

Sandia, Intel shatter world computing speed record

143.4-gigaflop rating returns 'world's fastest computer' title to US

When Sandia installed its new Intel Paragon XP/S 140 supercomputer last year, it was billed as the world's highest-performance supercomputer. For the past year, a succession of milestones have been announced, and now comes a big one: Sandia's Paragon has beaten the existing world record for computing performance by more than 15 percent.

A team of Sandia and Intel scientists achieved a record-shattering 143.4 double-precision gigaflops (billion floating point operations per second) on a widely used massively parallel benchmark problem called LINPACK. The previous record of 124.5 gigaflops was set in August 1993 by Fujitsu's Numerical Wind Tunnel, a one-of-a-kind system owned by the Japanese National Aerospace Laboratory (NAL).

The achieved speed is actually greater than the manufacturer's originally advertised maximum speed for the machine of 140 gigaflops.

"Sandia's success with the Intel Paragon system demonstrates successful achievement of the US High Performance Computing and

(Continued on page 5)

The team beat the existing record for computer performance by more than 15 percent.



RECORD BREAKERS — David Womble (1422, seated), Art Hale (1424, middle), and David Greenberg (1423) examine data documenting the world-record LINPACK benchmark speed of 143.4 gigaflops achieved on Sandia's Intel XP/S 140 massively parallel supercomputer. Four of the computer's more than 30 modules are visible. Stephen Wheat (1424) and Intel scientists Greg Henry, Satya Gupta, and Jerry Baugh also were part of the team that broke the world record for computing performance. (Photo by Mark Poulsen)

Eight Russian scientists join US, UK in Saturn physics experiment

By Ken Frazier

Lab News Managing Editor

For the past four weeks, the Saturn accelerator in Sandia's Tech Area 4 has been the site of a unique international physics experiment that would have been highly improbable before the end of the Cold War.

Scientists from the three US national weapons labs, the British Atomic Weapons Establishment (AWE), and Russia — yes, Russia — have been carrying out a series of experiments designed to test a possible new way to produce very high X-ray radiation fields.

From April 21 until today, when this phase of the project ends, Saturn, which uses pulsed power technology to generate intense bursts of X-rays, has seemed a little like a United Nations conference arena — in addition to the defense-oriented advanced research and testing facility it is.

The tri-lab, tri-national scientific team consists of eight scientists from Russia, 12 from Britain, five from Los Alamos, six from Lawrence Livermore, and 10 from Sandia — not including the Sandians from Above-Ground Testing Accelerator Operations Dept. 9342 who operate the Saturn accelerator.

"What's unique about this is that this is the first group of Russians approved by Defense

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Sandia LabNews

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Sandia National Laboratories

Computers streamline prescription drug design process

Could save pharmaceutical companies millions

By Michael Sheehan

Lab News Correspondent

Working with a progressive pharmaceutical company, Sandia/California researchers hope to develop and fine-tune innovative ways to pre-test promising drugs electronically. If successful, the new computer-based methods may cut the cost of developing prescription drugs, such as antibiotics, by millions of dollars, while speeding up the process of introducing new products to market.

"We recently signed an agreement with Sterling-Winthrop, a \$20 billion pharmaceutical company, to develop methods for testing a wide variety of compounds on the computer to see if they would be worth pursuing as potentially marketable drugs," says Richard Judson, project manager in Scientific Computing Dept.

8117, which includes the Center for Computational Engineering. "Our goal is to provide tools to Sterling that will allow them to design new compounds to synthesize and test in animal and human trials. Although we have not reached that point yet, our computer-based drug design methods look promising and cost-efficient."

Eliminating manual methods

Before a drug makes it to market, the compound must pass a discovery stage, animal testing, and, finally, clinical trials on humans. Until about 15 years ago, medicinal chemists often used a "shotgun" approach to find promising pharmaceutical agents. For example, to develop an antibacterial drug, chemists would randomly select from 1,000 to 10,000

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EnviroTRADE helps find cleanup solutions in Russia

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Latest fullerene research looks toward practical uses

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Sandia 'struts its stuff' at recent Advanced Manufacturing Day

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Monitoring center aims at reducing regional tensions

This & That

Didn't Gorgeous George do that? - Sometimes I truly feel like a low-tech man in a high-tech world. Our page-one story about the Sandia and Intel team setting a new world record for computing speed notes that the new record is 143.4 double-precision gigaflops (billion floating point operations per second). I'm not proud to admit this, but only six months ago, I thought a double-precision gigaflop was a fancy pro wrestling move.

* * *

Pondering the paper pile - I think I heard my in-basket moaning and groaning when I returned to my office last week after attending a vital two-day communications conference. It's almost frightening to ponder the pages and pages of paper we send to one another at Sandia these days in the interest of "better communication." Some Sandia organizations are trying to tell me lots more than I want or need to know about their operations. I may apply for federal disaster relief funds for my poor in-basket if this proliferation of paper products continues.

* * *

No fun any more? - Speaking of that communications conference, several speakers there said employees in large companies *throughout the US* are saying something I've heard some Sandians say in the past year or so: "This place isn't fun any more!" The causes for this feeling at Sandia and elsewhere today are probably many and complex, so I won't even try to get into them here, but it seems to me that management and employees must work together to remedy this. Our jobs, whether management or staff, should be fun - not a laugh a minute, but fun, as in *satisfying* and *enjoyable*. I'd be interested in hearing any ideas you have, and I'd be glad to participate in a continuing effort to make our workplace more enjoyable. Let's hear from you - with or without your name.

* * *

Pension forum coverage next issue - Our deadline for this issue preceded the May 25 pension plan forum by several days, so our coverage will be in the next issue, June 10. The forum was centered at Sandia/California and video-linked to Sandia/New Mexico. I wrote this several days before the forum, and I'm willing to bet the vested interest of the entire *Lab News* staff (except for my own, of course) that it was a lively session. Two things were evident after we published stories on April 29 about the pension plan changes and about the DOE Inspector General's report recommending that so-called "excess assets" from the plans be returned to the federal government: (1) Sandians and Sandia retirees have some strong opinions about both matters, and (2) they aren't shy about expressing them. Stay tuned.

* * *

I may be in a hairy fix - This in a note from the friendly Sandia crew at the Nevada Test Site: "We were wondering if you noticed your slight oversight occurring on page 10 [Earth Day photo page] of the 4/29/94 issue? You identified Captain Planet as VP Dan Hartley, but failed to identify which VP was dressed as Olive the Baboon! Please let us know as soon as you can. The suspense is killing us!"

You NTSers should know I could get in mucho trouble for printing something like this, so please stop sending me such irreverent stuff. Besides, Olive doesn't look at all like any of our VPs. She has way too much hair.

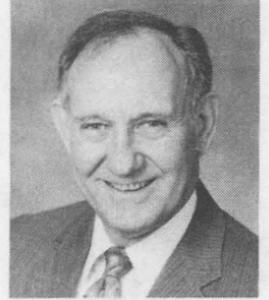
- Larry Perrine

Supervisory appointments

GIB MARGUTH to Manager of Licensing and Regional Economic Development in 8800.

He comes to Sandia/California from Lawrence Livermore National Lab where he has been head of the Technology Transfer Initiatives Program since 1991. Before that he was deputy program leader for Tech

Transfer and before that a consultant for the LLNL Executive Officer. His past positions include chief technical officer for a firm involved in rating television commercials and programs, executive director of the California Commission on School Governance and Management, and deputy superintendent of Public Instruction for the State of California. He was also cofounder and CEO of Livermore Data Systems, and from 1961 to 1967 was an engineer at Sandia/California.



GIB MARGUTH

Gib earned BS degrees in electrical engineering and mathematics from Oregon State University, and attended graduate school at UC Berkeley, majoring in advanced computer design and numerical analysis.

His civic and community activities include serving on the Livermore Board of Education, Livermore City Council (mayor 1968-70), board member and chairman of Alameda County Water Management Board (Zone 7), California State Assembly (1980-82), and founder and president of Valley Study Group.

* * *

MARGE YORK to Manager of Personnel & Employee Resources Dept. 8522.

Marge joined Sandia/California in July 1969 as a stenographer-clerk in the Publications Division. Later that year she became a department secretary and in 1971 was promoted to staff secretary for the director of Staff Services. In 1974 she was selected as section supervisor of the Information and Distribution Section, which included the mail room. In 1978 she was accepted as an MLS trainee in the Personnel Division where she was



MARGE YORK

reclassified as an MLS. She transferred to the Budgeting organization in 1989 to handle direct and indirect support for the California site. Next she became administrative assistant to the director of Combustion/Materials Science/Technology. Marge returned to Personnel in mid-1992 to assume responsibility for the California site's recruiting and hiring program.

Prior to Sandia, Marge had been a real estate associate in Northern San Mateo County, an assistant credit manager for American Optical in San Francisco, and a secretary at both Bechtel Corporation and GE Vallecitos.

She has a bachelor's degree in business administration from the University of San Francisco and an MBA from St. Mary's College.

Marge has also been a Sandia recruiter at the University of Utah from 1985-90, an Upward Feedback consultant since 1991, and California site representative on the Strategic Staffing Forum.



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MARTIN MARIETTA

Take Note

American Nuclear Society, Trinity Section, will hold a dinner meeting on Thursday, June 2, at the High Mesa Inn in Santa Fe. Members of the Mescalero Apache Tribe will present "Mescalero Spent Fuel Storage Project," a program about a proposed facility for private monitored retrievable storage of spent nuclear fuel. Social gathering begins at 6:30 p.m., a dinner buffet is at 7:15, and the program is at 8 p.m. Anyone interested is invited. Reservation deadline is May 31. Call 277-5431 for reservations.

A reminder that full ANS memberships are available for \$35 for new applications postmarked during May. Special application forms may be obtained from Sharif Heger on 277-2640 or Sonoya Ebara (7715) on 844-7864.

* * *

The Society of Women Engineers (SWE) will hold its annual banquet Saturday, June 4, at the Ramada Classic Hotel (6815 Menaul NE) at 6:30 p.m. Guest speaker Pamela Sullivan (senior vice president and general manager of International Security Programs, BDM Federal) will talk about "Changing International Security Environments." She will also answer questions about career development and workplace diversity. Cost is \$25 per person; guests and spouses are invited. RSVP to Carol Yarnall (5500) on 844-8005 or 266-4312 by June 1. SWE is a volunteer, nonprofit, educational service organization whose members support the advancement of women in engineering.

California researchers use computers to design drugs

(Continued from page 1)

compounds that had been painstakingly synthesized by company chemists and measure their effect on bacterial growth. They would then collect the few compounds that demonstrated a strong antibacterial effect and synthesize multiple derivatives to discover compounds that were more effective. A variety of learning methods were developed to guide the synthesis of derivatives, but chemists lacked the most important piece of the puzzle — the three-dimensional structure of the protein to which the drug binds.

Drugs interact with proteins such as enzymes or cell receptors in a lock-and-key fashion. Today chemists can solve the 3D atomic structure of that protein with a candidate drug bound to it. "Using computers, scientists can now bring a picture of the protein onto the screen and test different drugs by seeing which will fit best into the protein's active site. In principle, a chemist could test many drugs in a few hours and see what effect will take place as atoms are added or deleted from the starting compound," Richard says.

New method saves time, money

To solve the problem, the joint Sandia/Sterling research team is developing computer software searches for optimal ways of fitting proposed drug molecules into target proteins. "Currently available commercial software allows a chemist to manually fit a drug into a protein, but that's still extremely difficult," Richard says. "In contrast, our algorithms provide more efficient ways of pre-screening new compounds on the computer."

Richard points out that the cost of developing a drug that reaches the market often tops \$250 million. By eliminating many costly, time-consuming steps in the initial discovery

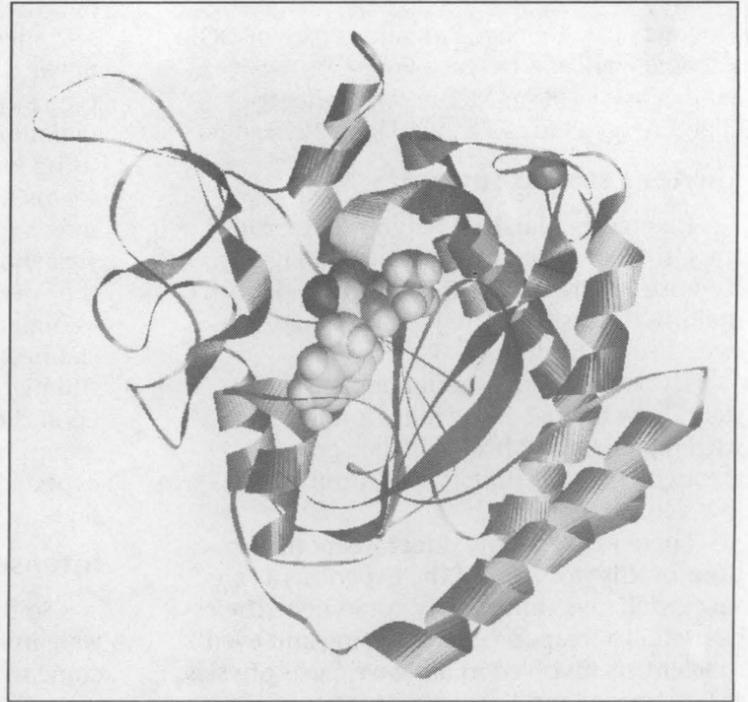
stage — during which pharmaceutical companies routinely spend \$50 million to synthesize and test compounds — computational drug design can save a significant amount of time and money.

"We hope to take drug compounds that a medicinal chemist has dreamed up, then use the computer tools we develop to determine with a high degree of accuracy if the compound will work against a specific protein," explains John Wendoloski, Director for Biophysics and Computational Chemistry at Sterling. "Although chemists must still be doing experiments, they no longer will need to synthesize each derivative, but instead could test them quickly on the computer. In principle, a chemist could try out 10 molecules in one day and only synthesize the best one found. In contrast, today it takes several weeks to synthesize and test each compound, and up to three years to complete the discovery stage."

To date, Sandia has developed generic techniques and tested them on known proteins. After Labs researchers fine-tune their methods, Sterling will try out those tools on proprietary compounds.

Reaping biotechnology benefits

"Several companies often are working simultaneously to develop the same type of drug," says Carl Melius (8117), a Sandia chemist working on the Sterling cooperative research and development agreement



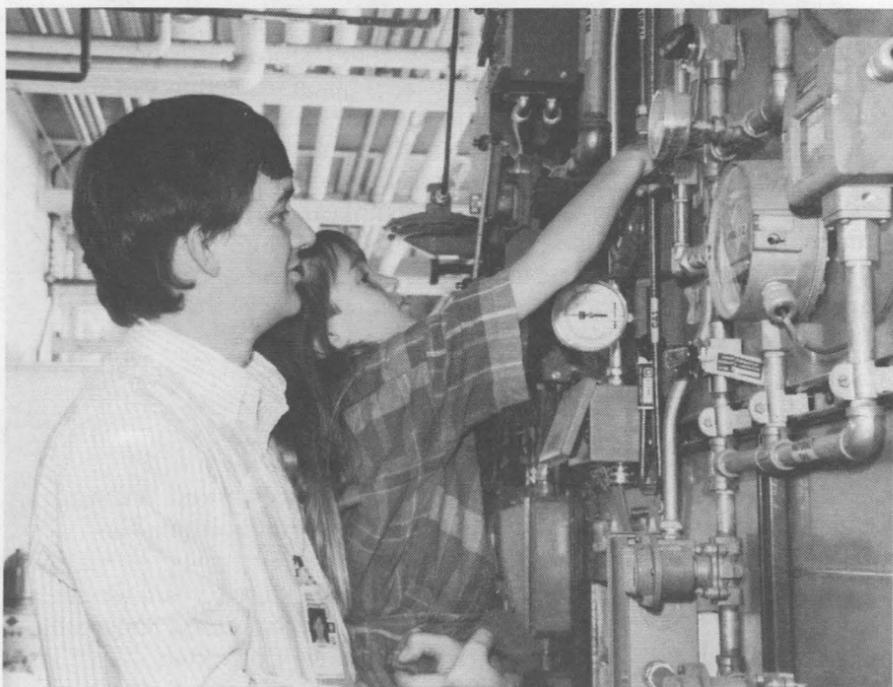
MOLECULAR MODELING — Results of a calculation using Sandia's in-house molecular modeling package to predict the orientation of a typical drug molecule, glycine-L-tyrosine (GLT), in the binding site of the digestive enzyme carboxypeptidase-A (CPA). The predicted conformation is virtually indistinguishable from one known experimentally from X-ray diffraction experiments.

(CRADA). Computational tools that can speed up the discovery process are therefore very important to Sterling, he says.

According to Richard, Sandia will reap key benefits from the Sterling project by gaining a better understanding of how different compounds interact with biological molecules in the body. In addition, Sandia researchers are currently studying how environmental toxins work and have initiated development of biosensors to detect toxins in the air and water.

"Our department is taking the lead on all biosensor development projects," says Len Napolitano, Manager of Dept. 8117. "If we can design molecules that bind to particular proteins, we also hope to design proteins for biosensors that can detect particular toxins that are released into the environment, and thus provide another tool in the battle against pollution."

Sandia California News



DAUGHTERS AT WORK — Larry Baxter (8361) was one of more than 100 employees at Sandia/California who brought their daughters to work April 28 and shared their daily routine in their labs and offices. Larry shows 10-year-old Aubrey the controls in his multi-fuel flow reactor lab in the Combustion Research Facility. The day included a breakfast on the computing center patio, tours of Sandia's technical library, and lunch together at the LLNL cafeteria across the street, with the remainder of the day spent at their workplaces.



SANDIA VOLUNTEERS — Five Sandians were among more than 100 volunteers honored at this year's Tri-Valley Corporate Volunteer Council Employee Recognition event April 22 at the Pleasanton Holiday Inn. In front, from left, are Charlie DeCarli (8116), who has been a longtime volunteer at Sunol Regional Wilderness; Jim Gibson (5375), who serves as an officer in the Wings for Charity Livermore Airshow; Bob Carling (8362), who has been a scoutmaster for seven years; Cynthia Richards (8535), who cochaired Expanding Your Horizons at UOP in Stockton; and Shelia Daigle-Beard (8641), who cochaired Expanding Your Horizons at Pac Bell in San Ramon. In back are Rick Wayne (8700), who introduced the honorees, and Arlene Franke (8502), Sandia's representative on the Corporate Volunteer Council.

Saturn experiment

(Continued from page 1)

Programs [the Defense Programs office of DOE] to come work at a Defense Programs facility at Sandia," says Dillon McDaniel, Manager of High Energy Plasma Physics Dept. 1273.

Sluyter's strong support

He credits Marshall Sluyter, Director of the Office of Research and Inertial Fusion, Defense Programs, DOE, Washington, with making it possible. "He was a strong influence," says Dillon.

The experiments should help better understand how intense X-ray radiation interacts with materials and how it is transported through channels in both a vacuum and in low-density materials.

There won't be any direct weapons applications of this work, but if the experiments are successful, says Dillon, they could nevertheless be useful to weapons-effects testing and even to scientists involved in basic weapons physics at Los Alamos and Lawrence Livermore national labs.

Apart from that, the understanding gained will be relevant to inertial confinement fusion and for civilian applications such as soft-X-ray lithography.

The experiments at Sandia are a follow-up on an earlier series carried out by the same scientific team in May-June 1993 in Russia. Most of the Sandians who are involved with this spring's experiments went to Russia to take part in that earlier series.

Those experiments were at the TRINITY Institute, which is located just outside of Moscow and reports to the

Ministry of Atomic Energy.

Sometime earlier, the Russians said they had come up with a way to create very high radiation fields using low-density foams. The experiments in Russia last year showed that the energies weren't as high as had been claimed but were still higher than the US and British groups had expected, Dillon says.

Intense X-rays

So the Russians were invited to come to Sandia this year to do a "scaling experiment" on the powerful Saturn accelerator. Saturn is the only facility that can drive 100-nanosecond implosions with enough kinetic energy to produce the



PREPARING EXPERIMENT — Russian scientists Georgyi Volkov (left) and Eugeni Grabovski (center) and Sandia experiment coordinator Johann Seamen (1273) work on a line-of-sight diagnostic tube underneath the Saturn accelerator.



CHECKING DATA — Florindo Salas (Data Acquisitions Systems Operations & Development Dept. 9322, left) and Bill Clements, an engineer with the British scientific team doing experiments on Saturn, go over results of an experimental run in the data acquisition room.

high X-ray fields envisioned. In Saturn, short multimillion-amp bursts of electrical current are passed through a gas shell produced by a high-velocity nozzle. This causes the gas shell to implode, and the resulting collision between the gas shell and a low-density foam creates intense X-rays.

Although most of the Russian team has been here since late April, their team leader, Valentin Smirnov, arrived only May 20, for the final six or seven days. John Porter and Johann Seamen (both 1273) are Sandia's experiment team leader and experiment coordinator, respectively.

The Saturn experiments have been using important parts of Russian technology, including their low-density foams and special high-Mach-number gas nozzles used to make the initial gas shell.

Nearly one accelerator shot a day has been conducted, making about 20 experiments in this series. "That's a lot of data to analyze," says Dillon. It'll keep all the scientists busy for months. This run of experiments is over this week, but sometime next October or November the next round is planned, probably also on Saturn. "We expect there'll be two to three such experiments a year for three years," says Dillon.

Meanwhile it hasn't all been work. "When we were in Russia they treated us quite graciously," says Dillon, so the New Mexico scientists are now trying to reciprocate. The Russian scientists have been taken to see some of the sights around the state and treated to informal get-togethers at the Sandians' homes.

The Russians have even been allowed to have their own rental car, so they have a little more mobility. But, notes Dillon, they have to be escorted onto the Base and of course all the time they're at Sandia.

EnviroTRADE helps find cleanup solutions in former Soviet Union

Three new workstations delivered to Russian sites

Three new workstations completed their journeys to scientific institutes in the former Soviet Union (FSU) earlier this month, accompanied by Mark Harrington of International Programs Dept. 6907.

Mark, along with Charlene Harlan and others from DOE, is developer of an electronic information system called EnviroTRADE (Environmental Technologies for Remedial Actions Data Exchange) that matches environmental problems with technological solutions. The system uses text, maps, charts, and other data entered into the system about contaminated sites and matches site profiles with available remediation technologies (*Lab News*, Sept. 17, 1993).

Although EnviroTRADE was developed to assist in the cleanup of DOE sites, the system was installed at a facility in the Ukraine last year to help scientists clean up contaminated sites there. Since August, scientists at Mayak, a former nuclear weapons production site in Rus-

sia, have been entering environmental data into the new system.

The three new workstations (supplied by Sun Microsystems of Mountain View, Calif.) are being installed at the Russian Federal Nuclear Center Institute of Technical Physics (Chelyabinsk 70), the Khlopin Radium Institute (St. Petersburg), and the Russian Academy of Sciences (Moscow).

Sun will provide a total of five workstations for operating the data base in Russia. The remaining two will be shipped later, allowing Sandia researchers to remedy any information gaps found in the previously installed systems.

In return for the equipment and information system, Russia is providing DOE with useful environmental data it has gathered that will allow DOE to better predict the movement and spread of volatile organic compounds, radionuclides, and heavy metals in US water, soil, and air.

Recent Patents

Terry Michalski, Robert Rye, and William Smith (all 1114): Method for Forming Hermetic Coatings for Optical Fibers.

Vincent Hietala (1322), David Ginley, and Jon Martens (both former Sandians): Superconducting Active Impedance Converter.

Richard Brow (1845) and Larry Kovacic (2476): High Thermal Expansion Sealing Glass.

Michael Butler, Stephen Martin, Kent Pfeifer (all 1315), and Cecil Land (retired Sandian): Ferroelectric Optical Image Comparator.

Joseph Abbin (5093), Clifton Briner (2574), and Samuel Martin (2641): Rolamite Acceleration Sensor.

'Rugbyballs' research focuses on practical uses

Fullerenes with 70 carbon atoms

Working with rugbyballs, the 70-carbon-atom cousins of the soccer-ball-shaped buckyball, chemists at Sandia have developed theoretical models that allow them to quantitatively predict the stability of two forms of a chemically modified fullerene.

Their studies on the simplest derivatives — $C_{70}H_2$ — are considered an important step toward being able to fashion fullerenes into molecules with practical applications. The curved, rigid fullerene scaffold has unique characteristics. Chemical modifications will allow scientists and engineers to take advantage of these unique electrical, chemical, and physical properties.

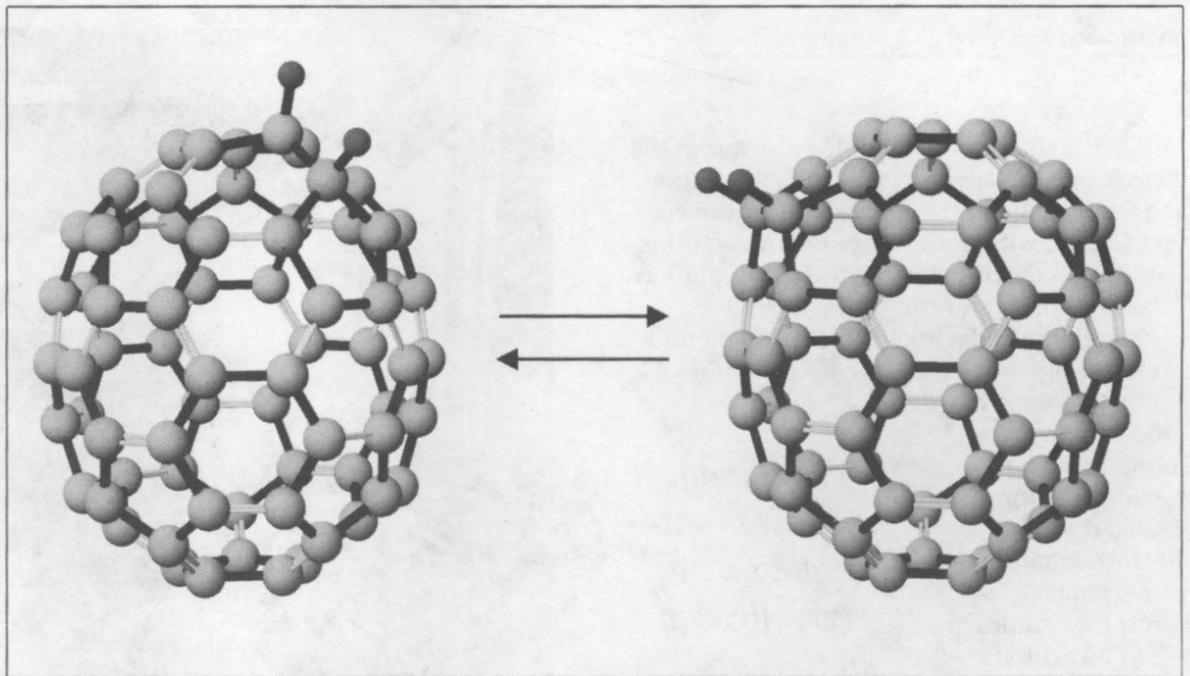
Pharmaceuticals, ultra-high-strength materials, catalyst supports, and gas-separation membranes are among the technologies targeted for applications of the fullerene derivatives.

"We demonstrated that our computations reflect precisely what's observed in the lab," says Paul Cahill of Organic Materials Synthesis/Degradation Dept. 1811. "This is the first time anyone has been able to do that with a fullerene reaction."

The results of the work, done by Paul, Craig Henderson (Organic & Composite Material Dept. 8711), Kenneth Gillen (Properties of Organic Materials Dept. 1812), and Celeste McMichael Rohlfing (Combustion Chemistry Dept. 8353), were published in the April 15 *Science*.

"Sandia's work has led to a precise under-

The model will be used in research into high-strength, lightweight materials.



CAGES OF CARBON — Two forms, or isomers, of $C_{70}H_2$, the simplest hydrocarbon derivative of the 70-carbon-atom 'rugbyball' fullerene studied by Sandia chemists. They say the quantitative agreement between theory and experiment in this system indicates that they can reliably model other fullerene derivatives for materials and pharmaceutical applications.

standing of fullerene chemistry, and we are now poised to apply this knowledge," says Paul.

Fullerenes are a family of all-carbon molecules with the carbon atoms linked into an essentially spherical structure. The first, buckminsterfullerene, was discovered in 1985 and consists of a cage-like lattice of 60 carbon atoms. Since then, researchers have been actively studying fullerenes' properties as well as exploring ways to attach or insert other chemical groups to them with the hopes of developing new materials with novel properties.

Last year Paul and Craig reported in *Science*

that they had synthesized the simplest fullerene derivative — $C_{60}H_2$ — using a unique process, and were able to accurately forecast that only one of 23 possible configurations would occur.

Building on that work, they decided to work with C_{70} and compare and contrast its reaction behavior with $C_{60}H_2$. "We were lucky in that we ended up with a system that enabled us to predict what products would occur and which would be more stable," says Craig. The quantitative model developed for $C_{70}H_2$ will be used in research into high-strength, lightweight materials.

— Julie Clausen

Speed record

(Continued from page 1)

Communication (HPCC) initiative and US leadership in high-performance computing," says Art Hale, Manager of Parallel Computing Science Dept. 1424.

"The achievement also resoundingly proves the power of the Paragon architecture," says Art.

Problem had 57,000 unknowns

Sandians David Womble (1422), David Greenberg (1423), and Stephen Wheat (1424) worked with Intel scientists Greg Henry, Satya Gupta, and Jerry Baugh in achieving the record on the LINPACK benchmark. (The term is a contraction of "linear" and "package.")

David Womble says the benchmark involves solving the largest system of linear algebra equations that fits in the computer's memory. This accords with Sandia's interest in solving very large problems. "We're not interested in small problems, with 10 or 100 unknowns, on our massively parallel machines," he says. The problem required solving a linear system with 57,000 unknowns and used 26 billion bytes of memory. "That's a lot of memory," he says. It's about 3,000

26 billion bytes of memory is roughly the equivalent of 250 sets of encyclopedias.

times the memory of a powerful personal computer or roughly the equivalent of 250 sets of encyclopedias.

"Our work on the LINPACK benchmark will have a major impact on applications that require the solution of large linear systems," says David.

Ed Barsis, Director of Computational and Computing Sciences and Mathematics Center 1400, was pleased. "Sandia's success illustrates the important role the national labs can play by working closely with American business and industry," he says. "This is the kind of teamwork that accelerates our nation's progress not only in computer technology but also in applying that technology to solve critical scientific and technical problems in areas such as health care, defense, and the environment."

Achievement a validation

Ed Masi, President of Intel's Supercomputer Systems Division in Beaverton, Ore., and Vice President of Intel Corporation, also praises the record. "Sandia's achievement certainly validates the soundness of Intel's supercomputer architecture and the leading role that Sandia plays in pushing the envelope of high-performance computing." He says the record "represents a win not just for Sandia and Intel, but for the US Advanced Research Projects Agency, DOE, and the entire US high-performance computing community."

The Paragon was installed at Sandia in July 1993. (Its U-shaped configuration of more than 30 modules is in the Bldg. 880 Computer Annex.) It has 1,840 compute nodes. Each node has two Intel i860 micro-

processors, one for computation, the second generally for message-passing between nodes. But for the LINPACK benchmark, the Sandia code used the message co-processors for computation as well as communications.

Sandia's Paragon is used by the institutions of the Defense Supercomputing Research Alliance and the National Consortium for High Performance Computing as well as by Sandia scientists.

The Paragon runs the SUNMOS operating system developed at Sandia and the University of New Mexico on the 1,840 compute nodes and interacts with the OSF/1 operating system provided by Intel that runs on the service nodes.

— Nigel Hey and Ken Frazier

Congratulations

To Patricia Standing (13423) and Theodore Kaufmann, married in Las Vegas, Nev., April 9.

To Margaret and Joseph (1822) Michael, a daughter, Mary Kristina, May 11.

Welcome

Albuquerque — Robert Simonson (1823), Karen Schultheis (10221)

Other New Mexico — Jennifer DePoy (9418)

Texas — Virginia De Marquis (2472)

Sympathy

To Anthony Thornton (3020) on the death of his sister Cheryl Thornton in Los Angeles, May 7.

Sandia exhibit wows browsers at ISE '94 show

Technology showcase draws record first-day crowd

By Howard Kercheval

Lab News Staff

Sandia showed off a flair for showbiz at the Ideas in Science & Electronics (ISE) Exposition and Symposium at the Albuquerque Convention Center, with an Advanced Manufacturing Day exhibit described in one media account as "dizzying" and "stunning."

Sandians displaying technology ranging from computer-aided design (CAD) to virtual reality to composite modeling to "green" robotic microchip cleaning demonstrated the Labs' advanced manufacturing strategic thrust capabilities in about 70 exhibits May 17 to a record first-day crowd at the 16th annual show.

"We had just under 3,000 people, and that's the highest attendance they've ever had for the first day of the ISE show," says Bill Alzheimer, Director of Advanced Manufacturing Center 2900. "It was an excellent turnout, including a lot of representation from invited guests, as well as general ISE attendance."

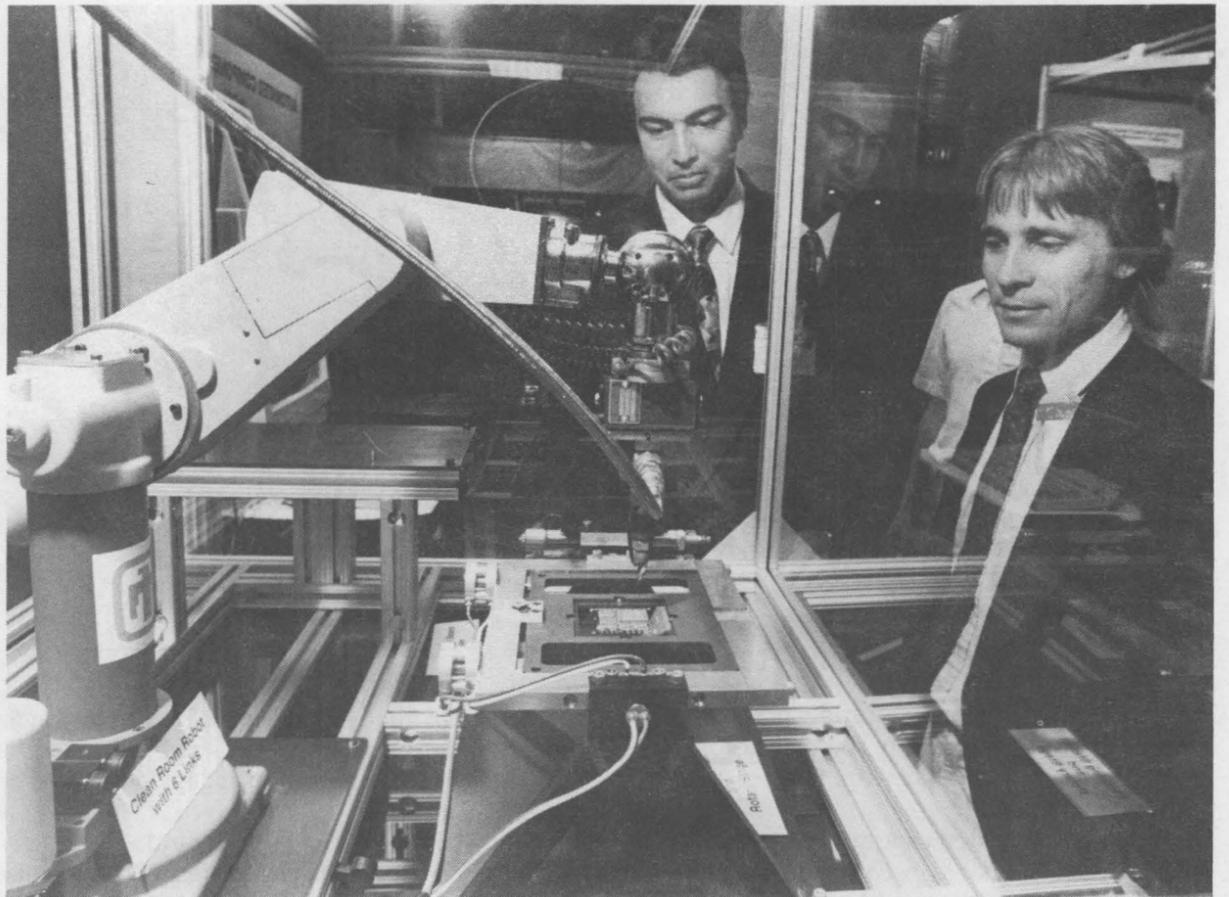
Heinz Schmitt, VP of Component Development and Engineering Support Div. 2000, welcomed invited guests to a preview of the Labs' 15,000-square-foot exhibit. Representatives from General Motors, Chrysler, Martin Marietta, and textile manufacturer Milliken joined others from large and small businesses, universities, and state and federal government agencies for the tour and lunch before the exhibit opened to the public.

'People were impressed'

"It was really a marvelous show," says Sandia President Al Narath. "All the comments I heard were highly complimentary. I think that in general, people were impressed."

Lilita Meirans of Intelligent Systems Dept. 2171 did a brisk business explaining the workings and attributes of a robot demonstrating

"What made it great was participation by every division in the Labs."



Bob Hillaire (center) of Manufacturing Initiatives and Center Integration Dept. 8205 and Walt Wapman of Intelligent Systems Dept. II 2171 watch Walt's robot go through its paces simulating the cleaning of solder flux from a microchip board. Both were on hand May 17 to help host visitors to Sandia's Advanced Manufacturing Day exhibits. (Photography by Randy Montoya)

microchip cleaning technology.

"I think people were initially attracted to it mainly because the robot was moving and actually performing some actions," she says. "We had a lot of interest from people who actually are involved in chip cleaning. They were very interested in the fact that we were using environmentally benign materials to perform the cleaning process."

The robot, operating inside a transparent box, demonstrated how it can be used to spray a water-based solution containing an ingredient that dissolves solder flux. Lilita explained to lookers that the difficulty in using water-based spray is that it has to be directed precisely at the chip edges and must be maintained for a relatively long time.

"If you use ozone-depleting chemicals, removing the particles of solder flux takes a matter of a few seconds," she says, "whereas if you use a water-based solution, you may take anywhere from six to 10 minutes to clean it. That's very difficult for humans to do, but it's definitely suited for robotic application, and we use the CAD model of the part to automatically program the robot's path."

A steady stream of visitors stopped to watch the small robot connect to a spray nozzle, move back and forth over

the chip in a precise pattern, return the nozzle to its resting place and disconnect, swing back to the chip, pick it up, and deposit it on a drying rack.

Information superhighway on display

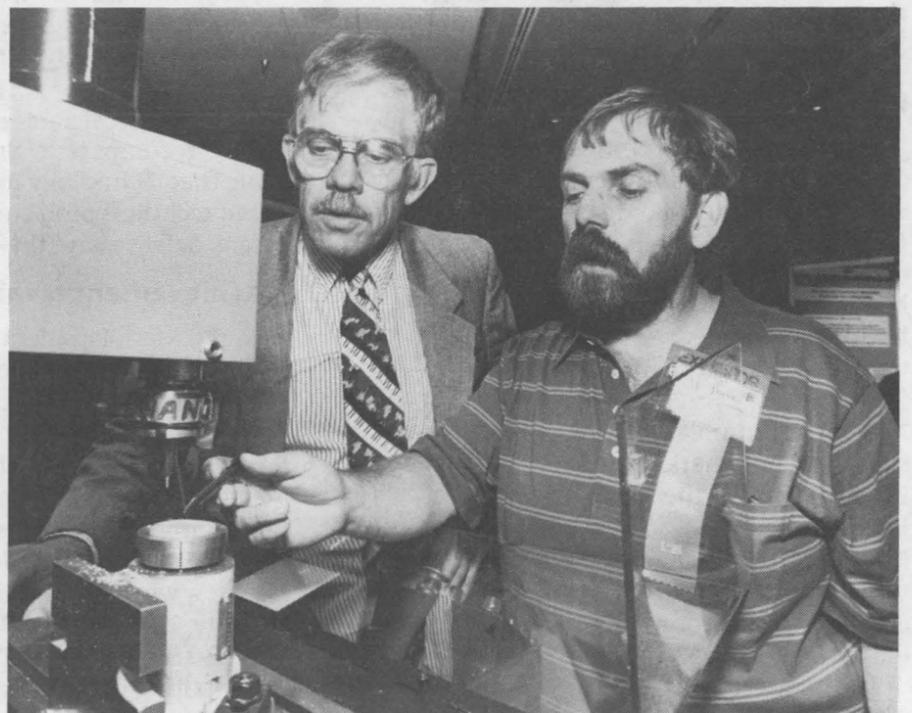
Bob Hillaire of Manufacturing Initiatives Dept. 8205 and Jim Hachman of Design Definition Dept. 8272 wowed visitors to their exhibit by showing them how process information can be sent over the information superhighway to manufacture parts as far away as California.

Visitors were given the opportunity to design a part — the Sandia thunderbird was a favorite — using a solid modeling program, then watch via a live video link as the part was

(Continued on next page)



Clint Atwood, Supervisor of Rapid Manufacturing Team 2484-1, explains Sandia's rapid prototyping process to ISE attendee Greg Hanson of Hsqquared, Inc. The prototype in the foreground is of the manifold of a four-cylinder automobile engine.



Dave Van Ornum (right) of Mechanical Processing Dept. A 2481-3 shows Bill Alzheimer, Director of Advanced Manufacturing Center 2900, his CAD-driven machining exhibit. Dave machined intricate patterns into poker chip-size blue plastic disks, which he then gave to exhibit visitors.

Sandia exhibit

(Continued from preceding page)

machined on a CNC mill at the University of California at Berkeley.

Bob notes that "a lot of engineers and manufacturers didn't realize what the information highway could do for them. But when they saw the part they had just designed being machined in California minutes after they requested it, their eyeballs almost popped right out of their sockets!"

CAD-driven machining drew interest

"And two owners of a machine shop in Northern New Mexico were so impressed, we saw them come by two or three times during the day," Jim adds.

Louie Tallerico, Manager of Org. 8205, says, "This is another example of how information technology can bring together the designers

and manufacturers from across the country, as well as from the two Sandia locations."

Nearby, Dave Van Ornum of Mechanical Processing Dept. A 2481-3 (Composites and Abrasives Team) presided over a CAD-driven tool machining intricate patterns into poker chip-size blue plastic disks. After an explanation of the process, many walked away examining a finished disk.

"A lot of Sandians who came by didn't realize what the machine shop or programmers have to offer," says Dave, "but after a brief explanation, they were interested in our technology — being able to transfer files, to get going on a job right away, for whoever."

He says he also talked to "a lot of non-Sandians who didn't realize Sandia is involved in composites, and some indicated they might have further interest. We passed out a lot of business cards."

A particularly impressive aspect of the exhibit, says Paul Percy, Director of Microelectronics and Photonics Core Competency Cen-

ter 1300, was that it not only showcased Sandia's advanced manufacturing capabilities, but also demonstrated some of its capabilities in information and electronics technologies, encompassing the technology development spectrum from research to applications.

Electronics technologies of the future

"Visitors were introduced to novel electronics technologies of the future, from sensors to photonics," he says, "and the science base that enables these new technologies."

"They also saw applications of Sandia's science and technology to real-world manufacturing problems," he adds, "using Labs information technologies to connect work stations at the Convention Center to computers at the New Mexico site and machine tools at remote locations [UC-Berkeley, referred to above] for real-time analysis and manufacturing control."

Bill says representatives from General Motors and Chrysler were impressed with displays and explanations of Sandia's work in modeling and simulation, and a man from a major computer company "found something in virtual reality he's going back to talk to his company about."

Heinz says non-Sandians he talked with told him that for the first time they were seeing Sandia technology that could be useful to their organizations.

"I think they found it unusual to see all these technologies together, in a product-realization setting," says Heinz. "What made it great was participation by every division in the Labs. It showed that advanced manufacturing as a strategic thrust is alive and contributing to Sandia, industry, and the nation."

Al also praised the overall effort.

"Each and every exhibit was well done," he says, "but it wasn't just the gloss, it was the substance underneath. The presentations, the discussions — everything was done uniformly well. The competence really came through."



Heinz Schmitt (center), VP of Component Development and Engineering Support Div. 2000, explains the three-dimensional modeling shown on a monitor to Bill Garcia (right), New Mexico Secretary of Economic Development, at Sandia's Advanced Manufacturing Day exhibit. Rob Bugos (left) of Guidance and Control Dept. 2334 ran the modeling displays.

Take Note

The Central Rio Grande Chapter of the New Mexico Network for Women in Science and Engineering will meet on Wednesday, June 8, at 6 p.m. in the home of Ellen Evans (7601), 1500 Cornell NE, 265-5229. Elizabeth Sellers, acting deputy director of the Environmental Restoration Project Office of DOE, will speak about "Changes in the DOE Environmental Restoration Program" and describe potential job postings in technical, environmental, and waste management positions at DOE. For more information, contact Carol Skinner (9215) on 844-8901.

Next week is Education Outreach Awareness Week

Wanted: Sandians to work with teachers, students

Sandians who have participated in the Labs' various education outreach programs during the past year can relax in the sun and bask in recognition of a job well done during a lunchtime celebration in their honor next week on Hardin Field (KAFB Parade Grounds).

The recognition ceremony Wednesday is just one of several events planned during Education Outreach Awareness Week May 31-June 3, sponsored by Education Outreach Dept. 3020.

The purpose of the week's activities, says event coordinator Josephine Graham (3020), is to give education outreach participants a "pat on the back" and to interest other Sandians in sharing their expertise in science, math, and engineering with young people and teachers through Sandia's various education outreach

programs.

The Science Advisors (SCIADs) program is the Labs' largest education outreach program. Sandians who become SCIADs visit elementary or middle schools weekly to support teachers with information and equipment. They often participate in classroom activities relating to science and math.

Sandians are invited to stop by the Area 1 Cafeteria (Bldg. 861) during lunch on Tuesday, May 31, or the Coronado Club during lunch on Friday, June 3, to find out how to become a SCIAD, mentor, or volunteer for the upcoming school year. Education outreach program coordinators will be available to answer questions.

In addition, all Sandians are invited to attend the following events.

- Wednesday, June 1, 11 a.m. - 1 p.m. —

Bring your lunch to Hardin Field or buy lunch at the Marriott food services stand and join Dept. 3020 in recognizing Sandians who participated in education outreach during the previous school year. Enjoy live bluegrass music by Endangered Species (musicians are Sandia and DOE employees and retirees) and lively stepping by the Atrisco Elementary School modern dance troupe.

• Thursday, June 2, noon - 1 p.m. — Vicente Villa, 1993 Professor of the Year (Southwestern University, Georgetown, Tex.), will speak about mentoring and motivating students at the Technology Transfer Center (Bldg. 825). The Professor of the Year is selected annually by the Council for the Advancement and Support of Education.

— John German

New Cooperative Monitoring Center promotes weapons nonproliferation technology

Aim is to reduce weapons, boost regional security

By Nigel Hey

Strategic Media Planning Dept.

A new concept aimed at helping reduce regional tensions worldwide has been initiated at Sandia.

The new DOE facility, dubbed the Cooperative Monitoring Center, will begin hosting visits by arms control specialists from throughout the world this summer.



ARIAN PREGENZER

Development work has moved into high gear with the lease of space in the Sandia Research Park east of the Eubank Gate for meeting rooms, offices, and labs.

The center will be used to acquaint visitors with a wide range of sharable technology that can be used to monitor compliance with regional arms control or environmental agreements.

"The basic idea," says Program Manager Arian Pregonzer of Verification and Analysis Dept. 9241, "is to use technology to help attain regional security, thereby reducing tensions that could motivate regions to acquire weapons of mass destruction."

Forum for international collaboration

She says one important function of the center will be to promote communications between political and technical experts and serve as a forum for international collaborations on monitoring applications. Resident experts will interact on an ongoing basis with participants who arrive with questions about confidence building or monitoring as applied to their particular region.

The center is sponsored by the DOE Office of Nonproliferation Policy within the Office of Arms Control and Nonproliferation. Funding level for FY94 is approximately \$2.2 million. DOE is also encouraging active participation by the Department of State and the Arms Control and Disarmament Agency. Many other government agencies are also expected ultimately to draw upon the center's resources.

The CMC is one of the newest activities in Sandia's nonproliferation program, which began with the Vela satellite system for detection of clandestine nuclear weapons tests in 1962 and now embraces a number of programs with an annual budget of approximately \$200 million.

Gives experts hands-on experience

The new center will give visitors hands-on experience with monitoring hardware, software, and data processing and integration capabilities.

Hardware will be supplied by both commercial sources and the DOE national labs. It will include ground-based devices such as cameras and acoustic and seismic sensors. In addition, the center will have access to unclassified satellite imagery and data from airborne sensors, such as the Open Skies synthetic aperture radar. Computer simulations will be used to experiment with and train participants about the way sensors can be used to monitor potential agreements and assist them with applications that fit their specific needs.

"The objective is to establish a prototype of a regional cooperative monitoring center, says Arian. "Center personnel will help international and regional participants in the design, evaluation, and testing of sharable monitoring systems for regional confidence building.

"We believe that shared monitoring systems will play an important role in achieving nonproliferation objectives," she says. The approaches are also expected to help in controlling the supply of materials that can be used to manufacture such weapons.

She says participants, through their experience at the center, ideally will achieve a more realistic view about both the capabilities and limitations of technology.

Sandia News Briefs

AMMPEC wins Federal Laboratory Consortium tech transfer award

The Advanced Materials and Manufacturing Processes for Economic Development Alliance (AMMPEC) has been awarded a 1994 Federal Laboratory Consortium (FLC) Award for excellence in technology transfer. Bob Eagan, Director of Engineered Materials and Processes Center 1700, is founder of AMMPEC. He accepted the award at an April meeting of the FLC meeting in Kansas City. AMMPEC was formed in 1992 to promote the transfer of laboratory technologies in materials and manufacturing to businesses. Participants in AMMPEC include Sandia, Los Alamos National Laboratory, Phillips Laboratory, the New Mexico Economic Development Department, UNM, NMSU, New Mexico Tech, and Albuquerque Economic Development. An industry advisory group of representatives from Motorola, General Electric, Aerojet Electro Systems, BDM, Radiant Technologies, the HERA Corporation, and Science Applications International is also working with the alliance. The FLC consists of representatives from more than 500 federal laboratories and centers representing 16 government agencies. It works to enhance the transfer of federal technology to domestic users in industry and state and local governments.

Joyce Etheridge named Outstanding MBA Student

Sandia accountant Joyce Etheridge, Energy and Environment Sector and Management Support Dept. 10403, has received the College of Santa Fe 1994 Presidential Departmental and Program Award for the Outstanding MBA Student in the Albuquerque graduate and external programs. Only one student is selected each year for this award. Qualifications include academic excellence together with leadership and service to the department. In addition to carrying a 4.0 grade point average, Joyce is also an adjunct business faculty member teaching accounting principles in the undergraduate program for the College of Santa Fe at Albuquerque.

Al Narath to receive National Jewish Spirit of Achievement Award

Sandia President Al Narath will receive the National Jewish Spirit of Achievement Award from the National Jewish Center for Immunology and Respiratory Medicine at a tribute dinner on June 2 at the Albuquerque Marriott Hotel. Sherman McCorkle, president of Technology Ventures Corp. (a subsidiary of Martin Marietta Corporation), will serve as the dinner chairman. The dinner will serve as a fund-raiser for the nonprofit National Jewish Center, the world's only institution dedicated to treating and studying chronic lung and immune-system diseases. For more information about the benefit dinner, call Suzanne Slauson on 272-7882.

Dan Hartley honored by Georgia Tech

Dan Hartley, VP for Energy and Environment Division 6000, was recently selected for membership in the first class to be inducted into Georgia Institute of Technology's Academy of Distinguished Engineering Alumni. An induction ceremony was held May 20 in Atlanta.

Dr. Annette Sobel elected to space medicine executive committee

Dr. Annette Sobel, Systems Research Center 5900, has been elected member-at-large of the Aerospace Medical Association's space medicine branch executive committee. Election results were announced at the 65th annual scientific meeting of the association on May 12 in San Antonio.

Send potential Sandia News Briefs to Lab News, Dept. 12660, MS 0413, fax 4-0645.

Ross schedule to Los Alamos changed

Effective June 1, the Ross Aviation flight schedule between Albuquerque and Los Alamos will change. The improved flight schedule is a result of a Continuous Quality Improvement (CQI) effort between DOE, Los Alamos National Laboratory, Ross Aviation, Inc., and Johnson Controls, Inc. Inputs from travelers who utilize the DOE Air Service were also sought and used to develop the schedule. The future schedule allows for easier connections between Los Alamos and the major airlines in Albuquerque, especially in the early morning and late evening hours, while still providing daytime travelers with convenient service to both destinations. Call Ross for details on 845-5022.

Retiree deaths

William C. Craft (72).....	7250	.....	April 7
Daniel C. Eaton (72).....	1481	.....	April 12
Michael A. Lovato (79).....	8257	.....	April 17
H. Eleanor Owens (70).....	3700	.....	April 17
Carthel D. Henry (81).....	3421	.....	April 23

Two waste minimization success stories reported

Chemicals usage reduced 'a little bit here — a little bit there'

Sandians involved in two different Labs waste minimization projects have reported successes recently.

The Chlorofluorocarbon (CFC) Elimination Coordination Group reports that the use of ozone-depleting chemicals at Sandia dropped significantly in calendar year 1993. Gay Dybwad (2411), chairman of the group, says Sandia as a whole has reduced its usage of ozone-depleting-chemicals by more than 50 percent in the last 18 months, and that every division is reporting lower usage.

Recent data compiled by the group show that the two biggest users of such chemicals at Sandia — Component Development and Engineering Support Div. 2000 and Environment, Safety, and Facilities Management Div. 7000 — reduced the use of ozone-depleting chemicals by more than half in 1993, as compared to their average usage during the two previous years.

"At a research facility, these are hard-won gains — a little bit here, a little bit there," says Gay.

CFCs and other ozone-depleting chemicals are used at Sandia as refrigerants and to clean equipment and microelectronics. The Labs has been looking into suitable alternatives to ozone-depleting agents and plans to stop using such chemicals altogether by Dec. 31, 1995.

For more information or help in finding substitute agents, contact Gay on 4-8236.

A 'STAR' in waste minimization

Jim Fish of Environmental Protection Dept. 7574 reports that recent waste minimization efforts in Experimental Impact Physics Dept. 1433 have resulted in some dramatic reductions in the amount of hazardous waste produced by Sandia.

By implementing some "common sense approaches" to two of its applied research projects, says Jim, the Shock Technology Applied Research (STAR) program in Dept. 1433 has reduced the amount of hazardous waste it creates by more than 20 barrels a year. STAR uses a number of gun systems to conduct applied

shock physics research.

STAR researchers implemented a filter system that removes contaminants from a kerosene-based solvent used as a cleaning fluid. The filter system allows the solvent to be used many more times than before, reducing by 75 percent the total amount of waste produced.

In another example, STAR researchers began collecting waste water — used to wash and rinse a 6-ft.-diameter, 15-ft.-long powder

gun — in a sump rather than dispose of the contaminated water as waste after each shot. By filtering out carbon and trace amounts of lead, about half the water can be used again to clean the gun.

For more information about how your organization can minimize waste, call the Pollution Prevention Info Line on 848-0500.

— John German

DOE team praises Sandia's compliance with radioactive waste order

Members of a DOE inspection team comprising representatives from Headquarters (DOE/HQ) and the Albuquerque Operations Office (DOE/AL) said in their closeout meeting that they are "more than pleasantly surprised" with Sandia's adherence to DOE's department-wide EM-30 Waste Moratorium Objectives.

The team inspected Sandia/New Mexico's and Sandia/California's performance under the objectives, which banned off-site shipment of waste until each DOE site could establish procedures and systems to assure that waste being shipped off-site for disposal as hazardous waste had "no rad (radioactive) added."

Laboratories Services Div. 7000 VP Lynn Jones says Sandia was among the first of the DOE sites to have the moratorium lifted, and the April 25-May 6 appraisal by DOE/HQ and DOE/AL "was a follow-up to be sure that we are, indeed, following the procedures we told AL and HQ we would follow, and are properly characterizing and managing these wastes."

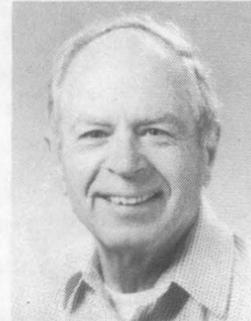
There were no findings (violations) and only four observations at Sandia/California, she says, and only five "minor" findings and three observations at Sandia/New Mexico.

"As a result of this appraisal, Sandia/California has completed the actions necessary to fully meet the requirements of the EM-30

Moratorium," the DOE report said, and "with the corrective actions necessary to resolve its findings, Sandia/New Mexico will have completed the actions necessary to fully meet the requirements of the EM-30 Moratorium."

Lynn says the appraisal team was upbeat and complimentary, and adds, "The team leader said we had a great operation, things were going well, and he wants to be sure we don't let it stop."

Recent Retirees



Don MacKenzie
1554 37



Lyle Whelchel
10200 36



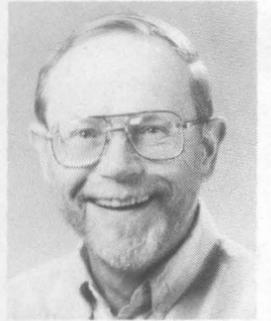
Jan Willis
3010 31



Eugene Cnare
1221 38



Roy Griego
12810 36



Peter Stirbis
1562 37



Audilio "Mike" Barela
10221 41



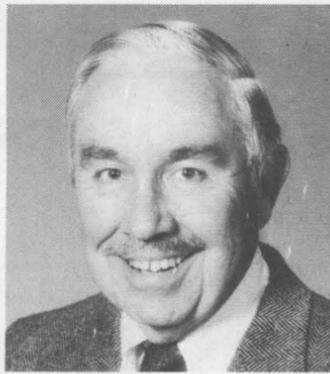
Richard Johnson
2341 35



SCHOLARSHIP WINNERS — Five sons and daughters of Sandians have been honored with 1994 Martin Marietta Corporation Foundation Scholarships, the first time the awards have been given since Martin Marietta became Sandia's management and operating contractor. Here Sandia President Al Narath joins the four recipients who were present at the May 9 scholarship awards luncheon at the Coronado Club. From left: Angelo Gonzales, Del Norte High School, son of James (2412) and Berinda (6403) Gonzales; Barbara Dybwad, Exeter High School, Reading, Pa., daughter of Gay (2411) and Joy Dybwad; Allison Bradley, Eldorado High School, daughter of Bob (5103) and Donna Bradley; and Adam Greenwood, Manzano High School, son of Bill (2645) and Dorothy Greenwood. The fifth recipient is Grace Lyo, Sandia High School, daughter of Ken (1112) and Jane Lyo. Grace was away participating (and winning awards) in the International Science and Engineering Fair. Al hosted the scholarship awards ceremony, and Charlie Emery, VP for Human Resources Div. 3000, made closing remarks. Each scholarship is for \$3,000 a year, renewable for a total of four years.

Mileposts

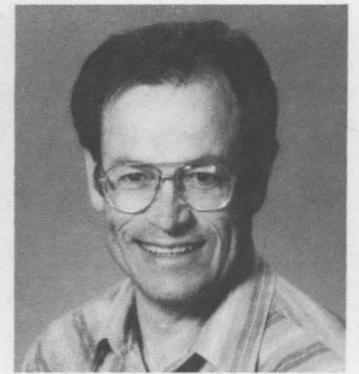
May 1994



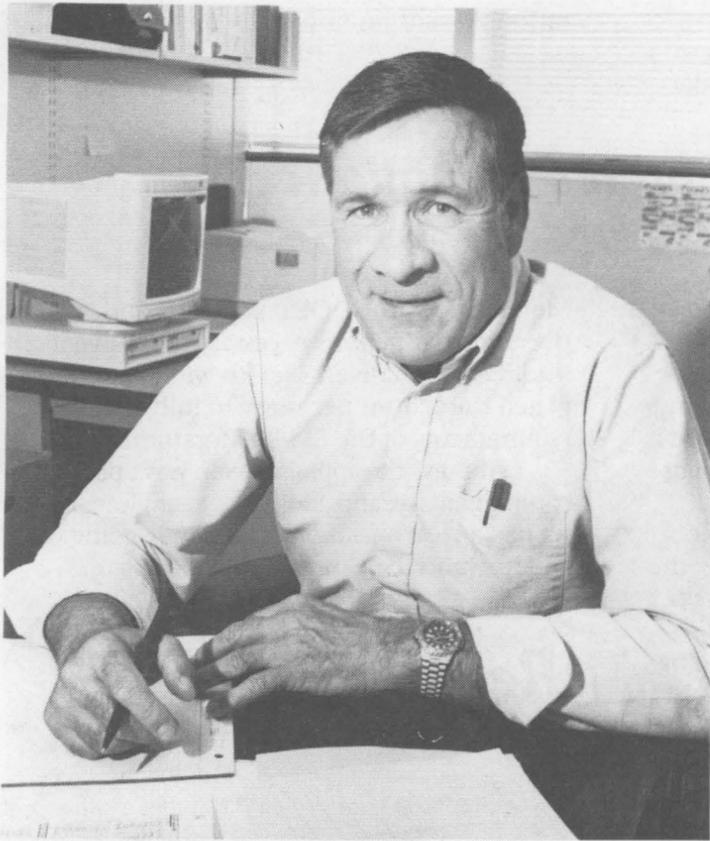
Glenn Dietel
5362 35



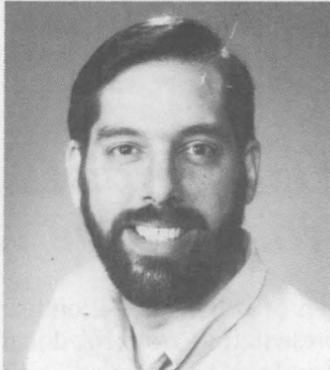
Irene Rivera
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Don Cowgill
8715 20



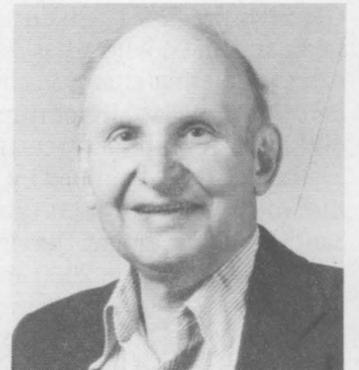
Robert Stinebaugh
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Ed Dutra
8271 15



Robert Cover
9604 30



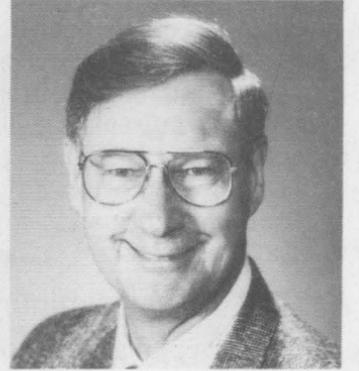
Martin Sherman
6513 15



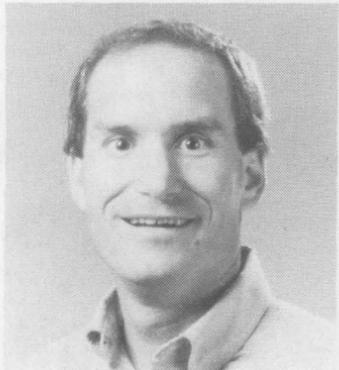
Bruce Hansche
2752 25



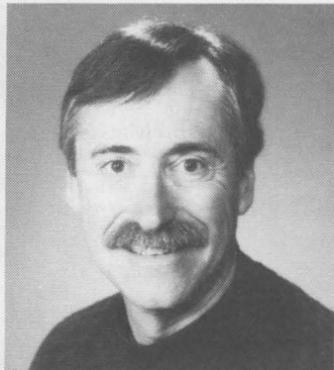
Joan Funkhouser
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Max Schell
8416 35



Timothy Dubay
2665 15



Bob Green
8362 25



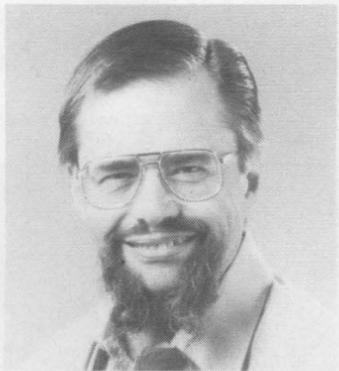
Marlin Kipp
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Gayle Allen
8631 15



Leroy Tafoya
2314 20



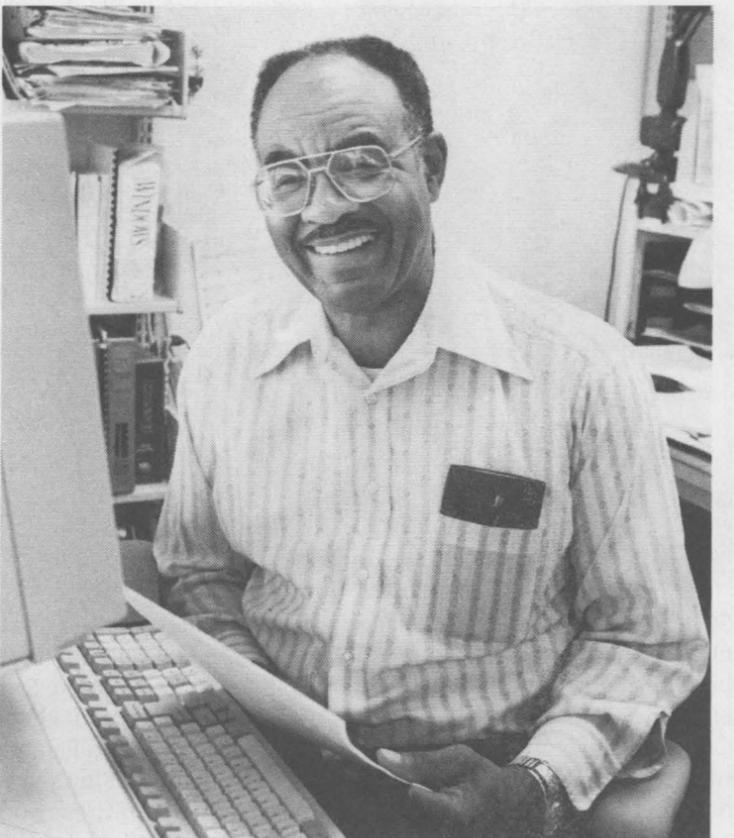
William Fienning
2665 30



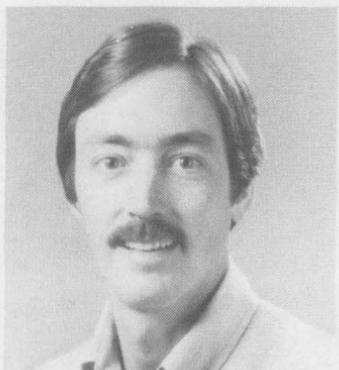
Bonnie Grant
8523 15



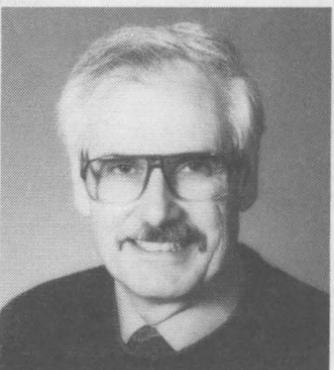
Ronald Tucker
9132 25



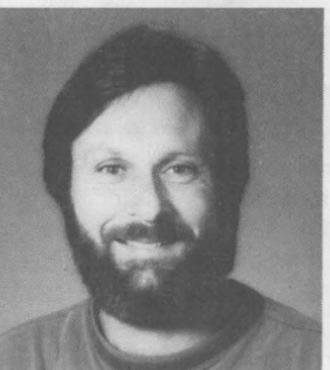
James Johnson
6306 35



Glenn Russell
2335 15



George Thomas
8715 25



John Dolce
8613 20

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

MISCELLANEOUS

- RECORDS & ALBUMS, 33-1/3, call for information and prices. Stuart, 345-6358.
- DOG, collie/golden retriever mix, male, 2 yrs. old, current shots, neutered, free to good home. Miller, 823-1070.
- ROCKWELL UNISAW, 10-in. w/3-hp single-phase motor, \$750. Zanner, 281-1789.
- GARAGE DOOR OPENER, automatic, Edwards Power Door Co., two remote openers and remote sensor, free. Brabson, 856-6916.
- HOSPITAL TRAY TABLE, mobile, height adjustable, \$60. Lynch, 298-7817.
- GUN COLLECTION, wide variety of hunting and military rifles, shotguns, and handguns. Pryor, 294-6980.
- COMPUTER, PC, good for dial-up, 1,200-baud modem, 30MB HD, mouse, software, Zenith mono monitor, \$200. Mitchell, 294-2973.
- ALTO SAXOPHONE, properly maintained, stored in hardshell case, excellent condition, \$700 OBO. Martinez, 883-6815.
- TRAILER, light utility, w/wooden top and canvas tarp, approximately 50-lb. tongue weight (empty), \$200. Mowry, 299-2526.
- DINING TABLE, w/leaf and four chairs, contemporary style, dark walnut texture, good condition, \$150 OBO. Aronson, 898-8893.
- GARDEN TUB, off-white, 48" x 60". Monnet, 865-7941.
- PORSCHE DASH, knobs, emergency brake boot, fits '68-'73, all brand new, in box, cost \$400, asking \$250. Armstrong, 254-9230.
- COMPUTER, 286-16, 44MB HD, 1MB RAM, color monitor, mouse, Epson 24-pin printer, \$500. Elliott, 299-7158.
- ANTIQUA BUGGY WHEELS, six, w/two axles, \$500. Brandon, 237-1189.
- SPINET PIANO, Baldwin Acrosonic, French provincial style, original owner, mint condition, tuned yearly, condition verified by tuner, \$2,500. Wagner, 823-9323.
- MICROWAVE OVEN, Tappan, large, w/all features including browner, works well, \$50. Dudley, 255-3626.
- DUCK DECOYS, 18, w/camo carrying bag, \$36; Yakima bike rack, fits bed of standard pickup, \$50. Mozley, 299-4204.
- COMPUTER, Gateway 486DX/33 mini desktop, 220MB HD, 3.5- and 5.25-in. drives, 4MB memory, loads of software, \$1,700. Brewer, 293-8791.
- LAWN MOWER, Black & Decker, 5 yrs. old, electric, w/one-year-old side bag, \$75 OBO. Lambert, 899-2060.
- MOVING SALE: girl's bedroom furniture; dinette table, w/four chairs. All in excellent condition. Harris, 884-9260.
- SHOPSMITH, Model 510, w/bandsaw, jointer, belt sander, scroll saw, power station, and many accessories, \$2,500. Mozley, 884-3453.
- PRINTER, Epson FX-100, 9-pin, w/some instruction sheets, \$45. Dietzel, 294-4702.
- SHOP MANUAL, for '84-'94 Jeep Cherokee, \$18; Chilton manual, for Toyota 4WD pickup, \$6. Stevens, 293-5704.
- CONSOLE ORGAN, double deck, "Thomas," w/bench and music, excellent condition, \$1,400 new, sell for \$400. Lloyd, 299-7153.
- MICROWAVE, Toshiba, 1.6 cu. ft., excellent condition, new \$240, sell for \$100. Dwyer, 271-1328.
- STANDARD POODLE PUPPY, AKC-registered, black, male, show quality, born April 1, excellent bloodlines and temperament, \$450. Baca, 856-1401.
- THULE RACK, for gutter mount, fits '86 Toyota 4Runner, bar and mounts only, \$50 OBO. Lipka, 836-6465.
- TRAMPOLINE, large, 7- x 14-ft., good shape, \$85; cartop box carrier, attaches to gutter, \$15. Linn, 296-3176.
- TANDEM-AXLE TRAILER, 16-ft. L x 6-ft. W, good condition, \$700. Castillo, 836-4213.
- GUN, Ruger, .357 Magnum, Model SP101, 3-in. barrel, fired only a few times, excellent condition, \$340. Baca, 345-6082.
- WATERBED, king-size, motionless, oak, w/heater, \$225; upright freezer, Kenmore, 19 cu. ft., \$275; tenor trombone, w/case, \$150. Montano, 821-1235.
- RECREATIONAL ITEMS: tent, Eureka, two-person, dome, \$30; weight bench, barbell, dumbbells, 120 lbs., \$50. Shinn, 291-8825.
- COLOR TV, 23-in., Heathkit #295, w/remote, in nice solid oak semi-console cabinet, not working, no books, \$100. Shapnek, 281-2258.
- CRIB, honey-oak, w/mattress, beautiful, \$100 firm; swing set, \$30 OBO. Cocain, 281-2282.
- WATERFALL HOT TUB, six months old, looks like rocks, w/water cover and hot tub cover, \$5,500. Smith, 344-5886 or 345-5867.
- AIRLINE TICKET, round-trip to Denver, Continental, changeable dates until Sept. 6, \$150. Morales, 296-0928.
- CAMERA, Olympus OM-1, includes standard, wide angle, and telephoto lenses, good condition, \$250. Hammond, 823-9619.
- SUB-WOOFER, Infinity servo-controlled, 100-watt w/crossover/level control, \$375; stereo pre-amplifier, Linn LK-1, balanced input and output, \$375. Norton, 299-3763.
- CD CHANGER, Alpine, w/6-CD cartridge, remote control, \$300; Viper car alarm, \$100. Gonzales, 344-6742 after 6 p.m.
- OAK DRAFTING TABLE, 3' x 5', w/parallel bar, \$175; vehicle tow bar, 5,000-lb. capacity, \$100; refrigerator, side-by-side, \$250. Wernicke, 237-9332.
- WHIRLPOOL ELECTRIC RANGE, harvest gold, continuous clean, w/storage, seldom used, \$100. Rancier, 294-5361.
- LAWN MOWER, Hahn-Eclipse, reel-type, 20-in., self-propelled, self-sharpening attachment, grass catcher, \$60. Coon, 884-4416.
- WEIGHT TRAINING SYSTEM, Sears Dual Trac TM 20, brand new, unused, \$500 value, sell for \$225 OBO. Glenn, 821-6952.
- GARAGE SALE, Saturday, May 28, 8 a.m.-4 p.m., 3025 Palo Alto, east of Tramway/Candelaria, furniture, clothes, speakers, books, more. Frazier, 298-1228.
- ROUND TABLE, w/four chairs and cushions, 47-in., very attractive, see to appreciate, will go with any decor, \$150. Bliss, 296-3752.
- METAL ARMY DESK; Westinghouse clothes washer, slow spin. Both free. Newman, 266-6928.
- CAPTAIN'S CHAIRS, two, from out of small van, \$50/ea. or will consider trade. Roeschke, 266-8988.
- EXECUTIVE DESK, matching credenza and chair, \$275; five-drawer double-pedestal desk, \$35. Spader, 255-5158.
- APPLIANCES: GE oven and microwave, black, \$150; GE dishwasher, almond, \$50; GE cooktop and hood, almond, \$50. Shoup, 291-9652.
- WOOD LATHE, 12 x 40, cast-iron head & tail stock, sanding attachment, \$325; Kentucky rifle kit, make offer; large desk, \$50. Swahlan, 292-3598.
- DINING TABLE, w/glass top, 60-in. round, four matching chairs w/Southwestern-colored chair cushions, soft beige, peach, green, \$175. Seyfer, 292-0179.
- EXECUTIVE CHAIR, high-back, vinyl w/cloth cushion, excellent condition, \$50. Graham, 865-9427.
- ELECTRIC RANGE, GE self-cleaning, white, free-standing, excellent condition, \$175 OBO. Cameron, 266-3250.
- FRIGIDAIRE FREEZER, approximately 30" x 48", \$200; '70 travel trailer, double-door, for cargo or motorcycle, sleeps five, \$1,000. Raines, 291-9002.

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

Ad Rules

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

- FISH TANKS, 125-, 50-, 29-, and two 10-gallon, cabinets, stands & turtle tank, 75 fish, two water turtles, filters, lights, extras, best offer over \$850. Ennis, 836-0504.
- MATERNITY CLOTHES, size 11/12, dress and casual. March, 291-9035.
- SWIMMING POOL, above-ground, 18-ft. diameter, 4-ft. high, w/pump and accessories, no liner or cover. Lamppa, 299-1119.
- 55-GALLON DRUMS, three, free. George, 292-5368.
- SCUBA GEAR: aluminum tank, \$125; Sea-Pro AT-PAK autoinflate BC, \$275; DACOR regulators, w/gauges, \$290. Lanes, 856-7738.
- ROWING MACHINE, Pro Sport 760XL, like new, \$65; Kirby vacuum, good worker, needs good home, \$60. Christensen, 884-8249.
- WEDDING & ENGAGEMENT RING SET, 54-pt. center diamond, w/16 4-pt. diamonds, TCW 1.14 cts., appraised at \$2,800, sell for \$1,200. James, 883-8784.
- ELECTRIC LAWN MOWER, Black & Decker; ladder; microwave; chest; answering machine; hardshell luggage; turntable; free grill. Swanback, 294-5850.
- TWIN-SIZE BED, w/head & foot boards, \$100 OBO; spreads & sheets, flower designs, \$12; Hartman briefcase, 5-in., black, \$200. Hobbs, 291-8267.
- HOTPOINT REFRIGERATOR, almond, excellent condition, \$285 OBO; Lifestyle ski machine, new, \$65. Metzger, 271-1621.
- BOOKCASE HEADBOARD, queen-size, 7 yrs. old, \$35; Fit-One cross-country skier, hardly used, paid \$300, will sell for \$100. Langwell, 293-2728.
- GARAGE SALE, May 28, headboard frames, canopy bed, nightstands, bikes, dressers, Ethan Allen sofa, bookcases, patio grill, more. Corcoran, 265-1694.
- BEDROOM SET, \$125; entertainment center, \$50; humidifier, \$25; sitting nude picture, for pool room, \$100. Johnson, 296-1917.
- PROM DRESSES: one royal blue, tea length; one powder blue, tea length; one pink/black, floor length. All size 14. Sampson, 892-7258.
- POWER MOWER, reel-type; hunting bow; child car seat; gas-powered Weed Eater; 8-ft. graphite fishing rod; open-face reel. Baney, 281-6117.
- WORD PROCESSOR, Brother WP75, w/spreadsheet software, \$100 OBO; dishwasher, GE, harvest gold, \$50 OBO; Fram filters, air, oil, fuel. Farmer, 857-0503.

- DINETTE SET, 7-piece, vinyl chairs, two leaves, dark oak, \$75; Emerson color TV, 20-in., w/remote, \$125. All in good condition. Graham, 293-7302.
- DOG, beagle, AKC-registered, 10 mos. old, tri-colored, has all shots, friendly. Gurule, 296-5220.
- STYROFOAM SHEETS, 2-in. thick, \$2/sheet. Smith, 281-9360.

TRANSPORTATION

- '89 CHEV. S-10 PICKUP, AT, V6, PS, PB, AC, AM/FM cassette, bed liner. Aboytes, 823-2791.
- '76 GMC VAN, 250, 6-cyl., 3-spd. \$300. It starts, it goes. Kelly, 266-5977.
- '84 VW QUANTUM, 4-dr., less than 80K miles, great shape, \$1,495. Linn, 296-3176.
- ROAD BIKE, specialized Epic Allez, carbon fiber frame, Shimano 600 components, clipless pedals, computer, many extras, \$500. Dudley, 255-3626.
- SAILBOARD, Fanatic 300, w/mast, boom, fin, dagger, two sails w/sailbags, very good condition, \$250 OBO. Lipka, 836-6465.
- ALPINE MOUNTAIN BIKE, commuter/recreational, solid, AT-4 bars, Avocet computer, oversize tubing, Suntour components, \$575 new, \$275. Wilshusen, 299-7036.
- BICYCLE, Schwinn, 10-spd., lightweight, excellent condition, \$75. Cocain, 281-2282.
- '65 LINCOLN CONTINENTAL, 4-dr., convertible, suicide doors, 85K miles, restored and fun to drive, \$9,500. Gregory, 294-5622.
- '79 CHEV. MALIBU, 40K miles, \$2,750; '83 Ford LTD wagon, \$1,500; '74 BMW 1602, \$2,400. Devejian, 884-3801.
- BOAT, '89 Bayliner, 19-1/2-ft., I/O, open bow, V8, 200-hp, includes skis, tube, accessories, low hours, excellent condition, \$8,500. Dwyer, 271-1328.
- '85 DODGE B-250 RAM VAN, V8, one owner, 8-passenger, AT, AC, PW, 103K miles, excellent condition, \$4,500. Jow, 828-3680.
- '88 PONTIAC GRAND AM, 4-cyl., turbo, PB, PS, cruise, AT, electric windows & seat, 4-dr., blue, clean. Cole, 864-6534.
- '90 ACURA INTEGRA GS, 2-dr., 5-spd., loaded, 30K miles, \$11,995; '91 VW Fox GL, 4-dr., AC, 5-spd., 42K miles, \$6,500. Washburn, 275-3751.
- '75 FORD F150 TRUCK, \$1,500; '71 Ford Van, \$1,200; '65 Lincoln Continental, \$3,200. Well maintained. Pryor, 294-6980.
- '89 HONDA ACCORD LXi, 4-dr., AT, AC, PW, PL, sunroof, AM/FM cassette, excellent condition, \$9,750 OBO. Bencoe, 881-6163.
- '93 HONDA XR600R, trails/enduro motorcycle, less than 100 miles, showroom condition, paid \$4,200 in Aug. '93, sell for \$3,300. Lanes, 856-7738.
- '85 PORSCHE 944, white, sunroof, security system, leather seats, AM/FM cassette, AC, PW, low miles, excellent condition. Haines, 293-8911.
- '83 NISSAN SENTRA, 4-dr., AC, AT, one owner, low mileage, excellent condition. Petterson, 299-0164.
- '88 YAMAHA FZ600, new Bamett clutch and Regina gold chain, runs well, \$2,000. Keener, 294-0856.
- '58 NASH RAMBLER, 6-cyl., AT, 2-dr., new upholstery and tires, original paint, very reliable, \$1,850. Newman, 266-6928.
- BICYCLES: man's Peugeot PHLE10, 25-in. frame, 12-spd., \$175; woman's Univega Custom Maxima, 23-in. frame, 10-spd., \$150. Shoup, 291-9652.
- '89 YAMAHA XT350, low miles, excellent condition, \$1,300. Swahlan, 292-3598 evenings.
- '90 GMC SIERRA SLE TRUCK, 3/4-ton, extended cab, long wide bed, fully-loaded, heavy-duty, 350 V8, EFI, low miles, extra clean. Baney, 281-6117.

- '89 GMC S-15, AC, AM/FM cassette, cruise, extended cab, tow package, \$6,500 w/cab-over camper, \$6,000 without. Raines, 291-9002.
- '74 JEEP WAGONEER, 360 engine, new brakes, 4WD, good condition, runs well, \$1,200. Knowlson, 299-1470.
- GLASSTRON OPENBOW BOAT, 18.6-ft., 130-hp Volvo I/O, Dilly trailer, lots of extras, \$3,200. Elliott, 299-7158.
- '92 TOYOTA CAMRY LE, V6, AT, AC, PW, PL, cruise, security system, power sunroof, upgraded stereo, \$16,000; '85 Jeep Cherokee, \$4,500. Saxton, 867-1171.
- MOUNTAIN BIKE, \$50. Johnson, 276-1917.
- '87 OLDS. CUSTOM CRUISER, 9-passenger SW, PS, PB, PW, PD, 59K miles, \$5,900 OBO. Bragg, 275-3172.
- MOTORHOME, 22-ft., Class A, Superior, Dodge 440, new interior, 67K miles, generator, awning, many extras, very clean, \$7,800. Perkins, 899-8766.

REAL ESTATE

- 4-BDR. HOME, custom Mossman, 2,872 sq. ft., sewing/game rooms, oversized garage/darkroom, new stucco and roof, near Comanche/Louisiana, \$209,500. Benham, 881-2593.
- 5-BDR. HOME, 2,850 sq. ft., deck overlooking city, landscaped yard, fruit trees, hot tub, east of Tramway/Candelaria. Frazier, 298-1228.
- 2.5 ACRES, vacant land, S-14 & Raven Road, includes water & power, \$35,000. Swahlan, 292-3598, evenings.
- 3-BDR. HOME, 1-3/4 baths, 1,172 sq. ft., one car garage, Rio Rancho, big backyard w/trees, grass, and play area, nice. Hobbs, 291-8267.
- 4-BDR. HOME, 2 baths, 1,650 sq. ft., Academy Acres, Spanish tile, landscaping w/sprinklers, \$115,000. Ashby, 821-3627.

WANTED

- GRASS CLIPPINGS, for summer mulch project, no bermuda or dandelion seeds, prefer SE area. Cibicki, 877-7098.
- ROOM TO RENT, mainly for weekends, any area of city, for employee on temporary assignment. Hubbs, 899-4424.
- CHEAP BOAT, with or without motor. Roeschke, 266-8988.
- TEMPORARY HOUSING, for responsible professor, wife, and two children, during July 19-Aug. 20 work at Sandia. Brost, 298-6969.
- USED BREAD MACHINE. Hymel, 293-6029 evenings.
- FIFTH-WHEEL, 19- to 21-ft., less than 10 yrs. old, non-smoker, must be in top shape. Danclovic, 897-7964.
- OUTBOARD MOTOR, for aluminum boat, must be 10- or 15-hp. Beeler, 822-9485.
- USED WATER SKIS and other water toys, reasonably priced. Woodward, 293-4369.
- RECEIVER/EQUALIZING HITCH SETUP, for '73 Ford 3/4-ton pickup; trunk mount bike rack. Zirzow, 281-9896.

LOST & FOUND

- FOUND: Silvertone wristwatch, Earth Day at Hardin Field. Raines, 844-8129.
- LOST: New prescription glasses, in black case, between Bldg. 891 and car. Dye, 844-0504.
- LOST: Set of 5-6 keys on navy leather and tan Dooney and Bourke key chain. Seyfer, 845-8990 or 292-0179, immediately.



Feast, dance, swim — it's summer time (well almost, anyway)

Coronado Club Activities

TONIGHT at the Coronado Club, Friday, May 27, it's time to put on those boots and dance to the country sounds of the Isleta Poor-boys. But before heading to the dance floor, come have a dinner of filet mignon, \$11.95, or grilled halibut, \$10.95, or the all-you-can-eat buffet, where there's baked ham, Baron of beef, roast turkey breast, and poached fish for only \$6.95. Dinner's 6-9 p.m., dancing 7-11 p.m.

YOU HAD A CHANCE for a preview last weekend, but tomorrow, Saturday, May 28, the swimming pool opens for the season. Hours are 11 a.m.-5 p.m. On Monday bring your shades and suntan lotion and come join us at the Memorial Day Pool Party, 11 a.m.-6 p.m., with

music by Bob Weiler & Los Gatos and some clowning around by Pixie, Mitzie & Sparky.

THURSDAY EVENING, June 2, and every Thursday evening for the rest of the month are Bingo Nights. Card sales and buffet begin at 5:30 p.m., and Early Birds bingo starts at 6:45.

THE ISLETA POORBOYS return Friday, June 3, in a repeat of the dancing and dinner menu of the previous Friday. You can't get enough of a good thing!

IT'S TIME for a Sunday Brunch Buffet on June 5, 10 a.m.-2 p.m., with a tea dance following that, 1-4 p.m. Music is by Best Shot.

this month in the past...

Sandia LAB NEWS

40 years ago...Here are a few "Secrets of Success" that were listed in the May 7, 1954, issue of the *Lab News*: "(1) Set yourself a goal. No man can attain success unless he knows in which direction he is traveling. (2) Be master of yourself. Self-control results in self-confidence. Think positive thoughts. Dress carefully but not so as to attract attention. (3) Learn the meaning of thrift. Save at least 10 percent of your earnings even if it entails great sacrifice. (4) Don't spend too much time watching the other fellow and trying to get ahead of him — he may be moving too slowly."

35 years ago...Sandia's "Sphere of Science," which contained many exhibits of scientific work being done at the Labs, was formally opened. The building is a geodesic dome, based on a design originated by architect R. Buckminster Fuller around 1940. Now generally referred to as "the dome," Bldg. 852 is used for office space and is the future home of Community Relations Dept. 12640.

20 years ago...A vertical axis wind turbine (VAWT) was installed on the roof of Bldg. 802. With "airfoil" blades that rotated on vertical shafts, the turbine was expected to produce about 3 hp in a 20 mph wind. Described as having the potential of alleviating the nation's energy shortage, this "modern" windmill that looks like a giant egg-beater was actually invented in France nearly 50 years earlier. Sandia continues to experiment with VAWTs today; two are located just east of Bldg. 858.

—Lisa Chavez

Sandia in the News

This is a periodic column listing a selection of print and broadcast news reports about Sandia. It is provided by Media Relations Dept. 12630 to give Sandians a sense of what is being said about Labs work in national and international media.

A detailed feature about three of Sandia's non-lethal weapon concepts — sticky foam, aqueous foam, and the "smart gun" — produced by Albuquerque's CBS affiliate, was fed nationally on that network's NewsNet for pickup throughout the country. Among those immediately airing the story, which had Steve Scott (9611) on camera, was KCBS-TV, Los Angeles.

USA Today's weather page carried details about the Sandia-directed portion of DOE's Atmospheric Radiation Measurement Program, designed to study the impacts of clouds on the atmospheric energy balance and to improve the reliability of large-scale computer models used to predict climate change.

Business Week carried a story about Sandia's "Prosperity Games," an exercise modeled on military war games but designed to help figure out what programs and policies involving government, industry, national labs, and universities can enhance US industrial competitiveness.

The New York City-based magazine *Metropolis* offers a major piece about the WIPP markers project and the team put together by Sandia to come up with ways to tell future generations about the waste disposal site. This project has been popular with the specialized and mass media for more than two years. Others carrying articles about the markers project since the beginning of FY94 include *The Independent* (London), the *New York Times Magazine*, the *Magazine of Fantasy and Science Fiction*, and *Radwaste* magazine.

Big Barney bones

The *San Diego Union* reviewed a children's book, *The Search for Seismosaurus*, in which the author, paleontologist David Gillette, described how technology helped his excavations several years ago. For instance, Sandia scientists provided him with vital information about the whereabouts of dinosaur bones by passing radar waves through layers of sandstone.

Aviation Week & Space Technology reported that researchers at Sandia and Virginia Polytechnic Institute are developing a virtual reality test environment.

BBC radio's "Science Now" newsmagazine interviewed Phil Stanton (1433) about Sandia's new hypervelocity launcher, which recently accelerated a quarter-inch metal plate to a record velocity of nearly 36,000 mph.

Add the *Boston Globe* and *Popular Science* to major publications reporting on Sandia's contributions to that very "green" luxury resort in the US Virgin Islands.

The *El Paso Times* ran a front-page feature about how FEMAP (a group of private health and community development associations), El Paso Natural Gas, and Sandia are cooperating to help poor families in Ciudad Juarez make bricks using environmentally conscious techniques.

Security magazine ran a short question-and-

answer story with Dennis Miyoshi (5800) about security challenges facing DOE facilities and some possible solutions. The piece explains that Sandia has DOE lead laboratory responsibility for physical security systems.

Martin Pilch and Michael Allen (both 6422) were each quoted in *Machine Design's* story about their work that involves testing scale models of nuclear power plants to simulate severe accidents.

Sandia's contributions to Quality New Mexico, which promotes development of quality standards across the state as a means of improving its competitiveness, were noted in the *Carlsbad Current Argus*.

Newsday's piece, "Research on Trial: Future of National Labs Under Scrutiny," pointed to Sandia's work with SEMATECH as an example of how these institutions need to help private industry

Sandia/California's photo lab, staffed by Lynda Hadley and Cary Chin (both 8535), was the subject of a two-page feature, with color photo, in *Photo Electronic Imaging*, a magazine that focuses on the integration of photography, electronic imaging, and graphics.

Carl Melius (8117) explained in a nationally syndicated feature (by the Knight-Ridder syndicate) that he values massively parallel computers because they work so quickly. "With the faster computers, you can get a more realistic result out before you lose patience," he said.

A summary of work by Richard Carson (1342) showed up in *Photonics Spectra* in a tech-transfer section article headed "Optical Sensor Thwarts Tampering."

The *Greater Baton Rouge (La.) Business Report* quoted James Holmes (9612) in its lengthy feature about biometrics, a specialized field that uses technical means of identifying a person by measuring physical or behavioral characteristics.

A *Providence Journal* feature about goals of USCAR, an umbrella group of consortia created by Detroit's Big Three, included info about Steve Lott's (6212) program aimed at reducing nitrous oxide emissions from lean-burn automobile engines.

A detailed article in *National Defense* about the challenges in dismantling thousands of nuclear warheads and dealing with the residue pointed out that Sandia is directing much of its effort in this area to use robotics to reduce human radiation exposure.

Fun & Games

Tennis — The Coronado Club Tennis Association "Double Your Fun" Weekend Tennis Tournament will be held June 25 and 26 at the Coronado Club tennis courts. Events include men's and women's doubles and mixed doubles. Gift certificates will be presented to winners and runners-up. Drinks will be provided to all participants. SERP and Coronado Club members and military personnel are invited to participate. Participants' guests may play. Entry deadline is June 20. For more information and entry forms, contact the SERP office on 844-8486.



MARGARET CARROLL, Manager of Safety Engineering Dept. 7732, is the newly elected president of the 30,000-member American Society of Safety Engineers (ASSE). Her one-year term begins July 1. Founded in 1911, ASSE is the world's oldest and largest professional safety organization. Its mission is to promote the advancement of the safety profession and foster the technical, scientific, managerial and ethical knowledge, skills and competency of safety professionals.