

## New Sensor May Cut Cost of Manufacturing Precision Parts

Robots that can do things better than humans can make people a little uneasy. But robots are easier to appreciate when they perform tasks that would be dangerous or impossible for humans to perform, such as cleaning up hazardous waste in contaminated areas or machining super-precise weapon components.

A recent development in Intelligent Machine Principles Div. 1411 could pay off big in a number of commercial machining applications. Researchers in the robot sensor lab have developed a sensor that "feels" the edges of machined parts without actually touching the parts.

HIRCIS (pronounced "hurkis") — the High-Resolution Capacitive Imaging Sensor — measures electrical-field changes to produce a surface image of a

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**Manual deburring can account for more than one-third the cost of manufacturing precision parts.**

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machined part. This surface image shows tiny burrs (raised discontinuities) or cracks in a part (see "HIRCIS: What Else Can It Do?" on page four).

Sandia researchers believe the non-contact sensor, when combined with other new Sandia-developed automation technologies (LAB NEWS, March 9, 1990), could reduce the cost of manufacturing many high-precision parts, such as jet engine hubs, by up to 30 percent.

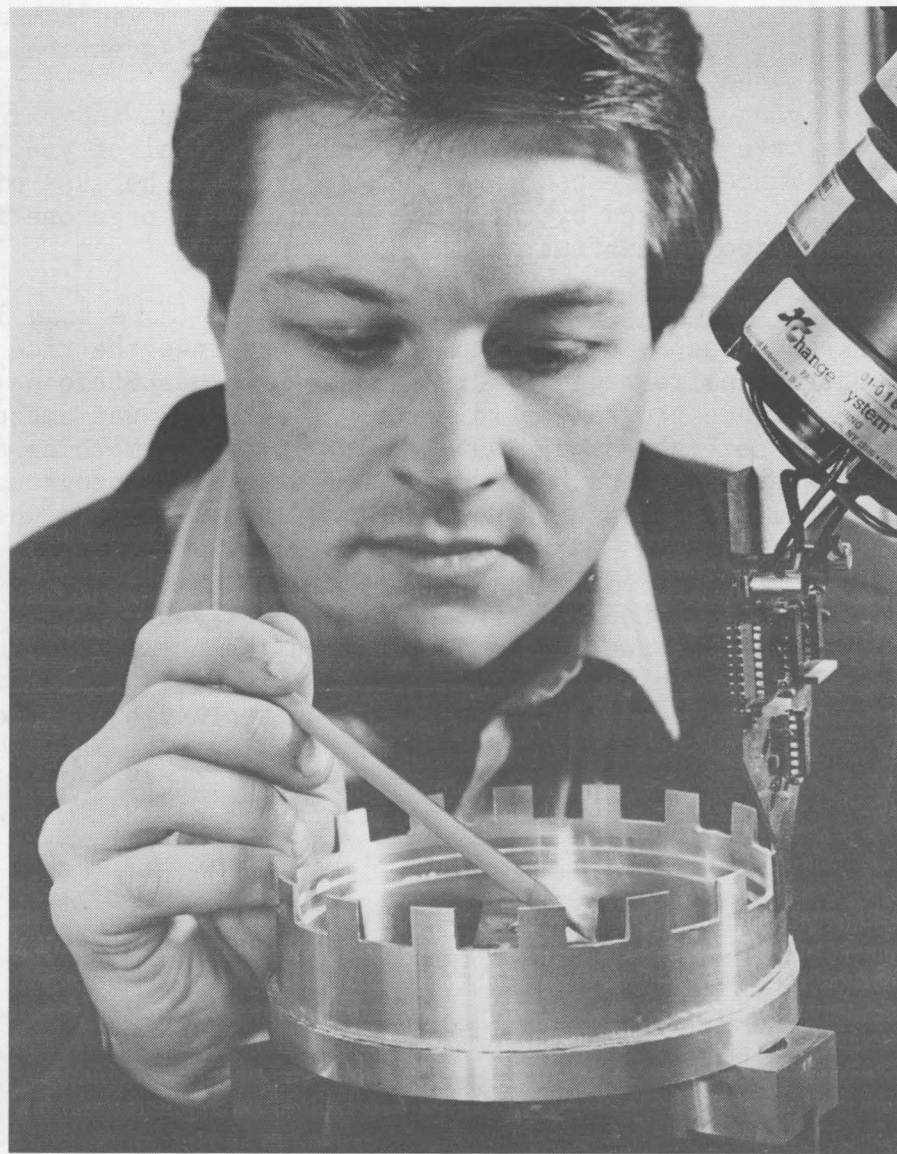
These automation technologies will enable a robotic arm to find and remember part coordinates, locate and map surface deformities, and then deburr and chamfer edges in much less time than with other systems and with greater reliability and precision. Such sensor-rich automated systems may soon have a profound effect on US-manufactured products, from printed circuit boards to jet engine parts, according to Jamie Wiczer (1411).

"HIRCIS can do some things that humans simply can't do with the same degree of precision," says Jamie, co-inventor of the sensor. "When attached to a robot, it helps reduce the possibility of human error."

### 'Reinventing the Wheel'

Because many nuclear weapon components and jet engine parts must be manufactured with precision, a single slip can mean an entire part must be discarded, driving the cost of manufacturing higher. Estimates from the Society of Manufacturing Engineers show that manual deburring can account for more than one-third the cost of manufacturing precision parts, and 150,000 people in the US spend their time finishing part edges by hand.

Using the new sensor, a robotic edge-finishing system could be developed  
*(Continued on Page Four)*



JIM NOVAK (1411) examines the edge of an aluminum part used to test the HIRCIS sensor. As it is moved along a part's edge by a robotic arm, the sensor locates and maps surface deformities. HIRCIS and other sensor-rich techniques developed by Sandia's robot sensor lab may soon be used on many US-manufactured precision products.

### What Do You Think?

#### The Current Question: A Second Chance

*Editor's Note: The following question was published in the Dec. 21 LAB NEWS. We planned then to publish employee responses in this issue. However, we decided to extend the deadline and publish responses in the next issue (Jan. 25) because several Sandians who wanted to respond said the short deadline necessitated by the holiday break did not give them sufficient time.*

DOE Secretary James Watkins says ES&H (Environment, Safety, and Health) compliance activities should have top priority at all DOE facilities. Some Sandians, however, seem unenthused and unmotivated in this area. **In your opinion, what one or two things could be done to get more employees solidly behind ES&H compliance activities?**

Please limit responses to 50 words, concentrate on presenting constructive ideas, and include your name, organization, and phone number with your response. We will print names and organization numbers with responses unless you specifically request that we don't; if that's your wish, we will honor it and won't reveal your name to anyone. Before we print any name with a response, we'll call you personally to verify that you submitted it.

Send responses to "Question," Division 3162, to arrive by noon on Wednesday, Jan. 16. If you prefer, responses can be faxed to 844-0645. Suggestions for future questions are appreciated.

# LAB NEWS

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### Follow-Up to Large Staff Conference

## Managers Discuss Current Challenges

At a Dec. 14 follow-up to the October Large Staff Conference, President Al Narath issued two directives to the group:

- "Communicate better — up, down, sideways, small group, large group, one level, quad level, formal, informal, face-to-face, by memo, by phone. Explain what leadership, quality, and empowerment are all about and how they affect the role of your organization. And demonstrate what leadership, quality, and empowerment mean by your actions, not just your words."

- "Let your people know that we're concentrating our leadership, quality, and empowerment efforts on ES&H [Environment, Safety, and Health] for the short term. Show them these principles have value in 'real-world' challenges."

### Strategic Success Stories

Dan Hartley, VP of Corporate Change Management 5, chaired a late afternoon session of the conference and asked several managers to summarize some changes they and their organizations have made in response to the *Strategic Plan*.

- Herb Pitts, Director of Information and Communication Services 3100, discussed the formal in-

volvement of his people in choosing a new manager for Technical Communications Dept. 3150. A group of 10 employees (including graded, MA, MLS, and supervisory) developed six key criteria for the job, then invited the nominees for the position to listen to the group discuss the criteria and what they mean in terms of the department's future. A week later, each nominee showed how he or she met the criteria and presented a plan for leading the department. On the basis of these presentations, the group selected three nominees for Herb to interview.

"I want to make two points," said Herb. "One is that I made the choice; it was not an election of a department manager. The other is that the group showed an incredible sense of breadth in its criteria and an impressive grasp of the importance of its task. It was a growth experience for the group members — not only did I gain an excellent manager, but I also gained some wiser people in my group."

Others who have developed innovative promotion practices are Arlyn Blackwell (2800) and Bill Childers (9110).

- How can Purchasing and Materials Management Org. 3700 ensure that its management structure  
*(Continued on Page Five)*



# This & That

**Deadline Extended** - With apologies to you folks who rushed to respond to the latest "What Do You Think?" question (how to get employees to better support ES&H compliance activities), we're delaying printing responses until next issue and extending the response deadline to next Wednesday. Several of you indicated that you wanted to respond but didn't have time because of the short deadline imposed by the holiday break. See page one for the question and response instructions.

\* \* \*

**Speaking of Response** - Nearly half (more than 3,500) of Albuquerque Sandians completed and returned the ride-sharing questionnaire recently distributed by Linda Stefoin (3533), commuter assistance program coordinator. "Frankly, I was amazed at this much response," she says, "but I think it says something about the growing interest Sandians have today in ride-sharing programs." Linda's busy compiling the results now, and we'll publish them when they're ready.

\* \* \*

**Holiday "Highlights"** - I hope your holiday luck was better than mine. First, LAB NEWS photographer Mark Poulsen brought some caramel popcorn into the office just before the break. Tasty stuff, but it turned out to be an expensive treat after I broke a molar on an unpopped kernel and had to have the tooth crowned. Don't know how much the dentist's fee will be, but I suspect Mark won't bring in any more popcorn after I hand him the bill! Another "holiday joy" was buying a new water heater and finding a plumber who wasn't booked up repairing broken water pipes. Just call me Ebenezer.

\* \* \*

**A Gift I Can Use** - I don't recommend products, but I suspect lotsa folks could use one of these: a Smile on a Stick.™ I'll probably use mine a lot when listening to the boss ("Yes, I think that's a great idea, boss") and in some situations with my children ("Sure, I'll be glad to give you 80 bucks for new sneakers").

\* \* \*

**Another Place to Avoid** - Folks who share my aversion to crowds probably already know several places to avoid between Christmas and New Year's Day. Ski slopes with good snow and any gift exchange counter the day after Christmas are classic examples. But one of the most crowded places I encountered during the holiday break was the computer software section in a major Albuquerque bookstore. Obviously lots of shoppers were looking for something to stuff into their new gift computers.

\* \* \*

**Attn: SODA Members:** - Strange acronyms are still proliferating, so I may soon call another general meeting of the Society to Outlaw Dumb Acronyms (SODA). Among acronymns we'll be discussing (I am not making these up): PIP (Productivity Improvement Program), FAT (File Allocation Table), and RAMBO (Rapid Amplitude Microwave Blumlein Output).

•LP



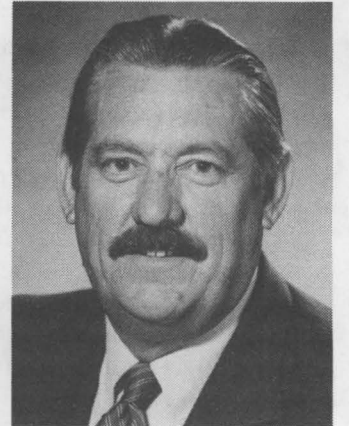
## Daily Violence In Our Cities

# Former US Senator To Discuss Race And Poverty



Although minorities in America have made economic progress, life is significantly harder today for the nation's poor than it was 20 years ago, says UNM Political Science Professor Fred Harris. Harris is the next speaker in the Community Focus series sponsored by Community Relations Div. 3163.

A former US Senator from Oklahoma, Harris discusses "Quiet Riots — Race and Poverty in the United States; How is New Mexico Doing?" on Monday, Jan. 14, at noon in the Technology Transfer Center. Seating is on a first-come basis.



FRED HARRIS

In 1967, a series of bloody riots occurred in cities across the nation. President Lyndon Johnson appointed a national advisory commission on civil disorders to investigate the causes of the violence. Harris helped formulate this commission's recommendations, which targeted poverty, unemployment, and racism. Two decades later, he looks again at the status of race and poverty in the US.

Harris states that the amount of poverty today is greater than it was in 1968 when the commission made its report. Southwestern cities are experiencing the same conditions as the rest of the nation, although Albuquerque may be in better shape than some, he says.

"There are 'quiet riots' in America's central cities," says Harris. "Unemployment, poverty, social disorganization, segregation, family disintegration, housing and school deterioration, and crime are worse now. The quiet riots are not as alarming as the violent riots of the 1960s, nor as noticeable to outsiders. But they are even more destructive to human life."

Harris served in the US Senate from 1964 to 1973. He has been a member of the UNM political science faculty since 1976. At UNM, he has been director of the Institute for Public Policy and has served on the board of directors of the Southwest Hispanic Research Institute and the Faculty Concilium on Latin American Studies. He is currently director of UNM's University Partnership Program with Guatemala.

Designated an Eminent Scholar by the New Mexico Commission on Higher Education, Harris has authored 11 books. He has also been a Fulbright Scholar for research and study in Mexico and a Distinguished Fulbright Lecturer.

•AStotts (3163)

## Take Note

The Cultural Diversity Colloquia Series will rerun the tape "A New Mexican Perspective," with Rudolfo Anaya, today from 11:30 a.m. to 1 p.m. in the Technology Transfer Center (TTC, Bldg. 825). Anaya participated in the Hispanic Lecture Series in September 1990. He is the author of *Bless Me Ultima* and winner of the Premio Quinto Sol Literary Award.

On Jan. 24, the tape of Norbert Hill's presentation, "Healing the Hurt: American Indians in Transition," will be shown from 11:30 a.m. to 1 p.m. in the TTC. Hill is Executive Director of the American Indian Science and Engineering Society. His presentation focuses on the emergence of Indian culture into the American mainstream.

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## Earnings Factors October 1990

Long-Term Savings Plan for Management Employees (LTSPME)	Earnings Factors
AT&T Shares	1.0999
Government Obligations	1.0127
Equity Portfolio	.9876
Guaranteed Interest Fund	1.0073
South Africa Restricted Fund	.9954

### Long-Term Savings and Security Plan (LTSSP)

AT&T Shares	1.1009
Guaranteed Interest Fund	1.0073
South Africa Restricted Fund	.9953
Equity Portfolio	.9873
Employer Stock Fund	1.1012





*Collegiate Cooperation*

## Sandia Offers Engineering Experience to Cornell Students

A cooperative work experience program between industry and Cornell's College of Engineering brought five Cornell juniors to Sandia, Livermore for four-month internships this fall. The students will return to Livermore to work this summer, before their senior year.

Ed Hathaway (8522), Personnel liaison for the program at Sandia, says the students value the program because it offers them a chance to gain practical experience in a paid job without delaying their graduation.

"We hope this is the first of several internship programs with universities of this caliber," he says. "Promising engineers can get a look at what Sandia

**"We hope this is the first of several internship programs with universities of this caliber."**

has to offer, and we can work with individuals we may be recruiting after they complete undergraduate or graduate degrees."

The interns have project assignments in scientific computing and applied math, mechanics of materials, thermal and fluid mechanics, and environmental testing. They are working with Sandians Bill Mason (8245), Frank Cupps (8210), Roy Lee (8210), Chuck Hartwig (8244), Brad Meyer (8244), Mel Callabresi (8243), Wendell Kawahara (8243), Pat Gildea (8283), and Jim Smith (8283).

One student, Samir Shah from Bayside, N.Y., is doing computer programming in Postscript and UNIX with Bill Mason. "Hands-on work, actually doing the programming instead of reading about it in class, is the most valuable part of the experience," Samir says. "Using what I've learned in school and



DEAN of Cornell's College of Engineering, Bing Cady (right), recently visited Sandia to observe the work experience programs of five Cornell undergraduates participating in internships at Livermore. Students (front row, from left) are Scott Lee, Obert Chu, Samir Shah, David Krein, and Wing Lok Lee. Behind them are Mike Birnbaum (8242, left) and Ed Hathaway (8522).

getting a chance to focus on what is valuable in a real work setting makes the time spent here worthwhile."

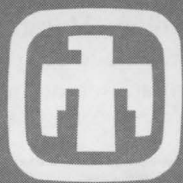
David Krein, a mechanical engineering student from Seaford, N.Y., is working with Wendell Kawahara on two projects — a high-strain-rate experiment and a medium-temperature creep test. "This has been a good experience for me," David says, "exposing me to a lot of equipment I wouldn't otherwise see. The staff here has provided a lot of support and answered my questions."

"It's a great program for everyone involved," says Mike Birnbaum (8242), who helped bring the Cornell students to Sandia. "Students get exposure to our type of work, and even if they don't return here as a career move, they share their experiences with

other students who might apply here. It's always fun to work with bright, energetic young people."

Some 168 members of Cornell's class of 1992 are involved in the industrial co-op program. Students who have high academic rankings qualify for the program. They are interviewed by participating companies who make final selections.

Among the other US industries and institutions training Cornell engineering students through the cooperative program are AT&T, Chevron Research, Cummins Engine Company, Digital Equipment, Dow Chemical, Eastman Kodak, Exxon, General Dynamics, General Electric, General Motors, Hewlett Packard, Jet Propulsion Laboratories, Oak Ridge National Laboratory, Proctor & Gamble, and McDonnell Douglas. ●BLS



## SANDIA LIVERMORE NEWS

### Congratulations

To Rose Ketchum (2910) and Richard Schubert, a son, Jacob Thomas Schubert, Nov. 20.

To Danny Bernacil (8535) and Terri Tobiasen, married in Grass Valley, Nov. 24.



A NEW SECRETARIAL COUNCIL at Sandia, Livermore will serve as a liaison between secretaries and management to promote better communications and information sharing. As one of its first projects, the council is creating a newsletter to be used as a networking tool. Standing (from left) are Gayle Allen (8400), advisor Randy Christman (8523), Liz Cox (8361), Carol DeWolf (8150), and Peggy Hatcher (8543). Seated are chairperson Cleo Hill (8431), vice chairperson Christie O'Shea (8300), and Carla Mertins (8273).



THESE LIVERMORE SANDIANS went on a shopping spree just before the holiday break, using \$2,400 collected during the LEAP campaign recycling effort to buy toys for needy children. Beneficiaries of the gifts included kids at several local shelters, community centers, Toys for Tots, and the Salvation Army. Shoppers are (from left) Joanne Lombardi (8271), Lana West (8451), Diana Wilson (2913), Sandy Ferrario (8161), Carmella Orham (8312), Renee Haynes (8531), Barbara Demo (8133), and Dan Mason (8271).

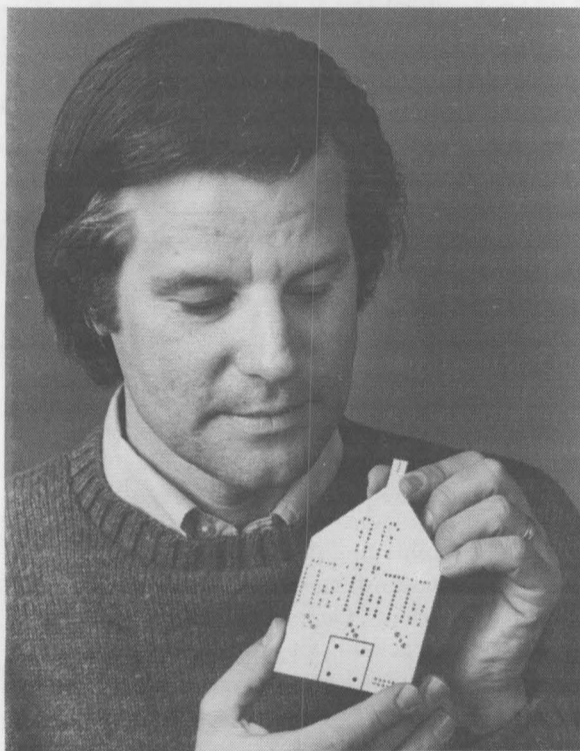


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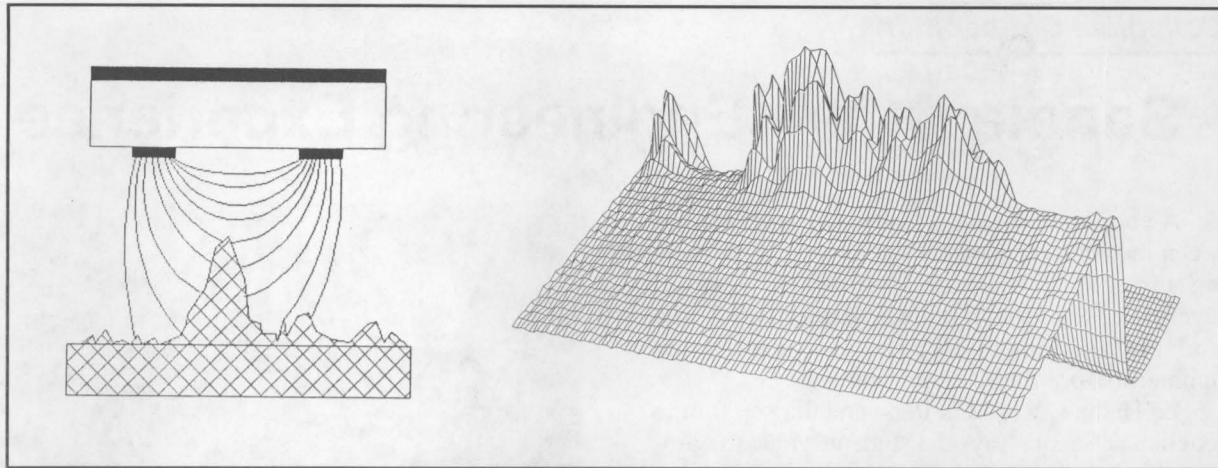
## New Sensor

that utilizes in-process control, a technique that allows a robot to automatically adjust and correct itself while machining a part. Feedback from a variety of sensors tells the robotic arm when and how to adjust itself. The HIRCIS sensor would signal the arm whenever deformities appear, says Jim Novak (1411), the other HIRCIS inventor. (See "Sensor-Rich Robots Boost Benefits of Robot Manufacturing" on page five.)

"Force control," another Sandia-engineered technique that combines a computer data base with force sensors, measures force, or resistance, on an edge-finishing brush located at arm's end. These sensors can locate a part's exact coordinates by moving the brush forward until it "feels" the part, allowing the robot to compensate for slight inconsistencies in the part.



DISPLAYING a card-like instrument that holds the HIRCIS sensor is Jamie Wiczer, Supervisor of Intelligent Machine Principles Div. 1411. The HIRCIS sensor, actually a tiny array of parallel electrodes, is contained in the card's tip (top), visible only as a dark line. The rest of the card contains circuits that support HIRCIS functions.



PARALLEL ELECTRODES (left) on the HIRCIS sensor send a bubble-shaped electrical field outward from the sensor. This field is passed over a part's edge, and changes in capacitance "felt" by the sensor are used to measure burrs and map surface images of a part's edge. A three-dimensional surface image (right) of an aluminum part is produced by plotting HIRCIS capacitance data from a part's edge. The peak of the largest burr is 270 micrometers high, about the height of one of the ridges on the edge of a dime. Changes in capacitance experienced by HIRCIS were measured every 0.2 mm. Places where burrs were manually removed are visible at the notch (left) and flat region (right) on the part's surface.

Combined with force sensors, HIRCIS could inspect a part's edge, measure the size of a burr, and determine the proper force, brush speed, and rate of movement necessary to grind it away. Feedback provided by the other sensors could be used to administer these forces. Jamie believes an edge-finishing job that normally takes three 8-hour work shifts by hand could take only 15 minutes using in-process control and the HIRCIS sensor.

### How HIRCIS Works

The HIRCIS sensor, actually an array of parallel electrodes, sends a bubble-shaped electrical field outward from the sensor (see figures above). When this bubble-shaped field is moved along a part's edge, tiny burrs and cracks alter the shape of the outermost field. The size of a deformity can be measured and mapped based on the change in capacitance (due to the changes in the electrical field) experienced by the electrodes.

The card-like instrument holding the sensor array can be picked up by the robotic arm and moved along a part's edge while the part is being machined. The edge is mapped, burrs are identified, and the robot corrects remaining burrs using a brush tool.

Chamfers (beveled edges) can also be measured accurately by HIRCIS in a single pass of the robotic arm. In one study, Jim found that a two-

hour process used to measure a single chamfer by hand can be performed automatically in less than a second using a HIRCIS sensor.

Jim says he and Jamie invented HIRCIS sitting in an airplane on a business trip to Bell Labs in Murray Hill, N.J. Since then, it's taken only 15 months to transform their idea into a hardware prototype, combine it with a robotic deburring system, and use them both in the robot lab — quick by all standards.

"Two months after we came back, we were filing invention paperwork," says Jim. "The capa-

**"The capability to develop and apply an idea like this is one of Sandia's major strengths."**

bility to develop and apply an idea like this is one of Sandia's major strengths. From basic sensing research to printed circuit board manufacturing — it's all right here in the robot sensor lab."

Other Sandians who helped develop the technique include Jim Akins, Jon Bryan, Cliff Loucks, and Larry Ray (all 1411). Sandia's Applied Research and Technology Activity Committee (AR-TAC) and the Technology Maturation Program (TMP), a new program devoted to moving Labs technology to the private sector, helped fund the research. ●JG

## HIRCIS: What Else Can It Do?

Mapping and correcting burrs and checking chamfers are only a few of the potential applications for the High-Resolution Capacitive Imaging Sensor (HIRCIS).

"We are excited because this sensor has near-term commercial applications," says Jim Novak (1411). "One mark of a good invention is when its potential applications can be seen immediately. There's still a fair amount of work to be done, though, before it can be used in a more rugged factory environment."

HIRCIS sensors could be used, for instance, to inspect 55-gallon drums of hazardous waste for leaks or cracks, says Jamie Wiczer (1411). These drums must be inspected weekly according to Environmental Protection Agency (EPA) regulations, and when there are a lot of drums to inspect, people sometimes don't do a thorough job. Using a robot to inspect drums might prevent human inspectors from being exposed to toxic substances or radiation, as well.

HIRCIS is also capable of identifying and mapping corrosion. Jamie says drums typically leak along seams, and HIRCIS could be used to inspect seams for corrosion and tiny cracks too small to be detected by the human eye. HIRCIS' capability to detect corrosion means the sensor could be

used to inspect the interior walls of underground storage tanks (USTs). Corroding USTs can leak stored chemicals or petroleum products into rivers and aquifers. A robotic arm with a HIRCIS sensor could be lowered into an emptied UST to determine whether exposed inner walls are degrading.

### High-Temp HIRCIS

Jamie's division is collaborating with Technology Transfer Dept. 410 and Sandia, Livermore's Process Development and Fabrication Div. 8284 to develop HIRCIS sensors for high-temperature applications. One promising application, he says, is inspecting weld quality by mapping a profile of a weld bead (the welded seam between two parts).

"We're still working on a version for these applications," he says, "but HIRCIS lends itself to this kind of application because it's not sensitive to bright light, smoke, or electrical discharges typical in arc welding operations."

The robot sensor and edge-finishing labs, both part of the Intelligent Systems and Technologies group, are already working with several companies interested in HIRCIS. Among them are Pratt & Whitney, which manufactures jet engines. Jamie says HIRCIS might be used to inspect a plasma

overspray applied to jet engine turbine blades.

Rocketdyne, another company interested in HIRCIS, manufactures the main engines for NASA's space shuttle. Jamie says HIRCIS might be used for machining more precise cooling channels that run along the shuttle's main engine combustion chambers. A human error during the machining process could cause a hydrogen leak in the shuttle's engine.

### More Applications Ahead

HIRCIS can also sense materials that are too hot, delicate, abrasive, or contaminated to touch. That could open up a whole series of new applications, such as hazardous waste cleanup or radiation safety work.

Kodak, Kaman Instruments, and Extrude-Hone, Inc., have also shown an interest in applying HIRCIS technology. DOE is pursuing licensing agreements with some of these companies and has applied for a patent on HIRCIS.

A group of business students at UNM's Anderson School of Management is studying HIRCIS for its commercial applications (LAB NEWS, Dec. 21, 1990). "The students are helping us develop a business plan for moving our sensor to the commercial sector," says Jim.



## Sensor-Rich Robots Boost Benefits of Robot Manufacturing

Manufacturing precision parts manually, without the aid of automated edge-finishing systems, is expensive and time-consuming. Industry estimates attribute one-third of the cost of manufacturing precision parts to current edge-finishing techniques. New Sandia-developed techniques could reduce the time and expense of finishing precision parts.

When parts are finished manually, they must be inspected and corrected by hand. A worker can spend hours perfecting one part, rubbing his or her finger along the edges checking for burrs, and then using a deburring tool (similar to a dentist's drill) to finish the edges.

A less labor-intensive method of edge finishing, called "position control," allows a technician to tailor-train a robotic arm so that it "knows" the configuration and orientation of each part. Using a device called a teach pendant, which resembles a calculator wired to the robotic arm, the technician determines the location of the brush tool at the end of the arm by entering the position of the robot's base, the length and angle of each arm joint in relation to the base, and the length of the metal brush at the end of the arm.

The technician places a part on a table and "teaches" the arm the coordinates of each wall, groove, and dip in the part by moving the brush methodically back and forth, up and down, along each edge. Algorithms for these coordinates are then stored in a data base, which is used whenever a similar part needs to be edge-finished. Expensive fixtures hold the part

exactly in place, while the data base dictates the arm's movements.

Machining by position control can be expensive and imprecise, however. All parts, especially cast-metal parts, vary slightly in shape and size. Many parts are mechanically complex, containing hundreds of grooves, dips, and walls, each of which may differ slightly from the part coordinates on the data base. Also, edge-finishing brushes wear down unpredictably, and the robot can't compensate for a slightly shorter brush because it knows only one set of coordinates based on the original brush length.

### Automatic Adjustments

"Force control," a Sandia-engineered technique, uses force sensors to find and record a part's exact coordinates. By moving a spinning metal edge-finishing brush located at arm's end toward the part until it "feels" the part, the arm automatically knows the part's coordinates and can adjust itself to each part. It then records the coordinates and uses them later, but only as a reference. This technique eliminates the need to "teach" the arm the coordinates of each part.

New sensor-rich systems being developed at Sandia's robotic edge-finishing lab combine position control techniques with force sensors and HIRCIS (see main story). These sensor feedback techniques, called in-process control, mean the arm can adjust to slight inconsistencies in each part and find and correct burrs automatically. In-process control could reduce substantially the cost of edge-finishing using existing techniques, says Jamie Wiczer (1411).

## feed back

*Q: I don't understand why our cafeteria prices are so exorbitant. The vendor has very little overhead compared to other facilities in Albuquerque, but the prices are as high or, in some cases, higher than prices charged elsewhere. I cannot afford to eat at the Bldg. 861 cafeteria even with the prices at the pre-Oct. 1 level. Now the prices are even higher!*

*Can't we have reasonable service at a reasonable price? How are vendors awarded the contract to operate in Bldg. 861? Perhaps we should have a competing facility at Sandia other than the military cafeterias.*

*A: The cafeteria contract is awarded for a five-year period based on competitive bids. The current vendor, Marriott Corp., was selected based on the quality of service, food, and management, as well as employee training, excellent references, and administrative costs.*

The main factors contributing to the latest price increase are increases in the cost of labor and food products. As a government contractor, the cafeteria operator must pay hourly wages well above minimum wage, in contrast to other vendors, which generally pay the minimum wage. Other factors affecting the price of cafeteria service are higher-quality ingredients used to prepare the food; higher levels of liability insurance required by the contract; new ES&H requirements, such as the use of paper cups; higher fuel and transportation costs; and limited hours of operation.

Finally, the cafeteria must be operated according to IRS guidelines regulating the operation of on-site eating facilities. These guidelines dictate that revenues from the cafeteria must at least offset labor and food costs, and as a result, prices are adjusted periodically.

Ralph Bonner (3500)

(Continued from Page One)

## Current Challenges

and practices mesh with the values emphasized in the *Strategic Plan*? "We chartered a Value Monitoring Team of six non-supervisory volunteers (graded, MA, and MLS levels) to answer the question," reported Bob Zaeh, 3700 Director. "The group used the PQMI [Process Quality Management & Improvement] model to create and administer a survey that showed what we have to do to ensure that 3700's new values-based operational plan works as well as we want it to for Sandia. The team members had the right — the responsibility, really — to question and recommend changes to 3700 operational practices.

"We also upgraded our communications in the directorate to identify customers and provide information to each one. For example, management issues a memo to its employees (customers) that documents lateral and upward moves and provides a rationale for each one. Also, management is doing a lot more MBWA [management by walking around] and talking with people than in the past."

• Charles Tapp, Director of Development Testing 7500, summarized Org. 7000's efforts to im-

prove communications: "We have asked the organizational effectiveness consultants in Corporate Change Management to help our Quality Improvement Team apply the change model to develop an improved communication strategy. We're still in the preliminary stages, but we'll use as a metric how satisfied all members of 7000 feel about communication."

• Roger Hagenruber, VP of Exploratory Systems 9000, reported that his group is also taking some formal action to improve face-to-face communications across his organization. "We've expanded our semiannual five-level meetings for all supervisors to bimonthly to speed up and expand communications and dialogue. Supervisors are the key to communications, because they are the people the staff come to with questions.

"Also, we're planning to have monthly get-togethers beginning this year for any 9000 employee who wants to chat with me or other members of 9000 management. We'll reserve a room either at the Coronado Club or at the Labs and provide light refreshments and listening ears."

• The traditional Distinguished Member of Technical Staff (DMTS) selection process is likely to be changed, Dan Hartley reported: "Howard Stephens [6212] is heading a Quality Action Team looking at how to involve all technical staff members in nominating new DMTSs, making it a more participatory process." •BHawkinson(5)

### Got a Question or Suggestion?

Employees who have suggestions for improvements at Sandia or who need quick answers to Feedback questions are encouraged to telefax their suggestions/questions to the Employee Communications Div. 3162 at 844-0645. For additional information or printed Feedback forms, call Janet Walerow (3162) on 844-7841.

*Q: Response times at Sandia's Area I Mardix booths have degraded significantly over the past few months. For some building occupants, a Mardix booth is the only direct access route from a parking lot to their building. Lines of 10 or more people may develop during morning and evening busy periods (7:50 to 8 a.m. and 4:30 to 4:40 p.m.), and the wait can be as long as 5 to 10 minutes.*

*This is certainly frustrating to employees and leads to some lost work time. I believe that such waits can lower employee morale. Since the delays appear to be caused by fewer booth operators and more people using Mardix booths, perhaps the addition of more booth operators at peak times would solve the problem.*

*A: Mardix booths were originally installed for the convenience of employees entering and leaving the Tech Area outside normal working hours when the main gates were closed (generally, the gates are open from 7 a.m. to 5:30 p.m.). Limited operation of some booths is now allowed during normal working hours to supplement the pedestrian gates controlled by security inspectors. This results in heavier traffic at some Mardix booths than the booths can efficiently handle and causes some backup during the peak hours you mentioned. Please remember that all main gates are open at the times you noted.*

*We will do our best to respond faster, but the problem is significantly hardware related, so adding more operators (even if we had them) wouldn't do much to solve it. Sorry for the delay — we'll try harder.*

Jim Martin (3400)

## Retiree Deaths

James Harter (69).....Dec. 5  
Lamar McKay (71).....Dec. 6  
Kenneth Overbury (77).....Dec. 6  
Frank Henry Fox (71).....Dec. 7  
Loren File (78).....Dec. 8  
George Pacheco (69).....Dec. 8  
Buford Eagan (66).....Dec. 14  
Heliodoro Salazar (70).....Dec. 22  
Charles Bild (72).....Dec. 26

## Sympathy

To Bob Anderson (2857) on the death of his mother in Albuquerque, Dec. 11.  
To Leigh Matthewson (9332) on the death of her father in Farmington, Dec. 14.  
To Barbara LaGree (9415) on the death of her father in Columbus, Miss., Dec. 18.  
To Charlotte Hunt (6345) on the death of her mother in Albuquerque, Dec. 20.



**Honored for Contributions to Physics Research****Schweizer and Narath to Receive APS Prizes**

Two Sandians — polymer physicist Ken Schweizer (1812) and Labs President Al Narath — will receive prizes from the American Physical Society in March for their contributions to physics research.

Ken will receive the John H. Dillon Medal, awarded each year for outstanding research by a young polymer physicist in High Polymer Physics.

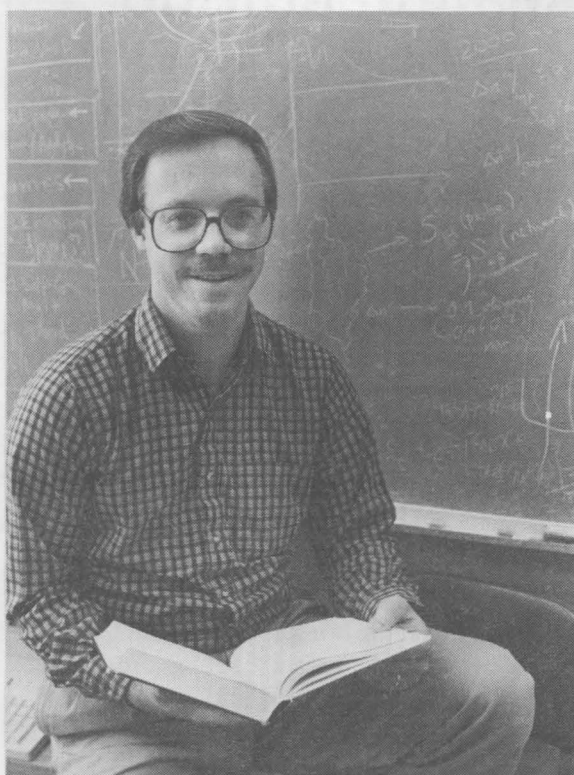
The APS is honoring Ken “for novel theoretical advances in macromolecular physics, particularly in the areas of thermodynamics, melt dynamics, and conjugated polymers.”

After seven years at Sandia, Ken recently accepted a full professorship in the departments of Materials Science and Engineering and Chemistry at the University of Illinois at Urbana-Champaign. He will begin teaching there in February, and will put together a polymer physical chemistry program at the university, which is also his alma mater.

Upon coming to Sandia after completing post-doctoral work at Bell Labs in small molecule physical chemistry and condensed matter physics, Ken was asked to work in the polymer and organic materials field. He collaborated with John Curro, and more recently with Kevin Honnell and John McCoy (all 1813), on a project to develop and apply the first microscopic statistical mechanical theories of the equilibrium properties of polymeric fluids.

Ken has also done extensive research in elec-

“I couldn’t be more pleased about Ken and Al receiving these awards from the APS,” says Research VP Venky Narayana-murti (1000). “We will miss Ken when he leaves, but we are very happy that we will be able to continue to collaborate with him. And, of course, we are most fortunate in having Al lead the way in research and development for all of Sandia.”



KEN SCHWEIZER (1812), soon to become a professor at the University of Illinois at Urbana-Champaign, will receive the 1991 John H. Dillon Medal of the American Physical Society.

tronic polymers, such as polysilanes, and viscoelastic and diffusion properties of polymer liquids. He says he plans to continue working with Sandia, at least in the near future, on problems relating to polymer melt and alloy structure, thermodynamics, and phase transitions.

He notes that the Materials Department at Illinois is the largest in the nation, with coursework and research in polymers, ceramics, metallurgy, and electronic materials.

“Usually it takes about seven years at a university like Illinois, typically after a post-doc, just to

get tenure,” notes Glen Kepler (1890). “Ken is going as a full professor, a position that usually requires another promotion. That says a lot about his reputation outside Sandia.”

**Pake Prize to Al**

The 1991 George E. Pake Prize, sponsored by the Xerox Corp., will go to Al Narath for “effective leadership of research and development at Sandia in defense, energy, and economic competitiveness.” He is also being honored for “the use of innovative NMR [nuclear magnetic resonance] techniques for the study of magnetic impurities in metals.”

Al joined Sandia in 1959 after receiving a PhD in physical chemistry from the University of California. During the early years of his Sandia career, Al used nuclear magnetic resonance to study fundamental aspects of magnetism and the electronic structure of materials. Later, as Vice President of Research and Executive Vice President, Al’s foresight contributed to Sandia’s diversification in the 1970s into the energy arena. This expansion of capabilities helped establish Sandia’s role as a multiprogram national laboratory.

In 1984, he transferred to AT&T Bell Laboratories and assumed responsibility for all Bell Laboratories systems engineering and development activities for the US government until 1989.

Al is an APS Fellow, was elected to the National Academy of Engineering in 1987, and is also a member of the Naval Research Advisory Committee. He serves as a consultant to various agencies of the US government, and has played a leading role in promoting technology transfer as a major mission for Sandia.

When Al returned to Sandia as President in 1989, he led the charge in launching the Labs into the strategic planning process and continues to provide leadership in achieving the objectives outlined in Sandia’s *Strategic Plan*. ●LD

**Sandian Recognized****Peter Winokur Named IEEE Fellow**

Peter Winokur, Supervisor of Radiation Technology and Assurance Div. 2147, has been named Fellow of the Institute of Electrical and Electronic Engineers (IEEE), an honor reserved for one percent of the institute’s 300,000-person membership.

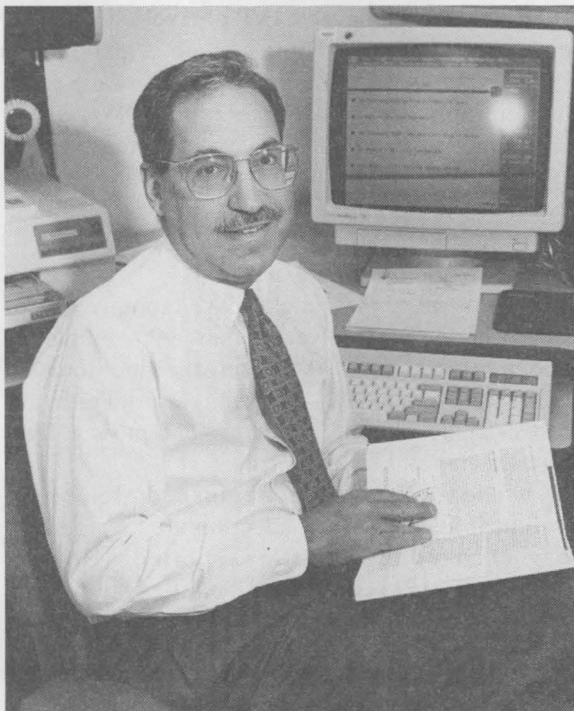
IEEE fellowship recognizes members for outstanding contributions in electrical and electronic engineering. Peter’s selection was based on his contributions in the field of radiation effects on electronic materials and devices and his improvements to total-dose hardness assurance of integrated circuits.

“Many strive for this recognition”, says Peter, “and I’m proud to represent Sandia and its radiation-hardened microelectronics program.”

Peter came to Sandia in December 1983 from Harry Diamond Laboratories in Adelphi, Md. As an MTS, Peter developed techniques for optimizing and controlling the radiation hardness of complementary metal oxide semiconductor (CMOS) devices for very large-scale integrated (VLSI) circuits.

He was appointed Supervisor of Radiation Technology and Assurance Division in May 1987, where he now develops test methods to ensure the radiation hardness of integrated circuits. His current research interests include using cost-effective methods to provide integrated circuits for space and defense applications.

Peter’s accomplishments include pioneering research in the field of radiation-induced interface traps and studying integrated circuit failure mechanisms in space environments. He served as technical program chairman for both the




PETER WINOKUR

IEEE Semiconductor Specialists Conference and the IEEE Nuclear and Space Radiation Effects Conference. He has received outstanding paper awards at four annual IEEE Nuclear and Space Radiation Effects conferences and one Hardened Electronics and Radiation Technology conference.

Peter received a PhD in Physics from the University of Maryland in 1974. He is author of more than 40 publications and a member of the American Physical Society. ●

**MSDSs for Chemical Safety**

This is the third in a series of “helpful hint” columns as we prepare for the visit of the DOE Tiger Team (Environment, Safety, and Health inspection team) next year.

**TIGER TEAM TIPS**  If you work with chemicals, you should have Material Safety Data Sheets (MSDSs) for them. MSDSs are produced by each chemical’s manufacturer. They inform users about the chemical’s properties, so that users may protect themselves and respond correctly in emergencies.

If you do not have the proper MSDSs, your division should complete a chemical inventory so you can get them. (Common consumer products used in normal household fashion and manufactured articles do not have to be included in chemical inventories.) Your supervisor can provide the name of the chemical inventory contact person for your organization. This person maintains your inventory, enters it into the central Sandia system, and obtains MSDSs through Div. 3211.

A Chemical Inventory Package is available from Inez Atencio (3211) on 4-5233 or Barbara Hawkins (3211) on 4-7369. This package contains the instructions and materials your division will need.

*Attention inventory contacts:* Have you remembered to inventory chemicals stored outside or underground? These large outside and underground storage locations are of critical concern to the central inventory and to Sandia’s corporate, federal, and state reporting requirements. If you have not inventoried these, contact Barbara Hawkins. ●



# feed back

*Q: It is not clear to me why "vacation used" is printed on our pay stubs rather than "vacation balance" for the fiscal year. I think the amount of vacation still remaining for the fiscal year is a more useful and pleasant piece of information. Except for the pay stubs, the only way to determine our vacation balances is to ask the secretary or call payroll. Particularly in September, this must be quite a headache, not to mention extra work and distractions for them. Vacation balances would be especially useful for people who have carried over vacation or for new hires in mid-year. I suggest that we eliminate the guesswork and extra work to determine balances by printing that information on our pay stubs.*

**A:** For employees with fewer than 10 years of service, vacation is accrued at the rate of 16 hours per month. For these employees, the actual vacation balance at any given point during the fiscal year would only reflect what has been accrued and not what is available for the entire fiscal year. For this reason, many of these employees would often have a negative balance. It was thought that "vacation used" is more universally useful since employees themselves know how much they have accrued, whether it is 16 hours per month, or 192 hours in October for those with more than 10 years of service.

In addition, the vacation balance for some employees would include convertible vacation, vacation carryover, or vacation borrowed. Without

itemized details, the vacation balance figure might not be as useful as it should be.

However, should we redesign our pay statements in the future, we would definitely consider including such itemized details for vacation balance.

Paul Stanford (100)

*Q: It appears to me that Sandia needs a different approach to ordering low-cost software. The spread of personal computers at the Labs will likely result in many small-item purchases for personal computer software and software updates, yet the cost of the paperwork and purchasing time far exceeds the cost of the orders. Some software companies provide quantity discounts and site licenses, but Sandia does not take advantage of them because of the individualized approach to ordering. In fact, some small software companies that prefer direct sales even charge an additional fee for purchase orders rather than orders paid with cash or credit cards. A purchasing employee once told me that, in order to get around the problem of companies that refuse to handle purchase orders, Sandia places a purchase order with an Albuquerque firm that directly orders the software or updates from such companies and then rebills Sandia, after charging for profit and overhead.*

*Recently, I prepared a purchase requisition for a \$10 update to one piece of software and a \$25 update to another piece of software. Since*

*the updates were from two different companies, they required two purchase requisitions. The \$25 update is for a software package in common use at Sandia.*

*It appears, from the perspective of overhead costs, that it would be much cheaper to charge the updates to VISA and use a petty cash reimbursement.*

*Perhaps our accountability requirements are such that there is no alternative to the purchase requisition system. However, this may be an area where the system can be streamlined to reduce overhead and take advantage of large-volume discounts.*

**A:** All of your observations regarding the procurement of software and software updates are, unfortunately, largely correct. Orders come from all over the Labs for hundreds of different software programs a year. It is extremely difficult to consolidate these orders because of the wide variety of software requirements and delivery requests.

We are sensitive to this problem and are exploring some innovative buying techniques that could be more cost-effective for the Labs. Examples are delegated organization buying and the use of credit cards for low-value commercial procurements. We will provide more information on these initiatives when the procedures are finalized and approved.

Bob Zaeh (3700)



UNCLASSIFIED ADVERTISEMENTS • UNCLASSIFIED ADVERTISEMENTS • UNCLASSIFIED ADVERTISEMENTS • UNCLASSIFIED ADVERTISEMENTS

**Deadline: Friday noon before week of publication unless changed by holiday. Mail to Div. 3162.**

#### Ad Rules

1. Limit 20 words, including last name and home phone.
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.

#### MISCELLANEOUS

- SONY SPEAKERS, 2, 18 in., \$25. Portman, 266-7648.
- SKI RACK, Bearcrafters SR-11, fits Honda Accord and similar cars, \$45. Hendrick, 296-2163.
- SOFA SLEEPER and recliner, w/ottoman, \$150 OBO. Hammond, 294-2045.
- KING-SIZE WATERBED, 6-drawer pedestal, \$125; exercycle, \$40. Rael, 345-2084.
- MAYTAG WASHER, large-capacity, 1 yr. old, \$425; electric dryer, \$325 OBO. Mathews, 881-7368.
- BABY FOOD JARS, approx. 200, free, take any or all. Eldredge, 298-3905.
- MICROWAVE OVEN, \$50; chest of drawers, \$20; 2 tall book cases, \$150; couch and chair, \$125. Gallegos, 293-7945 or 293-8885.
- BABY CRIB, \$75; high chair, \$30; guitar amp, 120W, \$125; Takamine acoustic guitar, w/electric pickups, \$200. Wilcoxon, 296-8295.

DIGITAL SYNTHESIZER, Kurzweil K-1000, full-size keys, \$750 OBO. Foty, 260-1747.

FACTORY SHOP MANUALS, 1983, complete: Continental, Thunderbird, Cougar, Marquis, Mustang, Capri, Fairmont, Futura, Zephyr Ltd., \$50. Perryman, 281-3020.

JUICE EXTRACTOR, Oster, 2-sp., new, \$35; 8 folding louvered doors, white, 30" width, \$50. Jennings, 255-5950.

CRIB, w/mattress, misc. bedding, \$100 OBO; infant car seat, \$20 OBO. Bott, 823-2821.

GARAGE SALE: furniture, toys, home furnishings, Jan. 12, 9005 Haines NE, near Indian School and Moon. Luetters, 296-3759.

NINTENDO, w/Mario Brothers, controls, gun, \$70; Yamaha PSS-270 keyboard, \$80. Lambert, 822-9459.

WOMAN'S FORMAL DRESS, white and hot pink, calf length, off-the-shoulder. Garcia, 266-2618.

VIDEO GAME SYSTEM, Atari 2600, w/35 games, 2 joysticks, paddle controls, \$100. Boston, 298-9727 after 6:30 p.m.

GRAPHITE DRIVER, Cobra Long Tom, cost \$175, sell for \$115. McCoy, 821-2509.

SIMMS, 1MB x 9, 80ns, new, 2 MB for \$90; PC-Globe software, still wrapped, \$25. Cox, 296-1337.

LANE SOFA TABLE, \$100; X-cargo car-top carrier, \$30; 3 matching ceiling light fixtures, \$30/ea. Bonzon, 828-1066.

ROTTWEILER PUPPIES, 10 wks. old, all papers and shots, \$375. Hole, 877-1903.

TOSHIBA VCR, 4-head, VHS-HQ, needs repair, make offer. Dean, 281-3489.

SNOW TIRES, 175SR14, mounted in 5-hole rims, metal studded, 3/8" tread left, \$30. Lagasse, 293-0385.

BABY BIKE HELMET, \$10; baby bike seat, \$5; bike rack for automobile, \$20. Anderson, 897-2772.

TIRE CHAINS, fit L78-15, 9.15-15, etc., \$20 OBO. Rodacy, 293-2668, keep trying.

TWO TICKETS to "Les Miserables," Sunday, Jan. 27, 2 p.m., Popejoy, row 8 left, seats 13 & 14, \$80. Duvall, 881-4406.

MOUNTAIN BIKE FRAME, 19-in., American bicycle, Comp-Lite, \$400 firm. Fellows, 821-7664.

CAMERAS: Fujica GS645 Professional, compact, folding, 120 film, w/instructions, case, \$300; Nikon FM body, w/instructions, box, \$100. Smith, 243-0714.

WORDPERFECT, for Macintosh, Version 1.0.3, never opened, \$100. Linnerooth, 299-6558.

IRVIN MARRS SADDLE, \$1,000. Marrs, 281-9889.

KING WATERBED FRAME, bookcase headboard, w/6 drawers, \$95; king mattress, complete, w/metal frame, \$250 OBO. Scurry, 291-9786.

SOFA, Ethan Allen, 88-in., \$200; 2 armless rollback chairs, from Leishman's, all have peach/green fabric, \$175/ea. Adams, 823-1845.

DOUBLE BED, Simmons, mattress, box spring, \$40; single bed, mattress, boxspring, frame, \$20. Stephens, 766-6674.

WIREWRAPE ID LABELS, 14-pin, \$1.50 per bag of 100, 100 bags available; VT100 terminal, \$10. Knapp, 294-6359.

BOOKCASES, mini-blinds, curtain rods, screens; Sony reel-to-reel recorder, player, tapes. Switendick, 255-1003.

AEROTECH LASER SYSTEM, Model LS16P, 16mW HeNe, 1000:1 linearly polarized, mfrd. 10/86, approx. 2,000 hrs., \$2,500. Kawulok, 877-7660.

BRA for VW Vanagon (1988-91), used 2 months, \$55. Prekker, 892-4107.

WINDOW COVERINGS, Hunter Douglas Duette Eclipse, used to cover window in Mossman home measuring 110" W x 50" L. Smith, 888-2402.

VIDEO CAMERA, new, Teknica, records directly onto VCR 1/2-in. tape, \$750. Nordeen, 296-7898.

KING-SIZE WATERBED, Wavecrest waveless mattress, needs heater controller, Santa Fe-style frame, \$95. Robertson, 293-1007.

REFRIGERATOR, Frigidaire, frost-free, white, 20.6 cu. ft., 1 year old, textured doors, energy-saver switch, \$650 OBO. Pritchard, 293-5297.

TURNTABLE, AR ES-1, w/Grace 707 arm & Grado ZTE+1 cartridge, \$150; ham radio, Kenwood TR-7600, 2-meter transceiver, \$100. Damkroger, 897-7017.

#### TRANSPORTATION

'77 CHEV. BLAZER, 4x4, new 400 engine, transmission, drive lines, & brakes, w/equalizer hitch & trailer brakes, \$3,000. Hindi, 271-2018.

'67 CHRYSLER 300 CONVERTIBLE, restored, power seat, PS, PB, AC, bucket seats, factory shop manual, \$7,500. Perryman, 281-3020.

'78 VOLVO 244DL, one owner, sunroof, \$3,000. Portman, 266-7648.

'82 SAAB 900 TURBO, 4-dr., sunroof, AT, PS, PB, AC, cruise, cassette, new tires, \$3,850. Yaniv, 294-4490.

'85 TOYOTA CAMRY LE, loaded, AC, AT, 4-dr., new tires, \$5,200 OBO. Case, 293-5466.

'86 FIERO, 4-cyl., AC-compressor available but needs installation, \$3,700. Stokes, 898-1237.

'87 BUICK LeSABRE LIMITED, 4-dr., white, 3.8 V-6, loaded, dealer price \$10,175, sell for \$9,175. Buckner, 828-0486.

'87 MUSTANG GT, 5.0 engine, AC, cruise, PW, PL, AM/FM cassette, 54K miles. Besse, 293-9511.

REPOS: '88 Chev. Astro van; '88 Nissan Pathfinder; '86 Dodge Aries SE; bids accepted through Jan. 16; we reserve the right to refuse all bids; subject to prior sale. Sandia Lab FCU, 293-0500.

PLANE, '69 Cherokee 235; 1/4 share, auto pilot, always hangered, STC auto gas. Roberts, 299-5671.

GIRL'S SCHWINN SCOOTER, neon pink. Wagner, 823-9323.

'89 MAZDA 626LX, 4-dr., 5-sp., sunroof, loaded, silver w/gray interior, \$11,000. Scurry, 291-9786.

'76 OLDS. 98 LS, loaded, 87K miles, all records, \$1,900 OBO. Lynch, 821-8126.

CHILD'S 16-IN. BICYCLE, \$20. Anderson, 897-2772.

'87 SUBARU STATION WAGON, 42K miles, blue, \$5,995. Bloomquist, 821-3018.

'88 MAZDA B2600 PICKUP, 4x4, red, 53K miles, AC, stereo, Brahma shell, bed liner, one owner, receipts, \$8,500. Damkroger, 897-7017.

'89 HONDA ACCORD LXi, Mercedes green, showroom model, 30K miles, complete maintenance record, \$12,000. Schneider, 292-8017.

'89 BUICK REGAL GRAN SPORT, loaded, 20K miles. Garcia, 344-3406.

#### REAL ESTATE

COLORADO LAND, 4 plus acres, on Rio Grande near South Fork, electricity, water well, views, level, \$29,500. McCoy, 821-2509.

4-BDR. HOME, 1-3/4 baths, 1,920 sq. ft., near KAFB, alarm, auto sprinklers, double garage, below market, \$97,500. Garcia, 292-0979.

2-BDR. HOME, 1,100 sq. ft., on 2 acres in Tijeras, barn, views, easy access, \$75,000. O'Malley, 281-3443.

#### WANTED

REGULAR 8 AND SUPER 8 MOVIE REELS, canisters, carton films; unwanted movie equipment. Vigil, 899-0046.

ROOMMATE, female, nonsmoker, share 3-bdr. 2-bath NE heights house, \$250/mo. plus 1/2 utilities. Schafer, 296-8645, leave message.

PC PRINTER, w/parallel interface for IBM-compatible computer. Lagasse, 293-0385.

HOUSEMATE, NE home to share w/single professional, master suite, carpeted, washer/dryer, fireplace, garage, \$290/mo. plus 1/2 utilities, deposit. Jackson, 292-1583.

#### SHARE-A-RIDE

CEDAR CREST VANPOOL has openings, Frost Rd., N-14, Tijeras. Yelton (281-2893) or Burns (281-3922).

CARPOOL WANTED, Rio Grande & Griegos area to Area I (Bldg. 802), 8 a.m. to 4:30 p.m. Krantz, 345-4075.



**Coronado Club Activities****Let Trio Grande Take You Back In Time**

IT'S A NEW YEAR, but tonight Trio Grande is on hand to play your favorite timeless oldies — '50s rock, '60s and '70s country, and bluegrass. Dinner includes filet mignon or deep-fried shrimp (two-for-one price \$14.95), chicken teriyaki (\$6.95), pan-fried catfish, and prime rib (both \$7.95). Strawberry daiquiris are \$2.50 all night. Reservations recommended (265-6791).

**DOUBLE DATES** — Sunday, Jan. 13, and Sunday, Jan. 20, are the dates of January's two champagne brunches. Each Sunday's menu includes bacon, French toast or pancakes, baron of beef, ham or turkey, potatoes, green chile stew, salads, desserts, and a glass of champagne for each adult. Each child receives a C-Club "flying circle." Serving time on both days is from 10 a.m. to 1 p.m., and Bob Weiler and Los Gatos will play after brunch on the 20th

from 1 to 4 p.m. (Cost is \$5.95/adults, \$1/children 4 to 12 years old, and free/toddlers.)

**SLIPPERY SLOPES** is the topic, as always, of this month's Coronado Ski Club meeting, Tuesday, Jan. 15. Paul Souder will present a slide show focusing on Purgatory Ski Area. To tempt you further, munchies and door prizes make the evening even sweeter. The social starts at 7 p.m., and the talk starts at 7:30.

**JANUARY'S JUMPIN'** at the Club's weekly Friday-night feast, Jan. 18, from 5 to 11 p.m. Disc jockey Chuck Avery returns to keep you hoppin', and the kitchen offers an unprecedented Italian buffet with all your favorites — pizza, spaghetti with meat sauce, salad, and garlic bread. Drink specials include wine by the glass, wine spritzers, or wine coolers (all \$1.50). Admission is free for members and \$2 for guests.

**Take Note**

A paper by Paul Veers (6225) and Jim Van Den Avyle (1832), "Fatigue Crack Growth from Narrow-Band Gaussian Spectrum Loading in 6063 Aluminum Alloy," has been selected as the best paper at a symposium on Advances in Fatigue Lifetime Predictive Techniques sponsored by the American Society for Testing and Materials (ASTM). The paper addresses the problem of fatigue failures in a vertical-axis wind turbine blade material not typically used in structural applications.

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Parentcraft, a division of Family and Children's Services, Inc. (a United Way agency), offers parenting programs at the Family and Children's Services office (1503 University NE) in January: "I'm OK! You're OK! Self Esteem: How to Build It," Wednesday, Jan. 16, 5:30 to 7:30 p.m., free pizza and child care for children ages 3 to 8; "Discipline vs. Punishment," Tuesday, Jan. 22, noon to 1:30 p.m., brown-bag lunch session. Each session is \$10 per person. For information, contact Linda Rengel on 243-2551.

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The 27th Annual Symposium of the New Mexico Chapter of the American Vacuum Society (NMAVS) will be April 22-26 at the Albuquerque Holiday Inn Pyramid. Sessions include surface science, electronic materials, applied

surface science, and thin films. The keynote address, "The Science Literary Gap," will be April 23, by David Goodstein, Vice Provost and Professor of Physics and Applied Physics at Caltech. Deadline for contributing papers is March 15. Submit abstracts to 1991 NMAVS Symposium Chairman Allen Sault (6211). Short courses will be offered in conjunction with the Symposium. For course information, contact Jay Fries (LANL) in Los Alamos on 665-0721. For general information, contact Allen on 4-8723.

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A series of new hour-long programs at the New Mexico Museum of Natural History and Science begins today. On the second Friday of each month, a program starts at noon with lunch, then a brief presentation and a behind-the-scenes tour of a part of the museum. On Feb. 8, David Willis, Museum Foundation's Executive Director, will lead a tour of the Dynamax Theater, including a look at its sophisticated projection equipment. On March 8, Marti Kyrk, the Museum's Chief of Exhibits, offers an expert view of exhibit development and a tour of the museum's fabrication equipment and work areas. Participation is limited to 24 people per tour. Reservations must be made by 4 p.m. the day before by calling 841-8838.

**Events Calendar**

Events Calendar items are gathered from various sources. Readers should confirm times and dates of interest whenever possible.

**Jan. 11** — "A Night in Vienna," Chamber Orchestra of Albuquerque Subscription Concert III, featuring music of the Strauss family; 8:15 p.m., St. John's United Methodist Church (2626 Arizona NE), 881-0844.

**Jan. 11-20** — "The Heidi Chronicles," by Wendy Wasserstein, bittersweet comedy about the effects of the women's movement on men and women, New Mexico Repertory Theatre production; 8 p.m. Tues.-Sun., 2 p.m. matinee Sat. & Sun.; KiMo Theatre, 243-4500.

**Jan. 11-Feb. 3** — "Lisbon Traviata," by Terence McNally, play following emotional pursuits of a man concerned with growing too old to attract a mate; wrapped up with his inner anxiety is the outward pursuit of a bootleg copy of Maria Callas' Lisbon performance in "La Traviata"; 8 p.m. Fri.-Sat., 2 p.m. Sat., 7 p.m. Sun.; Vortex Theatre, 247-8600.

**Jan. 11-April 14** — Exhibit, "Wolves and Humans," from the Science Museum of Minnesota, provides comprehensive picture of the social, biological, and mythological relationships between wolves and humans; 9 a.m.-5 p.m., New Mexico Museum of Natural History, 841-8837.

**Jan. 18-19** — Odetta, folk and blues singer; 8 p.m., South Broadway Cultural Center, 848-1320.

**Jan. 18-19** — Classical Concert 5: New Mexico Symphony Orchestra and Chorus performing Bach's Cantata No. 60, "O Ewigkeit, du Donnerwort," Berg's Violin Concerto, and Brahms' Symphony No. 4 in E Minor, Op. 98; 8:15 p.m., Popejoy Hall, 842-8565.

**Jan. 20** — Fine Arts Series: Empire Brass Quintet with organist Douglas Major (choirmaster of the Washington National Cathedral), co-sponsored by the Albuquerque Chapter of the American Guild of Organists; 4 p.m., First United Methodist Church (4th & Lead SW), 243-5646.

**Jan. 23-27** — "Les Miserables," Broadway hit music drama; 7:30 p.m., 2 p.m. matinees Thurs., Sat., & Sun.; Popejoy Hall, 277-3121.

**Jan. 25-26** — "Dancing Men," Bill Evans Dance Company, concert of New Mexico premieres with internationally acclaimed guests Heywood "Woody" McGriff and Patrick Suzeau; 8 p.m., KiMo Theatre, 764-1700.

**Jan. 26** — New Mexico Symphony Orchestra Chamber Players Series: "Metropolis," silent film by Fritz Lang (1926), musical score by Gottfried Huppertz, third annual presentation of films with live musical accompaniment; 8:15 p.m., Sunshine Theatre (Central Ave. & 2nd St. SW), 842-8565.

**Fun & Games**

**Cross-Country Skiing** — John Shunny (ret.) is again teaching cross-country skiing for the Sandia Employee Recreation Program (SERP). A lesson consists of a Friday after-work orientation at the Coronado Club, followed by a Saturday on skis in the Sandias. Lessons cost \$16. A rental package — skis, poles, and boots — is available for \$8 plus tax. Call the SERP office on 4-8486 to schedule your lesson.

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**Hockey** — The Albuquerque 30/30 Hockey Club (members are 30 years old or older) is looking for members to fill its ranks. The club includes four teams and plays Sunday mornings with each team playing 90 minutes of no check/no slap shot hockey. For information, contact Len Connell (9415) on 268-2386 or Marcus Bunting (9414) on 294-3431.

**Congratulations**

To Geri (111) and Ed (2922) Saucier, a son, David Hamilton, Nov. 12.

To Lydia Lugo and Ned Adams, Jr. (7341), married in Columbus, Ohio, Dec. 27.

To Becky (2310) and George March, a daughter, Eleanor Thisbee, Dec. 28.

**Favorite Old Photo**

"I'LL WORK IN A WAR PLANT if you'll continue to teach." That's what my mother, Ola Brodie, said to my dad, Elbridge, during World War II when he wanted to enlist at the age of 57. Dad agreed, and Mother joined a training program that included welding and riveting classes that led to her becoming a final-acceptance inspector for the Army at the North American P-51 (Mustang) plant at Grand Prairie, Tex. Mother was an inspector from 1943 until the end of the war. She's seen standing in front of the 2,105th P-51D Mustang made at the Texas plant. — Dick Brodie (25). Dick is a retired Air Force colonel. During his 20 years with the Air Force, he flew fighter planes, but never got to fly the Mustang.