERTAINMENT CENTER, dark oak laminates, 2 drawers, 4 shelves behind glass door, storage, \$75. Hebron, 281-2901.
- TV CART, 22"H x 16-1/2"D x 28-1/2"W, glass doors, adjustable shelf, oak finish, hidden casters, excellent condition, \$50. Meeks, 828-9825.
- EVAPORATIVE COOLER, 4,500 cfm, works well, \$50; boards/bricks bookshelves, free; 12 fire bricks, free. Beard, 821-0309.
- WEDDING GOWNS, white & winter white, size 5, cleaned & boxed, \$75. Clavey, 292-7667.
- MOVING SALE, Sept. 16, 7:30 a.m., the Shores, Morris & Indian School, ski rack, new Visions & Pyrex, furniture, VCR tapes. Dreike, 299-6670.
- WORD PROCESSOR, Smith-Corona PWP 1200, w/disk storage & tutorial, like new, \$125. Clark, 296-4541.
- BABY GRAND PIANO, excellent condition, \$3,200; Sony 12-in. color TV, (needs antenna), \$15. Dieter, 296-8287.
- TWIN BED, box spring, new, \$25; super-single waterbed, w/bookcase headboard, \$50 OBO. Spears, 266-9782.
- CHILDREN'S ITEMS: Fisher-Price stove, excellent condition, w/all accessories, \$40; girl's vanity, w/mirror, \$20. Greear, 839-4255.
- TOOLS: advance timing light, \$200; alternator test kit, \$110; heavy-duty riveting kit, \$35; retaining ring plier set, \$150. Mays, 844-2546, ask for Sandra or Don.
- WATERBED FRAME, queen, w/drawer pedestal, \$25. Vogel, 275-0774.
- LION KING SHEETS, hand-held game, movie, T-shirts, toys, like new, worth \$100, all \$75 (individually priced). Rogulich, 298-5261.
- WHEELCHAIR, Venture, lightweight, almost new, \$500. Barnard, 256-7772.
- KING-SIZE HEADBOARD, w/sliding doors, bookcase, \$50; La-Z-Boy rocker/recliner, gold, excellent condition, \$110. Garcia, 899-2707.
- VIDEO GAMES for Super Nintendo & Sega Genesis, like new, \$20 ea; waffle iron, used once, \$20. Anderson, 897-2772.
- CHEST OF DRAWERS, 12 drawers, white enamel, \$80; Scotts drop spreader, \$23; Lynx-USA 3-PW irons, \$125; girl's bike, \$30. Stang, 256-7793.
- CLASSICAL GUITAR, 6-string, w/case, excellent condition, \$200 OBO. Carroll, 298-2827.

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

Note: The number of ads received is increasing; our space is not. We now limit ads to one per issue. We will also enforce the 18 word limit. Please keep your ads as short as possible.

Ad Rules

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

- SEWING MACHINE, w/case, \$20; high chair, \$10; stroller, \$20; pots & pans, \$3. Forster, 293-7231.
- HEALTHRIDER, excellent condition, \$450. Lovato, 836-3517.
- CAMPER SHELL, aluminum, white, side windows, fits Ford Ranger 6-ft. bed, \$130; Pioneer CD player, \$70. Tweet, 293-6105.
- ENTERTAINMENT UNIT, \$40; video tape cabinet, lockable, \$30; sewing machine cabinet, \$10; Polaroid camera, \$5; fireplace tools, \$5. Parson, 291-8394.
- FLY RODS, Orvis, 5 wt., 7 ft., \$275; Powell, 1M6, 9 wt., 9 ft., zebra seat, \$290; belt sander, 3 x 21, \$125. Barlow, (505) 820-6845.
- UTILITY TRAILER, Ford suspension, 4' x 4'-box w/canvas cover, good 15-in. tires w/hub caps, 1-7/8" hitch, \$200. Candelaria, 344-4596.
- MICROWAVE OVEN, 1.4 cu. ft., 24"W x 19-3/4"D x 15-3/4"H, \$75; camper shell, full-size (LW), white/chrome, \$75. Moya, 856-1245.
- ROLLTOP DESK, \$150; Flexsteel swivel rocker, \$75; 60" x 30" desk, \$60; 4-drawer file cabinet; \$50; bookcases, \$10 ea. Kimberly, 293-5835.
- BEGINNER'S DRUM SET, plus throne, 5-piece, \$200; hutch-style cabinet, 78" x 30", \$50; twin bunkbeds, \$75. Oishi, 293-9478.
- MICROWAVE, \$15; changing table, \$30; oval table, \$20; drop-down trailer hitch, \$10; wall papering table w/tools, \$30. Estill, 883-1531.
- TWO BOOKSHELF SPEAKERS, excellent condition, \$35 ea.; B&H cassette recorder, w/110V & battery transformer, \$25. Stamm, 255-2640.
- ANTIQUA FURNITURE, dining, living & hall pieces, excellent condition, high quality. Ross, 299-3023, for details.
- CASEMENT WINDOWS, Marvin, 2 new, 1 used; 5 used glass panes, 34" x 76"; miscellaneous wood doors. Beattie, 898-2706.
- VACUUM CLEANER, Kirby Classic III, \$75; water cooler, refrigerated, 5-gal., w/bottle, \$55. Gorman, 292-7119.
- TRAILER HITCH, Class 3 receiver-style, fits '84-present Jeep Cherokee, \$60. Surbey, 823-2843.
- FULL-SIZE BED, w/mattress, Grundig stereo; Sharp Intellivriter typewriter; king somma waterbed, w/extra tubes & liner. Tibbetts, 293-2856.

TRANSPORTATION

- '78 CHEV. SUBURBAN, AT, AC, cruise control, runs great, engine just overhauled, \$4,000. Fisk, 296-4601.
- '65 OLDS 98, 4-dr., V8 425ci, 130K miles, almost new battery, generator/regulator, tires, \$900. Allen, 268-3654.

- '94 HONDA ACCORD EX, 4-dr., AT, ABS, moonroof, PD, PW, AM/FM cassette, \$16,700 OBO. Archuleta, 865-1899.
- '90 ACURA INTEGRA LS, 3-dr. hatchback, 5-sp., moonroof, 83K miles, service records, excellent condition, \$8,600. Alvin, 294-5170.
- '58 WILLYS PICKUP, 6-cyl. flathead Superhurricane, w/extra fenders, chrome, engine, front ends & rear axles, runs well, \$5,000. Gustwiller, 268-4893.
- '71 CHEV. C-10, shortbed, Cheyenne pkg., 292 6-cyl., manual transmission, 36K miles, original owner, \$7,000. Bennett, 299-7400.
- '88 HONDA ACCORD, 4-dr., AT, tinted windows, loaded, 81K miles, one owner, great condition, \$5,500 OBO. Cummings, 292-0524.
- '76 FORD VAN, passenger & utility, HD towing, 460 engine runs, needs work, peripherals good, \$900 OBO. Remund, 296-8427.
- '92 HONDA ACCORD EX, 4-dr., loaded, low mileage, sharp, \$13,000, will consider trade for pickup truck. Lackey, 869-9333.
- '87 FIREBIRD, Formula V6, fire red w/gray upholstery, excellent condition, inside & out, \$3,995 OBO. Torres, 836-4574.
- '93 FORD F-150 XLT, super cab, short bed, 4x4, AT, 351, loaded, 39K miles, perfect condition, \$18,900. Baca, 271-2962.
- '84 ISUZU IMPULSE, sport coupe, loaded, well-maintained, 121K miles, 5-sp., very nice, asking NADA retail. Riley, 294-2792.
- '67 CORVETTE, 427/450-hp, Roadster, PW, both tops, redlines (2 sets), new motor, AM/FM, \$32,000. Cerutti, 292-0186.
- '89 DODGE RAIDER, 4x4, 6-cyl., 5-sp., 2-dr., one owner, excellent condition, Alpine stereo, blue book \$5,500. Douglas, 281-9843.
- '95 FORD WINDSTAR LX, emerald green, privacy glass, cruise, tilt, rear air, 14K miles, \$19,500 OBO. McWilliams, 281-1224.
- '94 DODGE RAM 1500 SLT LARAMIE, 360 V8, loaded, 15K miles, under warranty, \$1,000 under book. Crawford, 247-9638.
- '91 OLDS DELTA 88, Brougham Royale, white, every luxury, excellent condition, new tires, 46K miles, \$10,900. Sanders, 822-1486.
- '83 CHEV. BLAZER S-10, 5-sp., AC, V6, 137K miles, new brakes/battery, one owner, \$2,000 OBO. Lambert, 899-2060.
- '79 DATSUN, king-cab, \$1,400 OBO; '70 Fiat, convertible, w/extra parts, \$2,100 OBO. Roybal, 296-8493.
- '84 TOYOTA CAMRY LE, AT, AC, AM/FM cassette, all power, sunroof, white, 1 owner, \$2,475. Daniel, 821-2935.
- '89 BUICK LESABRE LIMITED, 88K miles, 1 owner, V6, PS, PB, climate control, AC, luxury interior, \$3,800. Moore, 294-5646.
- '89 AUDI 200 TURBO, leather, all service records, 82K miles, new alternator, belts, brakes, tires, \$9,400 OBO. Fellows, 256-7678.
- '84 CHEV. CAPRICE CLASSIC, 302 V8 engine, AT, PS, PB, powerlock, powerseat, posi-track, runs great, \$1,500. Rector, 286-1217.
- '88 CHRYSLER Le Baron, sharp, sporty, maintained, dependable. Kallio, 856-1350, leave message.
- '88 FORD F-150, 6-cyl., 5-sp., AM/FM, 64K miles, bedliner, excellent mechanical shape, no AC, body good, \$5,850 OBO. Hanson, 890-4069.
- '93 FORD RANGER, 1/2-ton, V6, 4-cyl., 5-sp., 19,500 miles, silver, new condition, anti-theft lock, \$9,250. Hogan, 296-8846.
- '71 FORD G-500, 4-dr. sedan, V8, AT, AC, very good condition inside/out, \$1,500 OBO. Booker, 299-3554.
- '92 SUBARU LEGACY, all power, all-wheel drive, very clean, 66K miles, \$11,650 book, \$10,000. Whittet, 281-2216.
- '94 KAWASAKI ZX-9R, absolute mint condition, adult-ridden, 4,035 miles, absolutely cleanest/best, must go, \$7,500. Hoke, 298-6731.
- THREE BIKES, \$20 ea. Witkowski, 271-1691.
- ROAD FRAMESET, Cannondale, 56cm, headset, stem, cranks, BB; AMP Research F-2 DH suspension fork, 1-1/8 threaded; \$200/ea. OBO. Sartor, 858-2554.
- '72 MOTOR HOME, 22-ft. Travco, mint condition, fully self-contained, exceptional bargain, \$5,800. Elisco, 858-0828.
- '83 BAYLINER, 19-ft., open bow, 125-hp, Volvo engine, beautiful, like new, \$4,700. Pettit, 293-7578.
- SAILBOARD, family board, good condition, \$250 OBO. Dixon, 254-1782.
- WOMAN'S ROLLERBLADES: Macrolade, size 5, \$100; Coolblade, woman's size 8, \$125, four times better than same price new. Weirick, 281-1462.
- MOUNTAIN BIKE, Specialized-Rock Hopper, Shimano accessories, paid \$600, will sell for \$300 OBO. Jeantette, 888-4835.
- '72 POP-UP TRAILER, Jayco, sleeps 8, heater, stove, icebox, clean but needs work, \$1,000 OBO. Blankenship, 296-9580.
- LOBO SEASON TICKETS, men's basketball, chairbacks, Section 2, Row 7, Seats 5 & 6, w/parking. \$479. Easley, 884-5192.
- MOPED, Batavis, 1,147 miles, \$100; exercise bicycle, \$20; Vitamaster treadmill, \$100; last two seldom used. Swain, 265-0098.
- ROAD BIKE, 21-in., 12-sp., indexing shift, cycloid crank, like new, \$150. Nash, 292-7086.

REAL ESTATE

- 3-BDR. HOME, 2-1/2 baths, LR, FR, backs on open space, spectacular view, heart of Taylor Ranch, \$135,900. Jones, 899-0642.
- 4-BDR. PLUS STUDY HOME, Winridge subdivision, 2,732 sq. ft., 3-1/2 baths, fireplace, 3-car garage, La Cueva school district, \$249,900. Carter, 299-6152.
- 4-BDR HOME, luxurious custom-contemporary, 3 yrs. old, great neighborhood, Indian School & Washington, \$300,000. Selleck, 254-9345.
- 3-BDR. HOME, Edgewood, 2 yrs. old, 2 baths, fenced yard, 2-car garage, mountain views, \$90,000. Johnson, 281-4295.
- '86 MOBILE HOME, Skyline, 14' x 70', in Terrace Seniors Park, buy or take over payments, 5-1/2 yrs. left. McMurry, 298-2155.
- 3-BDR. ADOBE HOME, 2,450 sq. ft., 1-3/4 baths, 2-1/2 car garage, lots of windows, skylights, patios, 2.5 acres along Rio in Los Lunas. Graving, 865-5581.
- 1.25 ACRES, wooded, Thompson Ridge Estates near La Cueva, NM. Davis, 881-0856.
- 4-BDR. BRICK HOME, desirable Heritage East, best schools, quiet cul-de-sac, many upgrades. FSBO \$199,900. Righter, 822-1927.

WANTED

- BABY JOGGER STROLLER, w/canopy, for two children. Weiss, 296-1226.
- RAILROAD TIES, will haul. Horton, 883-7504.
- DOLLY, 2-wheel, for transporting an automobile. Prevender, 296-8586.
- ROOMMATE, prefer single woman, furnished room, non-smoker, between Louisiana/Wyoming, \$300/mo. Avila, 823-2339, after 6 p.m.
- HOTWHEELS, Matchbox, Corgi, model cars, built/unbuilt, slot cars, toy trucks, anything automotive related. Torres, 294-7273.
- HANDY ROOMMATE, share 3-bdr. home at Eubank and Osuna, work off \$100 rent/mo. Adams, 299-6337.
- POP-UP, six-person, w/good fabric, \$1,000 range; pre-'68 CJ7 or CJ5 Jeep, repairable condition. Brewer, 293-8791.
- BACKPACK, for carrying a baby, preferably a Stallion Tough Traveler baby backpack. McBrayer, 293-4076.
- LARGE SHED, 8 x 10 and up, for reasonable price or free. Cunico, 892-8365.

Sandia News Briefs

Jeff Brinker wins American Chemical Society award

Jeff Brinker of Ceramic Synthesis & Inorganic Chemistry Dept. 1846 will receive the 1996 Ralph K. Iler Award in the Chemistry of Colloidal Materials, presented by the Division of Colloidal and Surface Chemistry of the American Chemical Society. Jeff was selected for his "original, significant contributions to the processing of glass and ceramics using sol-gel techniques." He synthesized and processed a wide variety of novel porous materials, ranging from ambient pressure aerogels to amorphous molecular sieves; contributed to the understanding of the structure and chemistry of the surface of colloidal silicas; and furthered the fundamental understanding of the sol-to-gel thin film deposition process. Jeff will receive his award next March in New Orleans.

Lockheed Martin audit team inspecting Sandia through Sept. 22

A 16-member Lockheed Martin audit team, consisting of Lockheed Martin Corporate Environmental Safety Health (CESH) staff, ES&H subject matter experts from other Lockheed Martin sites, and Lockheed Martin contract auditors, are inspecting Sandia/New Mexico through Sept. 22. The inspection began Sept. 11. Three auditors are focusing on ES&H Management Systems and Controls, which includes Sandia administrative management and assessment functions. The other 13 are conducting field compliance inspections and interviews across all divisions at Sandia/New Mexico. Lockheed Martin auditors are accompanied by their Sandia counterparts during on-site activities. At daily debriefings, auditors are reporting their findings to Sandians, who will determine the responsible organizations and distribute information for action. For more information, call Joe Honest (10106) on 844-0929.

Sandia and Lockheed Martin to participate in International SAMPE Conference

The New Mexico Chapter of the Society for the Advancement of Material and Process Engineering (SAMPE) and the Materials Research Society are sponsoring the 27th International SAMPE Technical Conference, "Diversity into the Next Century," Oct. 9-12 at the Hyatt Regency in Albuquerque. William Ballhaus, Lockheed Martin's Vice President of Science & Engineering, will be the keynote speaker. Along with the "traditional" topics (composites, adhesives, and manufacturing), the conference will cover several new material and process developments that will be the backbone of 21st century materials engineering. Several Sandians serve on the conference committee, including Robert Martinez (5932), Howard Arris (2472), John Emerson (2472), Gordon Pike (1802), and David Zamora (2472). Preregister on or before Sept. 22 by calling 800-562-7360, Ext. 610. For more information, call David Zamora on 845-9756.

Retired Sandian receives National Parents' Day award

Mike (ret. Sandian) and Mary Lou Michnovicz received the National Parents' Day Certificate of Recognition on July 21. National Parents' Day, the fourth Sunday of July, was established by President Clinton in October 1994 to recognize the "uplifting and supporting role of parents in the rearing of their children." Mike, retired from Sandia in 1988 after holding several managerial positions, and his wife were nominated for the award by former Mayor Harry Kinney. Mike and Mary Lou raised seven sons and six daughters. Eleven of the children are college graduates and have entered various careers, including engineering, accounting, teaching, and medicine.

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

Atomic Museum to sponsor 50th anniversary Trinity tour

The National Atomic Museum Foundation is sponsoring a 50th anniversary tour of the Trinity Site, where the world's first atomic bomb was detonated in 1945, on Saturday, Oct. 7. The historic 21-kiloton explosion marked the end of the Manhattan Project and the beginning of the Atomic Age and Cold War.

The site is located on White Sands Missile Range approximately 120 miles south of Albuquerque. Attractions at the site include a small monument and tower remnants designating "ground zero," an enclosure for viewing Trinitite (a green, glassy material produced by the heat and pressure of the blast), and the McDonald ranch house (where the bomb's plutonium core was assembled).

Tickets for the tour are \$25 per person, available at the National Atomic Museum Store. The ticket price includes transportation to and from the site, a guided tour, and a pre-tour presentation by Manhattan Project scientist and longtime Sandian Bob Henderson (ret.) on Thursday, Oct. 5, at 7 p.m. at the Museum.

On the day of the tour, buses depart from the Museum promptly at 6:30 a.m. and will return between 3 and 4 p.m. Cameras are allowed at the Trinity Site, but their use is prohibited anywhere else on White Sands Missile Range.

Any profits from ticket sales will be used to help further the educational goals of the National Atomic Museum and Foundation.

For more information about the tour or presentation, call the Museum Store on 845-6275.



CHRISTINA KENT DAY NURSERY KIDS — Thanks to help from United Way of Central New Mexico contributors, the carefree tykes seen here and other children from low-income homes are able to receive low-cost day care at Christina Kent Day Nursery while their parents work. Sandia's 1995 Employee Contribution Plan campaign to raise money for United Way agencies kicks off Oct. 5 on Hardin Field. Look for more information about the campaign in the next issue of the *Lab News*.

Coronado Club

Sept. 15 — Friday night dinner/dance. \$7.95 all-you-can-eat buffet, 6-9 p.m. Music by Lumbre, 7-11 p.m.

Sept. 17 — Sunday brunch buffet, 10 a.m.-2 p.m. \$7.95 adult members, \$8.95 guests, \$2.95 for children 4 to 12, free for children 3 and under. Music for buffet by Bob Weiler and Los Gatos, 1-4 p.m.

Sept. 21, 28, Oct. 5, 12 — Thursday bingo nights. Card sales and buffet start at 5 p.m., early birds' bingo at 6:45 p.m.

Sept. 22 (Friday) — Kids' bingo night. Buffet, 5 p.m., with cartoons and movies. Bingo starts at 7 p.m. Free hot dog and soft drink for all kids playing bingo.

Sept. 29 — Friday night dinner/dance. \$7.95 all-you-can-eat buffet, 6-9 p.m. Music by Nite Rider, 7-11 p.m.

Oct. 6 (Friday) — Oktoberfest dinner/dance. \$7.95 all-you-can-eat buffet will include Bavarian-style food, 6-9 p.m. Die Polka Schlingels will perform Bavarian music for dancing, 7-11 p.m. Reservations required, call 265-6791.

Oct. 8 — Sunday brunch buffet, 10 a.m.-2 p.m. \$7.95 adult members, \$8.95 guests, \$2.95 for children 4 to 12, free for children 3 and under. Music for buffet by So Rare, 1-4 p.m.

Fun & Games

Boating — The US Coast Guard Auxiliary is offering two courses — "Boating Skills and Seamanship" and "Sailing and Seamanship" — to introduce students to boat handling, navigation rules, safety and legal requirements, seamanship, trailering, and other boating topics. Classes began Tuesday, Sept. 12, 7 p.m. at the Armed Forces Reserve Center, 400 Wyoming NE. Both courses will run about 13 weeks and each course costs \$15 for text with worksheets, and \$5 for additional family members for worksheets only. To register or for more information, call 897-1695, 298-0116, or 281-9152.