

New Downhole Electronics Survive High Temperatures



PEGGY BONN, an ESA in Geothermal Technology Division 4742, holds the complete electronics package used in the geothermal well temperature tool developed by Sandia. The tool is equipped with electronic microcircuits that operate at 275°C. These microcircuits, under development at the Labs for the past four years, are now commercially available.

Field tests are planned in 1981 of geothermal well logging tools equipped with the first commercially available electronic microcircuits that operate at 275°C. The high-temperature electronics, under development at Sandia for the past four years, are now available from Teledyne Philbrick, Dedham, Mass. They are an outgrowth of technology developed here to produce radiation-resistant microcircuits for nuclear weapons.

Temperatures in geothermal boreholes typically reach 275°C, greatly limiting the usefulness of conventional oil and gas logging tools, whose electronics do not operate reliably at temperatures above 180°C.

"High-temperature circuits have been urgently needed so that borehole logging instruments can be used to assess high-temperature reservoirs," says Tony Venuso, supervisor of Geothermal Technology Division 4742.

"Reliable logging identifies reservoir rock and fluid properties and, thus, the ultimate production potential of geothermal reservoirs, planning well completions and production, and preventing thermal and chemical pollution of groundwater."

The new electronics employ hybrid thick-film circuits made by printing special resistor, conductor, and dielectric inks onto alumina substrates. After the inks are baked onto the substrates, semiconductors are added and the circuits are hermetically packaged.

[Continued on Page Two]

Dick Claassen Chairman of Evaluation Panel



Dick Claassen, Director of Materials and Process Sciences 5800, was recently named chairman of the Technical Evaluation Panel which advises DOE's Assistant Secretary for Defense Programs on classification matters. Gerry Yonas, Director of Pulsed Energy Programs 4200, is a member of the panel

along with other top-ranking scientists from LANL, LLNL and Oak Ridge.

The panel has completed a busy year, Dick reports, recommending classification policy for the inertial confinement fusion program—there is a relationship between the fusion program and thermonuclear weapons.

"Understanding what is classified and protecting that information is just as important as it ever was," Dick says.

Dick served on the old AEC Senior Reviewers Committee for classification starting in 1974 and has continued the work for ERDA and DOE.

LAB NEWS

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JANUARY 23, 1981

SANDIA NATIONAL LABORATORIES • ALBUQUERQUE NM • LIVERMORE CALIF • TONOPAH NEV

Sandians Help Decide Where The Money Goes

Last month the United Way of Greater Albuquerque began distribution of the nearly \$3 million it collected last year to the 35 human service agencies that United Way supports.

Involved in this process were Sandians Jim Giachino (3416), Otis Cox (3253), Luke Heilman (1400) and Frank Gallegos (3510). They served as volunteer members on UWGA Allocation Panels. Each panel is made up of 12 members who monitor program and budget information for several agencies.

The panels convened in June and finished their work in December. Their

various activities included visits to the agencies, meetings with agency staff, and panel meetings to work out budget allocations for individual agencies. Finally, panel recommendations were made to the UWGA Planning and Allocations Committee which then presented final recommendations to the United Way's Board of Directors.

Otis Cox summed up reactions of the panel members: "I completed my work with a good feeling about United Way. I felt that we had been fair but not extravagant, that we had put the money where it could do the most good."



LINDA ERICKSON (3141) and DAVE PALMER (2145)

Supervisory Appointments

DAVID PALMER to supervisor of Hybrid Microelectronics and Packaging Technology Division 2145, effective Jan. 1.

Since joining Sandia six years ago, Dave has worked primarily on the development of electronics which will withstand high temperatures; he has also been concerned with the development of hybrid thin films and surface acoustic wave devices.

Dave earned his BS in physics from the University of Wisconsin and his PhD in applied physics from Cal Tech. He and his wife Susan and their two-year-old son live in the NE heights.

* * *

LINDA ERICKSON to supervisor of Technical Library Processes Division 3141, effective Jan. 16.

A reference librarian at the Labs since 1977, Linda earned a BS in biology from the University of Wyoming and an MS in library science from San Jose State University. She is active in the Special Libraries Association and is current chairwoman of the College, University and Special Library Division of the NM Library Association.

Linda and her husband Jim, a local real

estate salesman, share outdoor interests in hiking and camping. Linda also enjoys sewing and embroidery and has recently taken up jazzercise. The Ericksons live in southeast Albuquerque.

And Don't Call 'Em LANL

Our friends to the north, whom we've all called LASL (pronounced "lassel") since the beginning, don't want that moniker any more. With the advent of the new year, they are the Los Alamos National Laboratory and you can call them that or, to quote from their directive, "... the Laboratory, the Lab, or Los Alamos." It also says "... the acronym LANL will not be used." Given our national penchant for acronyms, that may be a tall order . . .

Continued from Page One

New Downhole Electronics

Only certain junction field-effect transistors now exhibit suitable temperature tolerance, although efforts are now under way to improve circuit flexibility by adapting metal-oxide semiconductor field-effect transistors for high-temperature application. Studies are also under way to investigate use of alternate semiconductor materials, such as gallium phosphide, to replace the lower temperature silicon material commonly used.

During development, the new circuits were operated in the laboratory for more than 6000 hours at 200°C and 1000 hours at 275°C.

They were then installed in a borehole temperature logging instrument and tested in a northern New Mexico geothermal well. The electronics performed for 1½ hours at 282°C—the highest operational temperature for an uncooled, non-thermally insulated instrument equipped with active electronics. The package also

Am I Just Getting Old Or Am I Really Sick?

If we feel well, we can usually philosophically mark off the finished year as "added maturity." If we don't feel well, changing the wall calendar may be a painful reminder that we are getting older.

Patterns of illness change, as do our reactions to those illnesses as we grow older. We all know not to expect as much from our bodies at age 70 as we did at 20, but just what can we expect? How do we know which health changes are normal and which could be improved with proper health care?

These are some of the things that Dr. Judy Ewing from Sandia Medical will discuss in the third session of the series, "Let's Talk About Aging."

This session will be given on January 27th from 12:00 to 12:30 p.m. in building 815 (outside the Tech Area). Brown baggers are welcome.

Medical Offers Back Class

Got a back problem? Learning and practicing exercises to strengthen your back, as well as learning how to relax when your back is tense, are keys to a healthy, trouble-free back. Back exercises and relaxation techniques will be taught in a class sponsored by Sandia Medical and jointly taught by Ann Partridge, physical therapist, and Carl Ginsberg, instructor in body awareness.

The class, which begins February 3, is now open for enrollment. The class meets Tuesdays and Thursdays for four weeks from 4:45-5:45 p.m. in the lobby of Medical, building 831. Enrollment is limited to 15. To register, send your name, org. and phone number to Back Class, 3332-1.

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Supervisory Appointments



TONNI NUNLEY to section supervisor of secretarial training (8212-1), effective Jan. 1.

Starting as a clerk typist 17 years ago, Tonni became a division secretary in 1964 working in 8100, then 8300. Last May she moved into a department slot in 8200.

A resident of Tracy most of her life, she is married to Larry Nunley, a supervisor in the transportation department at LLNL. They have three children—a daughter who lives in Santa Ana, a son who is at the University of Alaska, and a second daughter who is married and lives in Stockton. They have one grandson.

Tonni serves on the advisory board for the Tracy Assembly of Rainbow Girls and lists her other free-time activities as coin collecting, tennis and racquetball.

* * *



CAROL VERITY to supervisor of the newly created Personnel Division II 8216, effective Jan. 16.

This new division will include Equal Employment Opportunity and Affirmative Action programs, Benefits, and Medical functions.

The new supervisor started at Sandia Livermore 11 years ago as a library clerk. In 1969 she became a compositor in the Technical Writing Division and, in 1970, moved to editorial assistant in the same division. Two years later Carol was promoted to member of the administrative staff in Technical Publications. Later, she was Affirmative Action Coordinator and, last year, became coordinator of MS and PhD recruiting.

Carol received her bachelor's in English from the University of Minnesota and a master's in the same field from San Jose State.

Her husband John is manager of the Technical Information Division library at LLNL. They have resided in Livermore for 16 years.

They enjoy travel and have made a recent trip to England. Weekends are spent at a vacation home near Carmel.

A Matter of Degree

Two Sandia Livermore employees have recently completed degree requirements under the Education Aids Program. They are Carolyn Kramer (8313) who gained her PhD in materials science and engineering at UC/Davis, and Durwood Green (8413), a BS in management at U of San Francisco.

LIVERMORE NEWS

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LIVERMORE LABORATORIES

JANUARY 23, 1981

Labs Woman Is Nominated



Carolyn Kramer (8313-LOA) was recently nominated for an award as an Outstanding Young Woman in America by the nationwide organization of that name. She will be one of those considered among the 15,000 women selected for state level honors; later, 10 finalists will be honored nationally.

This month Carolyn takes a one-year leave of absence from Sandia for post-doctoral studies at the Naval Research Laboratory on a National Academy of Science fellowship.

She began work at Sandia as an engineer in 1973 and, for the past four years, has been in the Exploratory Chemistry Division.

Her nomination for Outstanding Young Woman comes from a former dean at the University of Illinois where Carolyn studied ceramic engineering.

Congratulations

To Russ Wertenberg (8272) and his wife, a son, William Russell Brice, Nov. 7.

To Tim Dubay (8272) and his wife, a son, Aaron Michael, Sept. 16.

To Miram Hall (8264) on passing the California bar examination and being admitted to the bar, Dec. 16.

Johnny Allen (8264) and Barbara Papish, married in Reno, Nov. 22.

Ted Hebebrand (8262) and Janis King (SNLL Guard Service), married in Pleasanton, Nov. 15.

Graham Thomas (8444) and Cynthia Bruno, married in Philadelphia, Sept. 27.

Marv Kelly (8444) and his wife, a daughter, Krystal Marie, Nov. 18.

Betty Dominguez (8264) and Bill Lapaze, married in Lake Tahoe, Dec. 6.

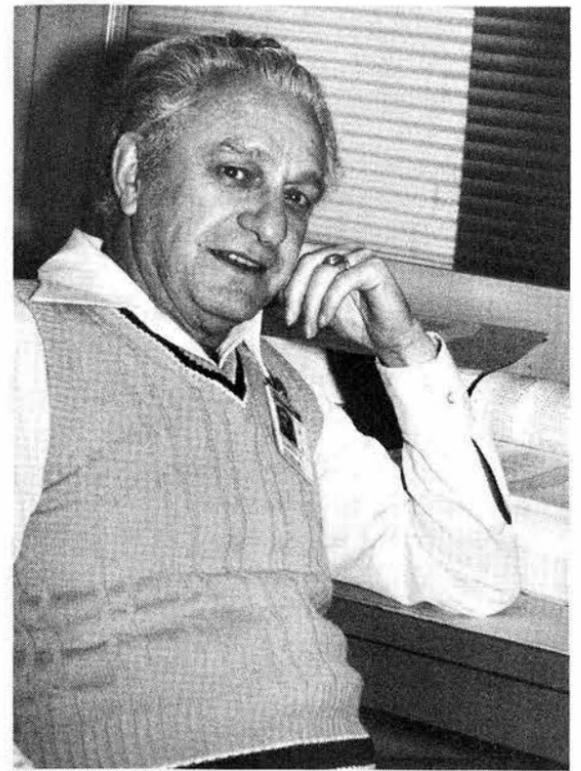
Harold and Ruth Gabriel (LOA 8322), a son, Harold, Jr., Nov. 26.

To Mac Spivey (8168) on his marriage to Roselie Coleman in Livermore on Jan. 17.

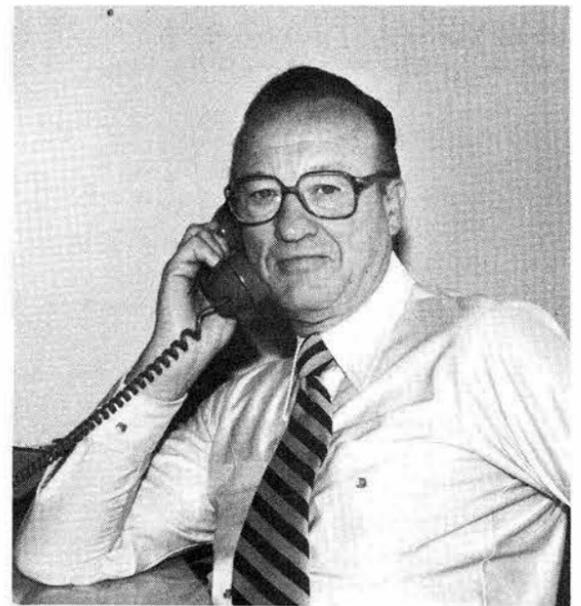


DID BELA LUGOSI EVER SAY THAT?
Dracula presents a contest between two evolutionary options: the ameliorative, progressive, Christian congregation, or the social Darwinian superman in the form of the ultimate parasitic degenerate, Count Dracula. . . . Dracula fantasizes on what could happen were materialism to be as successful in shaping the moral basis of the human community as it has been successful in elucidating the physical basis of life.
— Massachusetts Review

Retiring



E. A. "Pat" O'Brien (8161)



Al Derby (8264)

Sympathy

To James "Rudy" Grund (8257) on the death of his wife in Livermore, Jan. 2.

To Pat Gildea (8443) on the death of his mother-in-law in Livermore, Dec. 12.

To Harry Lauderbaugh (8461) on the death of his mother in Stockton, Dec. 9.

To Walter Ghio (8152) on the death of his father-in-law in Stockton, Dec. 16.

To Glenn Smith (8272) on the death of his brother in Lodi, Dec. 20, and his brother-in-law in Stockton, Jan. 4.

To Mac Spivey (8168) on the death of his mother in Memphis, Tenn., Jan. 6.

Sandia's One Year On Campus Program

In today's highly competitive recruiting of academically top-ranked students, Sandia's OYOC (One Year On Campus) program gives the Labs an edge in attracting qualified people.

Contacted while still an undergraduate by one of Sandia's college recruiters (LAB NEWS, Dec. 5, 1980), the student is invited to visit the Labs for additional interviews. The candidate meets with a number of line organization supervisors while at Sandia and the "get acquainted" process starts. If things go well, a job offer is made and accepted. The student returns to school to complete bachelor's level work in a scientific field. Following graduation, the OYOC works the summer at Sandia and starts graduate work in the fall. A calendar year is allowed to complete a master's degree.

Sandia pays cost of tuition, fees and books and also provides a stipend salary. Travel expenses are also paid. After completion of the master's degree, the graduate returns to Sandia as a member of the technical staff.

"The fact that Sandia offers a list of select graduate schools which the student may attend full time is a definite recruiting advantage," says Duane Hughes, supervisor of Education and Training Division 3521 which administers the education portion of the OYOC program. "Other firms offer support for further academic work but usually with strings attached—attend classes part time, work part time, and the school is usually located in the same city.

"From the student's viewpoint, these other offers are attractive. Still, since 1968, 92 of the 128 graduates of the OYOC program are still with us. That's a very good 72% retention rate. Much of our attraction reflects the exciting technical programs at Sandia plus our geography—the Southwest and living in Albuquerque have a definite appeal."

From the company's viewpoint, the new OYOC employee is highly qualified in those areas of expertise most needed at the Labs—electrical and mechanical engineering, computer science and, more recently, civil engineering and geosciences.

The recent '80 class of OYOCs illustrates the point. The 19 participants attended such schools as Cal Tech, Stanford, UC-Berkeley, Purdue and Cornell and all successfully completed on time and returned to Sandia.

LAB NEWS talked with four of the recent OYOC graduates about their current job assignments.

* * *

KAREN GRUBE is part of a team in Chris Dalton's Exploratory Systems Division 5621 developing instrumentation for penetrators that will explore the properties of seabed sediment.

"We've spent a lot of time," Karen says, "developing the data which we need to decide what to measure and how to measure it. We have to use the body responses of the penetrator—impact shock,



KAREN GRUBE (5621)—"I didn't feel all alone out there. Sandia support gave meaning to the course work."

vibration, deceleration and the forces on the nose of the penetrator—to give us a profile of sediment characteristics. In addition, we're developing a vane-like probe, extended in front of the penetrator, that will turn and measure torque to give us the shear strength of the soil. It will also measure the sediment pore pressure."

Karen specialized in the geotechnical phases of civil engineering while attending UC-Berkeley. She earned her bachelor's degree in civil engineering from the University of Texas.

With Chris Dalton advising, Karen tailored her courses at UC-Berkeley to be applicable to the seabed penetrator problem. She used library facilities at Livermore Labs while at Berkeley and visited the Labs as well.

"I didn't feel all alone out there," she says. "Sandia's support gave meaning to the course work. And coming back after graduation was like coming home."

Karen's leisure activities include horseback riding and playing the flute. "I also love dancing," she says.

* * *

CLEMENT CHIANG is constructing mathematical models for computer analysis of solar energy systems in Walt Schimmel's Systems Analysis Division 4723.

"We are looking at a solar receiver design for a parabolic trough," Clement says, "from the overall view of system efficiency. The emphasis is on cost effectiveness. How much heat transfers? How much power is required to pump fluid? What is the optimum size for components? What does it cost to build, operate and maintain? We try to answer these questions and optimize the design."

Clement became interested in solar systems while an undergraduate at Cornell. He learned from a fellow student who had

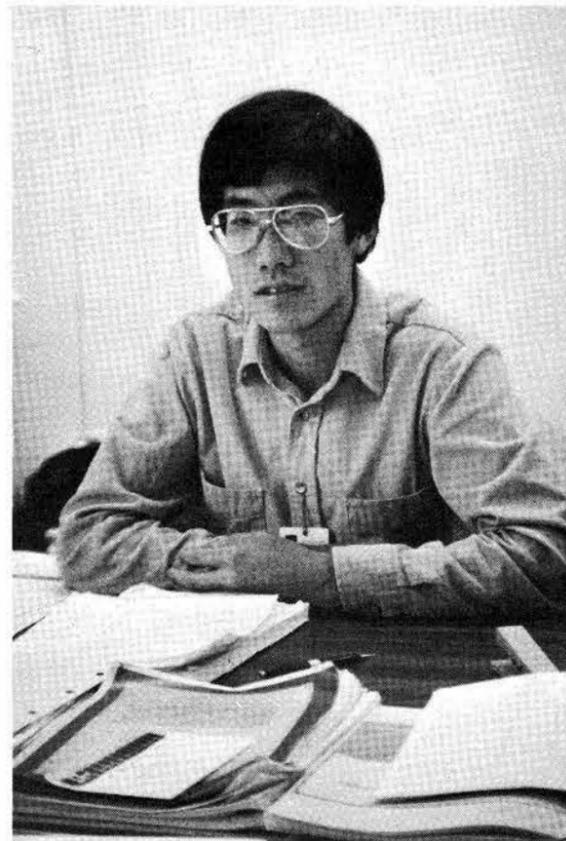
worked a summer at Sandia about the Labs' "mature solar program."

"I wrote to Sandia for more information," Clement says, "and was invited here as a prospective employee. I was impressed with the technical programs and the people. The OYOC program was the frosting on the cake. It took the worry out of earning the master's degree. I didn't have to think about money or a job."

After finishing his BS degree at Cornell, Clement worked nine months here before starting his master's work at Stanford. He was working with Walt on a computer model of central receiver systems.

"It was an exciting program," Clement says. "I felt as though I was making a real contribution. The feeling of satisfaction with my work provided encouragement during the many long hours of graduate study."

Clement's after-hours activities include the serious study of the violin—he has a tutor and practices several hours a day. He also enjoys bicycling and tennis.



CLEMENT CHIANG (4723)—"I felt as though I was making a real contribution—and the feeling carried me through graduate school."

* * *

KATIE BARHYDT is performing numerical analysis for the new large-scale melt facility used to simulate portions of a nuclear reactor core melt-down scenario in Ned Keltner's Thermal Test and Analysis Division 1537. The studies are aimed at understanding the severe material interactions caused by having molten core debris in the reactor cavity region. Katie is also working on an analysis and comparison of different heat flux measurements for the Central Receiver Test Facility (the solar "power tower"). She has just begun a heat transfer analysis of glass molds in support of Sandia's Scientific Glass Lab. Her analysis may help pinpoint some failures in casting and forming glass ceramics and may contribute to the design of new molds.

Take Note



KATIE BARHYDT (1537)—"It's a very busy time but it's exciting work."

"It's a very busy time," Katie says, "but it's exciting work."

Katie is also excited about her new house, living in Albuquerque and "maybe getting married."

"The work is demanding," Katie says, "but it is a pleasure after the 80 to 100 hours a week I spent at Cal Tech on course work. They grade on the curve—every class—and it was very competitive. Thanks to OYOC I could concentrate on school without worrying about anything else. It was a very comfortable scholarship."

* * *

STEVE GONZALES came to Sandia as the result of a chance meeting with Randy Maydew (5630) on an airliner between San Diego and Phoenix. Steve was returning to Northern Arizona University after interviewing for a job in San Diego.

"We casually talked about the weather, basketball and finally business," Steve says. "Randy asked me to apply at Sandia. I wrote a letter to Personnel and was invited to visit the Labs. I liked it here right away—the people and the work. Of all the places interviewed, Sandia seemed genuinely interested in me as an individual and I was most comfortable here."

Steve is performing theoretical analysis to determine the response of reentry vehicle heat shields in the reentry environment. He's in Sam McAlees' Aerothermodynamics Division 5633. Steve is computing vehicle pressure and heat transfer rate distributions, ablation and in-depth temperature profiles. The work applies to the Advanced Exploratory Development Department's reimbursable reentry vehicle programs.

At UC-Berkeley, Steve specialized in heat transfer and fluid dynamics. His daughter was born while he was attending graduate school, and now he's involved with his new family and new home.

"Lots of chores," he says, "lots of

Until he retired last month, Corry McDonald was for many years the coordinator of Sandia's technology transfer program. This program is designed to help industrial organizations and other labs use technology resulting from government-sponsored R&D. Outstanding examples are the laminar flow clean room and the hot air solder leveler used in the processing of printed circuit boards. Both of these are in use in over a dozen countries as well as in many companies in this country. A Federal Laboratories' Consortium (FLC) of over 180 organizations is involved in technology transfer programs. Corry's successor on the FLC and in our technology transfer function is Pat Quigley (2433), telephone 844-8762. Please call Pat if you have information that should be disseminated to industry.

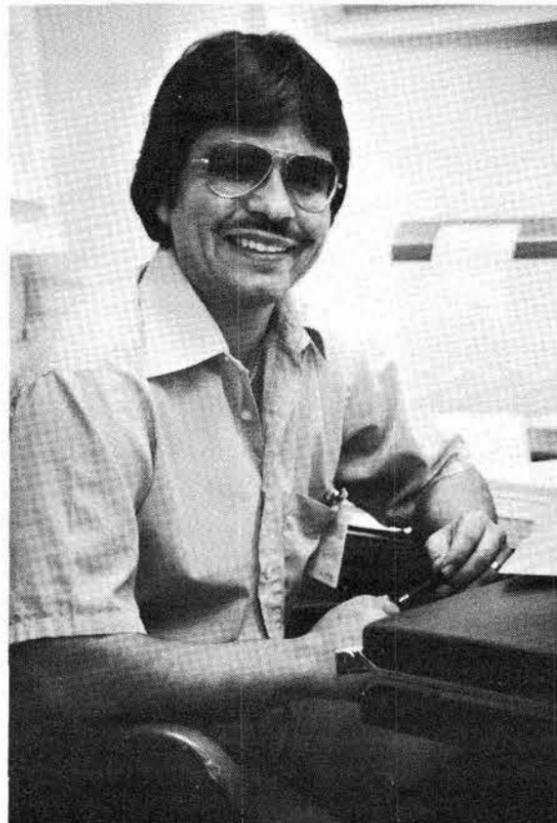
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Joe Laval (3163) will teach a course in photography in Umbria, Italy, next summer while vacationing from Sandia. Sponsored by UNM, the course is part of a four-week art/photography/language session at the La Romita School of Art. May 1 is enrollment deadline. Call Joe, 4-6531, for more info.

* * *

The Gordon Research Conference on Composites, held Jan. 19-23 in Ventura, Calif., was chaired this year by Frank Gerstle, supervisor of Composite Materials Division 5814. The conference brings together materials scientists, polymer chemists and engineering mechanics to discuss recent research on composite materials. All speakers are invited, and all presentations are off-the-record. Frank's program emphasized ultimate materials

projects around the house." He's looking forward to the time when he can return to his camping and backpacking interests.



STEVE GONZALES (5633)—"Of all the places I interviewed, Sandia seemed genuinely interested in me as an individual, and I was most comfortable here."

behavior; time and statistically dependent failure; matrix and interface effects; fatigue and toughness. About 130 scientists, representing seven countries, attended.

* * *

Gerda Krefft (5111) reports that 10 women from technical organizations at the Labs will participate in conferences entitled "Expanding Your Horizons," whose aim is to inform young women in high schools concerning engineering and scientific careers. Sponsored by the Network of Women in Science & Engineering, the conferences are scheduled to run in February and March at Eastern New Mexico Univ., the College of Santa Fe, UNM, and New Mexico State Univ.

* * *

The 33rd annual meeting of the Credit Union will be held on Jan. 29 at 5:15 p.m. in the C-Club. Following the business meeting there will be drawings for the three cash prizes—\$500, \$300 and \$200. You don't have to be present to win.

* * *

Monday next, the 26th, the colloquium speaker will discuss "The Promise of Inorganic Materials as the Construction Materials of the Future." He is Anthony Kelly, Vice Chancellor of the Univ. of Surrey. Note: this colloquium is scheduled for 9 a.m. On Feb. 4 Stephan Jacobsen of the Center for Biomedical Design at the Univ. of Utah is the colloquium speaker. His presentation is entitled "On the Design of Systems to Replace Lost Human Functions."

* * *

The American Lung Assn. of New Mexico is sponsoring a stop smoking clinic. It begins Feb. 10, runs one evening a week for six weeks. Cost is \$30 and the clinic is limited to 30 people. Contact Ray Moody, 265-0732.

* * *

Bob Grover of Advanced Energy Projects Division 4715 is the guest speaker at the next ASME meeting. He will discuss developments in Sandia's wind energy programs at the Kirtland Officers Club-West, 7:30 p.m. on Thursday, Jan. 29. A baron of beef buffet will be served at 6:30 p.m. Cost is \$5.95. Additional information can be obtained by calling Vern Romesberg on 4-2187.

Sympathy

To Jim Armijo (3432) and Jim Jr. (3618) on the death of their wife and mother on Dec. 4.

To Warren Taylor (2551) on the death of his father in Albuquerque, Jan. 2.

To John Murray (1473) on the death of his mother-in-law in Albuquerque, Jan. 8.

To Eddy Rael (1482) on the death of his father in Albuquerque, Dec. 22.

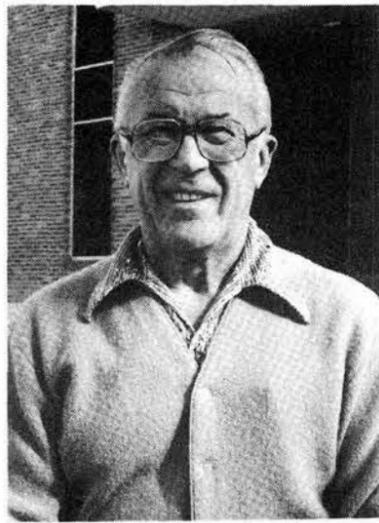
To Perfecto (3615) and John Romero (3426) on the death of their brother in Albuquerque, Jan. 2.

Fun & Games

Retiring



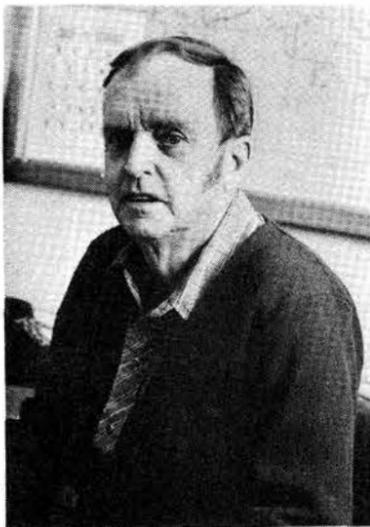
Fred Bentz (3713)



Erwin Barkowski (3743)



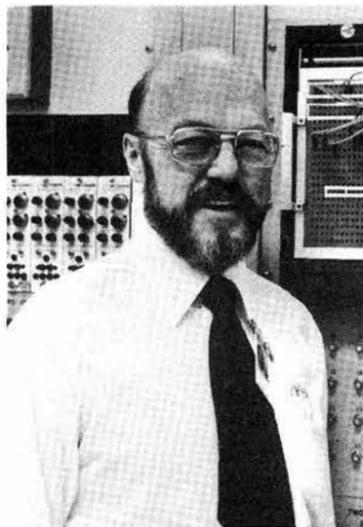
Ruth Randolph (3733)



Herbert Gentry (3618)



Verne Christy (3442)



Floyd Forsythe (5636)



John Budlong (1721)



Judy Hall (1000)



Jim Vincent (3611)



Bob Reineke (4745)



Thomas Crawley (1583)



Marian Goddard (1522)

Bowling—February and March tournament dates for SBA have been changed. On March 7 and 8, a four-game, no tap tournament with low game thrown out is scheduled. The last fun tournament is set for April 4 and 5. Flyers and entry forms will be mailed to members. Dan Puetz, 4-8017, is the contact.

* * *

Skiing—The snow drought has prompted one group of dedicated types (those who bought season passes) to propose a human sacrifice. Volunteers should drop by the LAB NEWS office to insure adequate press coverage.

Meanwhile, the NM Ski Touring Club heads by bus for Leadville, Colo., Feb. 13 to 16. Kathie Hiebert (5642), 4-3538, is the contact. The Club has another bus planned for Crested Butte, March 26 to 29.

* * *

Theater—Stephen Levi's play, *Angel on My Shoulder*, is the next offering of the Que Pasa Rec Center on Base, and it will be presented Tuesday next, Jan. 27, at 8 p.m. at the Rec Center Annex, Bldg. 485 (west side). You can get the \$3 tickets at Que Pasa, Bldg. 20155. Champagne is promised during intermissions.

Events Calendar

- Jan. 24—Pops Concert, pianist Peter Nero, Kiva Auditorium, Convention Center, 8 p.m.
- Jan. 24-25 — Albuquerque Children's Theater, "Puss In Boots," 1:30 & 3:30 p.m., Popejoy.
- Jan. 25—St. Paul's Day, dances, Picuris Pueblo.
- Jan. 26—Cultural Entertainment Series: "Dancin'," 8:15 p.m., Popejoy.
- Jan. 30-Feb. 15 — Albuquerque Little Theatre, "Broken Up"; performance schedule: T-W-T-F, 8 p.m.; Sat. 6 & 9 p.m., Sun. 2 & 8 p.m., 242-4750.
- Jan. 30—Lobo Basketball: San Diego State; Jan. 31—Hawaii, 7:35 p.m., UNM Arena.
- Metropolitan Opera Radio broadcasts: KHFM-96.3 FM, KZIA-1580 AM, 12 noon:
- Jan. 31—Wagner's "Tristan and Isolde"

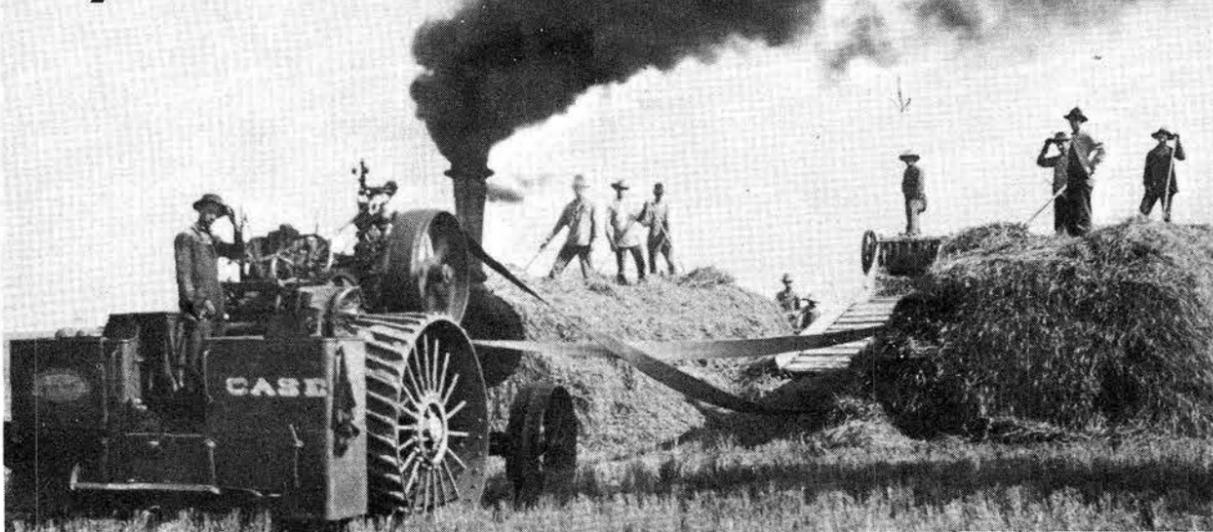
1981 Holidays

Sandians will observe the following 1981 holidays.

- Memorial Day . . . Monday, May 25
- Independence Day Friday, July 3
- Labor Day Monday, Sept. 7
- Thanksgiving Thursday, Nov. 26
- Christmas and New Year Shutdown Friday, Dec. 25 through Friday, Jan. 1

Energy Conservation Day will be announced prior to Oct. 1.

My Favorite Old Photo



TODAY when I see pictures of wheat and grain harvesters and their huge rigs going from farm to farm, I recall this photo from around 1910 which shows an early grain harvesting operation. My Dad (Arthur Arning) appears under the arrow. The coal-burning, steam tractor with huge metal wheels would pull the threshing equipment to a site, leather belts would be hooked up, and the operation would get under way, incredibly smoky, dusty and noisy. Dad homesteaded in Logan, N.M., in 1902, later moved to the Springer area where this picture was taken. (Charles Arning—2451)

Retiree Deaths

October—December 1980

Gustav Brockmoller (70)	Oct. 11
Rafael Montoya (69)	Oct. 18
Edith Duffy (71)	Oct. 19
Toke Harshman (80)	Oct. 22
Bob Chesnut (83)	Oct. 13
John Hobart (63)	Oct. 26
Lowell Stouder (71)	Nov. 7
Willard Scranton (66)	Nov. 2
Hallie Tankersley (70)	Nov. 11
James Schenck (77)	Nov. 14
Carrie Vick (80)	Nov. 19
Elizabeth Reese (70)	Nov. 25
Henri Guerin (71)	Dec. 16
Dean Wise (73)	Dec. 22
Homer Messenger (66)	Dec. 22
Maude Buchanan (78)	Dec. 27
Solomon Jaramillo (81)	Dec. 30
Rosemary Teasdale (61)	Dec. 31

JUNK • GOODIES • TRASH • ANTIQUES • KLUNKERS • CREAM PUFFS • HOUSES • HOVELS • LOST • FOUND • WANTED • & THINGS

CLASSIFIED ADVERTISING

Deadline: Friday noon prior to week of publication unless changed by holiday. Mail to: Div. 3162 (M0125).

RULES

1. Limit 20 words.
2. One ad per issue per category.
3. Submit in writing. No phone-ins.
4. Use home telephone numbers.
5. For active and retired Sandians and DOE employees.
6. No commercial ads, please.
7. No more than two insertions of same ad.
8. Include name & organization.
9. Housing listed here for rent or sale is available for occupancy without regard to race, creed, color, or national origin.

MISCELLANEOUS

FORD fiberglass campershell, white, LWB, sliding windows, tinted glass, \$450. Hoover, 821-0876.

STEREO, smaller advent speakers, dual turntable, Sherwood receiver, \$185; Akai GXM-50 metal cassette deck, \$225. Warren, 265-6822.

KODAK Colorburst 50 Instant Picture camera, \$15; Singer sewing machine w/cabinet, buttonhole attachment, \$75. Simons, 821-9343.

HEAVY DUTY clamp-on brackets for Toyota truck, but fit wide bed style, \$25 set of four. Horner, 821-0099.

GOLF CLUBS, Patty Berg, 3 woods, 8 irons (3 thru pitching wedge), new, never used. Michele, 298-8576 after 5.

SHOTGUN, Winchester model 101, over/under, 12 gauge, skeet #1 & #2. Komen, 299-8881.

WOOD BURNING STOVE, princess style Shradler brand, free standing, 1 yr. old, \$475. Wilson, 299-3046.

SKIS, Hart 100's, \$30; 110's \$30; ski boots, Ricker size 1 1/2, \$5, San Marco size 3, \$5; tricycle, \$10; 2 motorcycle helmets, \$8, \$10. Dixon, 298-5617.

SINGLE BED, Englander w/headboard, mattress pad, \$70. Merritt, 884-8487.

RADIO CONTROLLED AIRPLANE, complete w/transmitter, receiver, etc.; partially complete littlestick, misc. other RC items; O'Brien water skis. Fisher, 881-8072.

STEEL DESK, 45x18 formica top, 2-drawer file cabinet. Grant, 255-6105.

TELEPHONE RECORDER, Radio Shack duofone II w/instruction book, \$40. Moody, 281-3466.

LOOM, redwood custom built, weaves up to 45", bench & accessories, disassembles for easy moving, \$600. Schuetz, 881-7732.

4 EA. 14" Datsun rims; 10 1/2' overhead camper, \$400. Padilla, 877-2116.

BEIGE DIVAN, 90" long, reversible back & seat cushions, \$150; green loveseat, 54" long, reversible back & seat cushions, \$75. Hobbs, 268-6461.

KAWAI ORGAN w/2 manuals, pedals, entertainer section w/12 rhythms, revolving speaker, bench, \$850; 19 cu. ft. refrig. w/freezer, \$75. Parsons, 298-3053.

GARAGE SALE: wood lathe, Shopvac, tire chains, lumber, toys, games, much more; 7105 Lantern NE, Jan. 23-24. Stevens, 884-7984.

BANJO, Ome single X w/case, Keith tuners, strap. Downs, 293-9320.

FULL SIZE MATTRESS, box spring & frame, \$35; fireplace screen w/andirons, 39"x26", \$25. Zucuskie, 881-4086.

CAMERA, Nikonos II 35mm, retails for \$342.95, sell for \$275. Marquez, 344-8455.

KUSTOM 200 watt amplifier, Fender telecaster, Univox bass, all for \$700. LaFarge, 299-0929.

SKIS, Fischer 707 fiberglass w/Marker bindings, used twice, \$75; Garrard turntable-belt drive, cartridge & needle, never used, \$80. Farnsworth, 865-6160.

CAMPER SHELL FOR full size LWB, smoked bubble type windows, \$275. Nelson, 881-0148.

DAY BED: sofa converts to twin beds, new upholstery, newly recovered mattresses, lt. beige, \$250. Ruvolo, 296-1316.

NEW chrome commode for sickroom, frame will fit over toilet seat for safety, \$30. Arnold, 898-1467.

SEARS Kenmore clothes washer, portable on rollers, has hook-ups for sink or permanent installation; 8000 BTU AC; port. dishwasher. Mowry, 292-1527.

5-PIECE DINETTE w/2' extension, \$75; bar w/5 stools, glass top, brass rail, casters, best offer. Baldonado, 821-5016.

SYNTHESIZER, Roland SH1000, \$290. Stephenson, 299-3914.

BICYCLE, Rampar motocross, 20", \$70. Lobitz, 821-1509.

LOVESEAT/matching chair, tweed, \$150 or best offer. Helling, 293-2528 or 345-0678.

HUBCAPS, 1965 Corvair Corsa, set of four, \$15. Abel, 296-6089.

HIDEABED, 3-yr.-old, Herculon, red plaid, never used, queen mattress, cash, trade or both. Nation, 299-9213.

MAMIYA RB67, complete camera system. Burd, 884-9133.

8 1/2 FT. cabover camper, \$400. Padilla, 296-5048 after 5.

SUIT OF ARMOR, \$100; GE stove, \$175; 12-gauge pump shotgun; 2 guitars; loveseat; recliner, \$75 each. Terrell-Benton, 299-3843.

GIUITAR, Yamaha, student size, w/hard case, \$50. Zaffery, 294-6768.

TOW BAR, HD, \$50; air hose, 300 psi w/fittings, 1/2" I.D., about 43", \$25. Case, 299-3959.

SKIS, Skitique 170 cm, cable bindings, 99cm poles, \$25; boots, Nordica 6 1/2, 1 piece laminated, \$50. Coalson, 298-0061.

RAMPAR B.M.X. frame, rims & fork. Easterling, 298-7083.

TRAILER HITCH, Valley Tow-Rite bolt-on, Class II, plus receiver w/ball mount & 2" ball, \$150. Erne, 299-0565.

HO TRAIN SET, engine, cars, transformer, self-storing plywood board, some buildings, \$50. Schaedla, 898-9210.

O'KEEFE & MERRITT elec. range w/dbl. oven, lower oven is self cleaning, white. Stoever, 296-3717.

DELUXE PLAYPEN, 40"x40" w/pad, \$35; Kantwet travelcrib w/zip top & casters, \$20; Cosco cradleette, \$6. Stephenson, 296-9330.

FENDER-Rhodes "Seventy-Three" elec. piano, \$700. O'Brien, 293-6645.

LADY KENMORE convertible dishwasher, walnut cutting board top, \$420 new, now \$225. Turman, 298-3460.

KING size oak bedroom set: 2 nite stands, triple dresser w/mirror, headboard, frame & box springs, \$500. Riley, 821-6431.

CRIB, dbl. dropside, mattress, linens, pads, \$100; infant seat, \$5; potty chair, \$3.50; colorful plastic blocks, \$2.50. Bennett, 298-1142.

LOUNGE CHAIR, recliner, over-stuffed, brown vinyl upholstery, \$75. Harrison, 255-7978.

TABLE, 2 chairs, solid oak, \$95; 2 end tables, 1 round, 1 oblong, \$95 both; Zenith color TV, \$195. DeHaan, 266-7120.

SECTIONAL COUCH, 8-piece & 2 ottomans, beige, \$300. Sasser, 268-1465.

SHOTGUN, Winchester Model 1897, 12 gauge, pump, \$200. Jacobs, 881-9261.

TIME-LIFE Nature Series books, 24 vols., \$50. Marder, 268-9643.

OVEN BROILER, self cleaning, Toast-master, \$30; FP glass door, front & fan operated heat dispenser, offer. Liguori, 256-3613.

BURL clocks: one redwood, one buckeye, quartz movement, battery operated. Hesch, 881-9874.

STEREO, Sears compact, AM/FM, 8-track play/record, record changer, microphones, 9 1/2 w x 17h bookshelf speakers, \$80; 8-track 32-slot carousel, \$10. Conley, 296-0695.

8' CABOVER CAMPER, ice box, oven, sleeps 4, jacks, \$950; single quarter-horse trailer, \$100. Gorman, 898-9300.

PORT. video recorder/extra battery color video camera, electronic view finder, microphone for camera, tuner, power supply, charger unit, \$1195. Galbraith, 293-4786.

DWELL TACHOMETER, Heath CM-1073, std. ignitions, high-low tach-4, 6 or 8 cyl., voltmeter, manual, kit, \$37, sell for \$25. Dippold, 821-5750.

SMITH & WESSON 39, nickel, 9mm, auto., new, \$280; Remington 788 rifle, .308 w/scope & ammo, \$185. Haaker, 293-1077.

KING SIZE headboard, dark wood, \$15; wrought iron fp screen & grate, \$25. Ezell, 821-1768.

ANTIQUA "fainting couch," gold; complete set 1976 Ford passenger car shop repair manuals. Lukens, 299-1271.

PIANO, Gulbranson upright, \$500. Esterly, 881-1973.

TRANSPORTATION

79 HARLEY DAVIDSON FXS-80, 800 miles, \$5200 or best offer. Chiaramonte, 292-8824, 298-4353.

72 MALIBU 4-dr. HT std. 350 V8, AT AC, PS, 37,000 miles, reg. gas,

\$1300. Kish, 298-7090.

17' POWERCAT boat, 165 HP inboard/outboard, new full canvas, tandem trailer, \$2500. Tobyas, 877-0354 after 6.

70 FORD pickup, 68,000 miles, 1/2 ton, over-cab frame, snow tires, new hoses, AT, \$1275. Steele, 877-1225.

'80 YAMAHA Special 400, plexiglass fairing & windshield, 55 mpg, less than 2000 miles, black, many chrome features, \$1695 or best offer. Montoya, 836-6301.

'69 CHEV. window van, 4-spd., posi-traction, 6-cyl., 17 mpg, 8-pass., HD springs & shocks, carpeted, new engine, \$1200. Baxter, 344-7601.

'74 VW deluxe campmobile, sleeps 4-5, gas stove, refrig., many extras, 44K miles, 22 mpg hwy., \$4100. Keltner, 298-7888.

'71 PONTIAC Catalina, 4-dr., AC, PB, PS, \$850. Romero, 299-5189.

'64 CHRYSLER Imperial, 4-dr., one owner, \$1200 firm. Campbell, 255-4271 after 5:30.

'76 MONTE CARLO, PS, PB, AC, tilt steering, power door locks & windows, silver, Landau roof, radials, under 38,000 miles, \$3400. Johnson, 884-8670.

'68 DODGE Coronet stn. wgn., 273 V8, AT, PS, PB, complete maintenance record, \$600 or best offer. Wiczer, 296-4496.

'76 AMC Matador stn. wgn., PS, PB, AC, AhTo, recent valve job, \$1300 or best offer. Wallace, 296-6556.

BICYCLES: boy's 24" 10-spd., \$35; boy's high-rise, needs work, \$10. Madden, 296-1082.

'74 CORVETTE T-top, AC, black interior, T/A radials, luggage rack. Perryman, 294-6113.

'79 YAMAHA 650 Special, black & chrome, 9000 miles, \$1800. Lyons, 296-8866.

YAMAHA 175cc cycle, runs sometimes, \$125. Shunney, 265-1620.

'72 AMC Gremlin, 304 V8 std. trans., \$450. Moss, 299-6573.

'79 VW Rabbit, 4-spd., AC, AM-FM stereo cassette, 21,900 miles, \$5300. Harris, 821-8524.

BICYCLE, Ladies' 10-spd. Schwinn suburban, \$100. Reed, 884-8145.

'71 MONTE CARLO V8, AT, PS, PB, AC, vinyl roof, bucket seats, radio, \$1075. Zurawski, 268-9511 after 6.

'79 BLAZER 4x4 Cheyenne, AC, lock-out hubs, chrome spoke 12x15 tires, many extras, 17,000 miles, \$6650. Pacheco, 898-7695.

REAL ESTATE

5 ACRES at Placitas, power & telephone lines nearby. Gonzales, 867-2897.

2-bdr. on 2.1 acres in Sandia Knolls. Smith, 281-3430 after 5.

RESIDENTIAL LOT in Lake Havasu, Ariz. Noel, 884-4491.

3 ACRES, cultivated, irrigated, near route 47, 6 miles south of Valencia, easy terms. REC. Burton, 869-2541.

'73 SAHARA mobile home, 12'x52', 1-bdr., \$6000, located in Aztec Village MHP. Chemistruck, 299-7563 after 5.

ASSUME 8% loan w/moderate down, \$51,900, 3-bdr., 1 1/2 bath, single car

garage, Westgate Heights new addition. McClure, 255-4901.

WANTED

ANYONE interested in obtaining group rates at the Nautilus Fitness Center. Rivord, 296-9151.

BOARDING FOR CAT (altered male, 18 mos.) in caring home environment for up to several months. Kupferman, 299-7453.

DOUBLE HAY feeder for livestock. Tee: two half barrels w/overhead Vee rack for hay. Brown, 281-3608.

BOOK LOST: Will the person who borrowed the book *Master Photography* from Charles Karnes please return it or call 884-8674.

EXERCYCLE, preferably w/timer; garden hose, any length up to 150'. Underhill, 294-8774 after 6.

SKI RACK, cheap. Baxter, 344-7601.

SNOWSHOES & Ford 16.5" 8-hole truck wheel; 600x16 or 650x16 tires & tubes. Bauhs, 281-2688.

The World Science Fiction Convention will be held in Sept. at Denver; anyone intersted in going please call Barbera, 299-6045.

ANCHOR SMALL BOAT. Morrisett, 294-4086.

GOING TO NEW ORLEANS April 3, return April 17. Would like rider to share expenses. Woodson, 255-5948.

CHILD'S CAR SEAT. Noel, 884-4491.

TREES to cut down for firewood, Chinese elm preferred, no willows. John, 265-1620.

HELP PLEASE! Responsible gentleman with teenager seeks quiet, inexpensive rental soon, prefer 1-3 bdr., furnished, near campus. Dodson, 281-2649.

TIRES, used 15" standard, radial & snow tires. Burton, 869-2541.

FEMALE nonsmoking roommate to share 2-bdr. apt. in NE hts. Bradford, 292-3882.

BOOK, paperback copy of "Young Renny" by Mazo de la Roche. Easton, 256-7717.

ROSSIGNOL 550 skis, 175 or 180 cm. Souder, 281-3121.

POLAROID CAMERA model 180 or 195; Brooks veriwide camera; Wolensak 35mm stereo camera; Zeiss super Ikonta C; Voigtlander Bessa II. Mattox, 821-3945.

NEED trailer hitch for Type 1 VW bug, 1969 or 1970. Randle, 867-2668.

WORK WANTED

BRICK & MASONRY JOBS, estimates given. Mike Rogers, student, 344-9991 or 256-0066.

SHARE-A-RIDE

A FEW MORE van poolers from Moriarty-Edgewood-Tijeras area, contact Hansche, 281-5623 or Dungan, 281-3862.

Superbowl Sunday Set Jan. 25

TONIGHT at Happy Hour is a sit-down special dinner starting at 6 p.m. featuring a choice of prime rib, king crab or shrimp for \$7.50. Use your calendar discount ticket. No reservations will be taken. On the bandstand, the Scotsmen will make the dancing music while Happy Hour prices (cheap) prevail. Hors d'oeuvres will be available in the dining room and the main lounge.

SUPERBOWL SUNDAY starts at noon Jan. 25 at the Club with Happy Hour prices in effect, a giant TV screen imported for the occasion and bowls of green chili. Admission is \$1.50. Live it up among friends.

HAPPY HOUR on Friday, Jan. 30, sees the Country Showmen on the bandstand, a singer/guitar player called Scooter Vaughn entertaining in the lounge and barbeque ribs and beef on the buffet menu. Call the Club office, 265-6791, by mid-week for reservations. On Friday, Feb. 6, retirees and senior citizens get a break on a special Chateaubriand with mushroom sauce for \$5.50. The rest of us can use the calendar discount ticket and get the same price. Again, make reservations by mid-week. A variety group called the Del-Fives play for dancing.

TRAVEL DIRECTOR Frank Biggs (4231) announces a four-day economy bus tour to Las Vegas on May 24-27. The price is \$132 and includes transportation, three nights at the Maxim Hotel on the Strip, snacks and refreshments on the bus, a tour



RETIRED SANDIAN CHARLIE STUART (left) is a long-time member of the Labs Rifle and Pistol Association as is Dave Overmier (right), president of the group. Linda Hobart and K. K. Ma (center) are newer members but have already begun to rack up individual and team awards.

Go For Fun: Shooting

Join the Labs' Rifle & Pistol Club

[Ed. Note: This is another in the LAB NEWS series of articles describing recreational programs now offered to employees under the Labs' Reaction Program.]

The tradition of competitive shooting

of Hoover Dam and discounts on shows and meals. Pay a deposit of \$50 at signup, the remainder is due April 6. A pre-trip meeting is set for 7:30 p.m., April 28.

Frank is also working on a charter bus trip to Chaco Canyon for April 25. Details will be announced later.

In the meantime, consider Disneyland on April 14-18, Puerto Vallarta May 5-12, or Mazatlan June 1-8. Frank will be in the Club lobby tonight between 6 and 7 with details.

UPCOMING EVENTS—Variety Night on Saturday, Feb. 7, with live entertainment and movie. It's a family event with supper selections available and no admission.

A Valentine's Day dinner-dance is set Saturday, Feb. 14. Prime rib is the entree. A group called "Lawyers, Guns & Money" will play for dancing. The publicity blurb reads "LG&M is a five-piece progressive Western group consisting of attorneys at law." Ticket deadline is Feb. 7.

Congratulations

To Jim Harrison (4311) and Judy Hatch on their marriage, Dec. 24.

To Ken Bell (4713) and his wife Diana, a son, Steven Michael, Jan. 5.

with rifle or pistol is part of our history and, as a sport learned through necessity, the activity was enjoyed by the early Americans. In pioneer days, almost any gathering of people produced a session of target practice or a shooting match.

Today, shooting is organized and much of the competition is on a national basis. The Sandia Labs Rifle and Pistol Association has been in existence for 14 years and competes against shooters representing other firms in national postal matches.

Co-sponsored by the National Industrial Recreation Association (NIRA) and the National Rifle Association (NRA), the postal matches are conducted by each club under set conditions, and the targets are then mailed to NRA—thus the name postal matches. Over the years, Sandia shooters have won many awards; the pistol teams, both .22 and airgun, have been especially successful. Last year first-year-shooter Linda Hobart (wife of Tom 1481) placed first nationally in the women's air pistol match.

New members are welcome—both novice and experienced shooters. Good shooting takes practice and concentration, but a casual practitioner can still enjoy the game. The Club is currently signing up shooters for the 1981 postal matches.

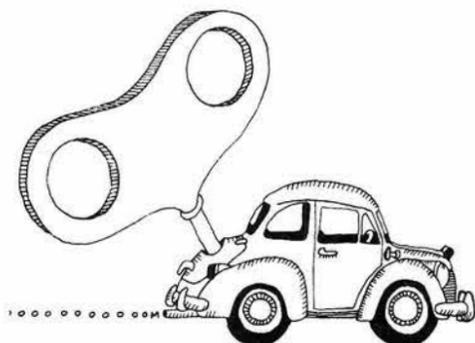
Airgun practice is scheduled at the Coronado Club. For those who don't own equipment, the club has a number of airguns, and new shooters will find coaching and advice available.

Besides target shooting, the club offers basic training classes to women in handgun shooting.

For more information, contact Dave Overmier (1585) or K. K. Ma (2331).

WIND-UP

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in your pocket



for carpooling info
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CAUGHT IN THE ACT—At the Army's ordnance facility in Yuma, Sandia Livermore photographers from Photography Section 8413-1 took this extraordinary picture last year of a W79 projectile emerging from the muzzle

blast of a mobile gun. This supplement to LAB NEWS catalogs the complete range of technical accomplishments by the Labs in 1980.

**SPECIAL
SUPPLEMENT**



LAB NEWS

VOL. 33, NO. 2A

JANUARY 23, 1981

SANDIA NATIONAL LABORATORIES • ALBUQUERQUE NEW MEXICO • LIVERMORE CALIFORNIA • TONOPAH NEVADA

**Technical
Accomplishments
1980**

With this special supplement, distributed only within the Labs, LAB NEWS introduces a new feature which we plan to carry with the advent of each new year. *Technical Accomplishments 1980* has a two-fold objective: to document in one place, unclassified, the principal technical accomplishments of the Labs for the year just past; secondly, to inform Sandians of what the other Sandian is doing. In a laboratory with interests as far ranging as those of Sandia, many if not most of us have scant knowledge of what's going on beyond our own organization.

The accomplishments given here have been submitted by technical department managers in Albuquerque, Livermore, and Tonopah. The department or origin is given in parentheses following each item. No attempt has been made to rank the items.

Weapons

- The SWERVE II flight test was conducted successfully in September 1980. This is a highly maneuverable, inertially guided reentry vehicle designed to fly IRBM ranges. It has a number of potential applications. (5620)

- We developed a parallel SITAN (Sandia Inertial Terrain-Aided Navigator) which uses a parallel Kalman filter scheme to process radar altimeter measurements and topographic data to improve the accuracy of an inertial navigation system. Improving the accuracy of navigation systems is currently of active interest in both our strategic and tactical missile defense systems. This parallel processing scheme extends previous SITAN work at Sandia by providing a high degree of navigation accuracy even when the initial navigator position errors are large. (5620)

- Aluminum-4 wt. pct. magnesium alloys have been produced which contain from 15 to 40 wt. pct. boron carbide particles uniformly dispersed throughout the matrix. This process, called compocasting, has been developed as an alternative method to produce multiphase materials. Applications would include neutron shields, wear-resistant layers, and penetration resistant sections. (5830)

- Joint programs with industry and with Y-12 are currently underway to transfer into application the results gained from the Sandia characterization of the vacuum consumable arc remelt process. Application of this technology can result in quality enhancement and significant cost savings. (5830)

- A patent application has been made for a method and a device to control electrode gap during vacuum consumable arc remelting. The device incorporates a micro-processor and is capable of adjusting furnace parameters based on real-time measurements. Control of electrode gap is important because this parameter is related to the partition of heat from the vacuum arc. The vacuum arc remelt process is used extensively for production of exotic alloys. Enhanced product uniformity through better process control is expected. (5830)

- Significant progress in special material technology and processing techniques has led to demonstration of a virtually weightless tamper detection system for use in nuclear weapon protective systems of the future. This development will provide an important degree of flexibility in future designs requiring secure volumes. (4360)

- An evaluation of the use of titanium for arming, fuzing, and firing system structures was completed. By replacing stainless steel support structures with titanium, significant weight savings, higher strength, and greater corrosion resistance can be obtained. Reentry vehicle systems that must strive for minimum weight can be reduced one to two lbs. by substituting titanium for stainless steel. (4363)

- We developed a feasible concept for the control of weapon disablement systems, which offers solutions to the technical problems of fully automated initiation and the psychological problems of manual initiation of these systems. The concept provides an additional option to the military commander for responding to an emergency situation involving the potential loss of weapons to an adversary. (4360/2330)

- We completed radiation effects testing of various Sandia components and systems on the Miners Iron underground test conducted in Nevada. The testing has applications to radiation effects hardening of present and future weapon systems. (4360)



SWERVE II, a highly maneuverable, inertially guided RV developed in Dept. 5620, was successfully flight tested in a STRYPI VIII-R rocket last September. Here test engineers from Org. 1500 ready vehicle for launch at Pacific Missile Range Facility in Hawaii. Launch photo was taken by Gene Moore (3153).

- The Primary Standards Laboratory performed over 2700 calibrations, 16 surveys, and 80 technical audits in support of the DOE/ALO production complex. This was part of the job assigned to Sandia by DOE/ALO and embodied in AL Chapter 72XF. (2550)

- We completed design of the W80-1 and W80-0 common warhead for the Air-Launched Cruise Missile and Sea-Launched Cruise Missile. All component designs and system design for the W80-1 have been released for production. We completed five W80/cruise missile flight tests, four air-launched cruise missile (ALCM), and one ship-launched cruise missile (SLCM) flights. (4340)

- Seven full-scale earth penetrator (EP) tests were successfully conducted into solid rock targets at Sandia's Tonopah Test Range in Nevada. These tests, the first ever of a weaponized penetrator design into rock, have validated a weaponized structural design approach for future EP nuclear weapons. A nuclear EP would be a highly effective weapon system against crater sensitive targets where minimizing collateral damage is an important consideration. (4340)

- An electronic device called the bomb interface simulator (BIS), which is capable of being mated to modern US and NATO nuclear capable aircraft, can simulate the electrical interface of the B43, B57, B61, and B83 nuclear bombs with responses identical to those of an actual weapon. This device provides an inexpensive and accurate nuclear bomb simulator for use in the Laboratories' aircraft compatibility program and could be employed in military aircraft training programs. (4320/2330)

- We developed a computerized system for measurement of all interface signals between operational aircraft and nuclear weapons. This system can gather more data and process it in the field faster than previous systems. This system is being used to gather data for aircraft/nuclear weapon



compatibility and can be used to insure compatibility on future applications. (4320)

- Phase 4, production engineering, was authorized for the W85 airburst/surface burst warhead under development for the Army's new Pershing II weapon system. Significant cost savings are being realized through the use of major components developed for the B61-3 and -4. (4310)

- Activities for improvement of stockpiled weapons continued through 1980. Additional feasibility studies were conducted on several of the older stockpiled weapons to determine optimal methods of improving on nuclear detonation safety and command and control. Engineering development was also continued on the B28 and B61 bombs to define retrofit hardware for improved nuclear detonation safety and command and control. (4310)

- The FY-80 production quantity of B61-3 and -4 bombs was accomplished on schedule (4310)

- A neutron detector has been developed which uses a commercially available, large-area photodiode and a proton radiator. The small size and simplicity of this system permits application in a variety of measurements involving pulsed neutron sources. (2350)

- We completed the first year of a three-year cost reduction program on the MC2935 unique signal strong link. An investment of \$79K base dollars has resulted in a cost savings of \$3.6M over the anticipated production run; a pay-off ratio of 45 to one! The MC2935 is used in most weapon systems being produced or in development today. (2320)

- We fabricated and tested the first model of the MC3524 unique signal strong link.

This device offers significantly increased abnormal environment bypass resistance and improved reliability at less than one-half the cost of present strong links. Every weapon requires strong link safing of some kind. This device has the potential for use in most new weapon systems as well as some currently being developed. (2320)

- An in-depth study of the high pressure response of beryllium was accomplished at the Sandia Powder Gun Facility to investigate whether a phase transition occurred in beryllium under shock loading, as previously proposed at LLNL, and also if the shear strength of beryllium varies with shock pressure. This study will result in an improved model for predicting the high pressure dynamic response of beryllium, which is necessary for assessing the performance of different weapon systems. (5530)

- A transient heating facility has been developed to heat conductive samples by resistive heating using capacitor discharge to allow uniform, rapid heating of metal and metal-oxide samples. This provides an accurate data base for developing dynamic equations of state which are useful in a variety of applications. (5530)

- Calculations have been completed of the effects of large-yield explosions near the earth's surface. Ground shock, ground motion and crater formation are investigated as a function of height of burst to provide more accurate predictions of weapon effects. Warhead design depends on the fuzing option chosen, and this choice requires accurate knowledge of weapon effects as a function of height of burst. (5530)

- In the testing of the Pershing II earth penetrator system with a Davis gun, highly

destructive stresses were created by the pusher plate upon impact with the target. A new design for the backplate derived from wavecode calculations was proposed and implemented. The actual environment to be encountered by the penetrator was simulated more closely, and components were no longer destroyed by backplate impact. (5530)

•A procedure for the chemical analysis for Cr (III) in a 10^3 excess of Cr (VI) was developed based upon the selective chelation and extraction of the Cr (III) with quantitative determination by inductively coupled plasma emission spectrometry. This procedure allows measurement of the rate of degradation of materials such as B/CaCrO₄, a pyrotechnic, and LiCl/KCl/CaCrO₄/SiO₂, a thermal battery constituent. (5820)

•A laser interferometer dilatometer which can resolve a length change of 0.4 microinches was developed for precise measurement of the thermal expansion of glass ceramic materials used in sealing applications. This equipment was designed to be suitable for use in a production environment, although to date it has not been used for this purpose. It is currently in use as a research tool in several weapons and energy programs. (5820)

•Investigations of Kevlar 29 narrow fabrics for parachutes resulted in improved understanding of material properties, fabric design parameters, and textile deformation modes. We developed a woven fabric simulator from guitar string holders which permitted inexpensive laboratory modeling of fabric strength behavior. Use of Kevlar in B61, 3-4 and B83 parachutes has achieved substantial weight and volume savings as compared with previous nylon parachutes. (5810/5630)

•Kevlar Epoxy Laminates, consisting of Kevlar 49 cloth and high temperature epoxy resins, have been developed and characterized for use in the W76, W79, and B83 weapons, and are also being considered for the W82. (5810)

•Advanced development in the Exploratory Batteries Division has led to a new generation of thermal batteries based on the Li(Si)/FeS₂ electrochemical system. One of these batteries is being developed as the main power battery of the B83, and other applications include JTA batteries for the W85, W84, and W70. The new thermal battery system allows longer life batteries, significant cost reduction, and much greater flexibility in performance than previously available in thermal batteries. (2520)

•Completed the development and first production build of a miniature ferroelectric neutron generator for the W80 cruise missile. New design techniques provide a combination of small size and long life never before achieved. (2520)

•We developed new high-electric field varistor materials and devices for use on weapon systems including firesets and lightning arrestor connectors. These unique devices provide precise, high-voltage regulation previously unobtainable by other means. (2520)

•AMEER, a modernized six-degree-of-freedom (6-DOF) trajectory code, was completed in 1980. It offers at least a 30% reduction in computing times over older 6-DOF codes as well as a number of other useful features such as a generalized input format, choice of several different numerical integrators, 20 atmospheric profiles, variable mass, up to five swiveling thrusters, and a center-of-gravity offset. (5630)

•A new spinner capability has been installed at Sandia System Test Lab (1424) in Amarillo for the W79 program. It has a capability of 25,000 rpm, with a maximum test load of 1500 pounds. Some capability for temperature simulation is also available.

One hundred slip rings are available for data. (1420)

•Two hundred twelve laboratory system tests and 120 joint system firing tests involving 22 different weapons in the current stockpile were performed. Four hundred twenty-three components from stockpile weapons were tested and evaluated. (1420)

•The first microprocessor-based subsystem has entered the nuclear stockpile. It is an electronic programmer for the B61-3 and B61-4 weapon systems and performs the same functions as its predecessor—controlling the entire arming and firing sequence—but costing one-third as much (savings of \$10,000 per weapon), using one-half the volume and only one-fourth the weight. (2330)

•The first intent-enabled Trajectory Sensing Signal Generator (TSSG) was developed and successfully flight-tested for the B83 bomb. Being microprocessor-based, it has vastly increased signal processing capability, assuring a safer nuclear stockpile and, at the same time, reducing cost by eliminating hardware. (2330)

•Equipment has been developed for demonstrating new concepts in the handling of classified information for releasing nuclear weapons. The new controllers are the first to incorporate principles of cryptography and to utilize multiple microprocessors in the complex processing of data. These controllers are scheduled for fielding in 1984. (2330)

•Equipment used for releasing modern nuclear weapons has been developed with special emphasis on low production cost, ease of manufacture and repair, and high reliability. This equipment includes a "unibody" design of the supporting structure (replacing numerous brackets and small individual mounting features) and an integration of electronics (replacing over a hundred individually packaged electronic

circuits). The cost savings are expected to exceed \$4 million during production. (2330)

•A navigation computer was successfully flight tested on a highly maneuverable reentry vehicle. The computer was designed, developed and flight qualified in-house and is an outgrowth of a design previously developed for terminal guidance of stand-off weapons. (2330)

•A prototype of a navigational computer based on a 16-bit microprocessor has been built and tested. This version, developed for future flight tests, has greater computational thru-put, smaller volume, and uses less power than previous navigational computers. (2330)

•We have developed a new microwave switch that uses lightwaves to couple microwave energy between its ports. The switch offers outstanding performance in terms of on/off ratio and reverse isolation while exhibiting a state independent input impedance. The device is particularly attractive for a variety of radar applications. (5130/2340)

•A small telemetry system was developed that encodes eight different 10-kilohertz analog signals, and stores the data in a half-million bit semiconductor memory for several weeks. The system has successfully survived the severe environments of earth penetrators entering and traveling into the ground to rest. The data is read out after digging up the penetrator. (1580)

•A modified version of the W70 warhead (W70-3) for the Lance Missile, having an enhanced radiation capability, was developed. The last development flight test was completed at White Sands in October 1980. (8160)

•We identified requirements for new nuclear weapon systems and significant deployment modifications for Army divisions of the late 1980s. This work was done with the Army Training and Doctrine Command. (8320)

•A new turbulence computational procedure developed for the combustion program was used to predict parachute behavior on the B83 bomb. The unsteady wake flowfield around a parachute undergoing a large deceleration was simulated using vortex dynamics. (8350)

•A new corrosion protection scheme for uranium alloys, using ion-plated aluminum was chosen for the W79 AFAP and put into production in less than one year. This new technique will save about \$1M during the production of the W79. (8310)

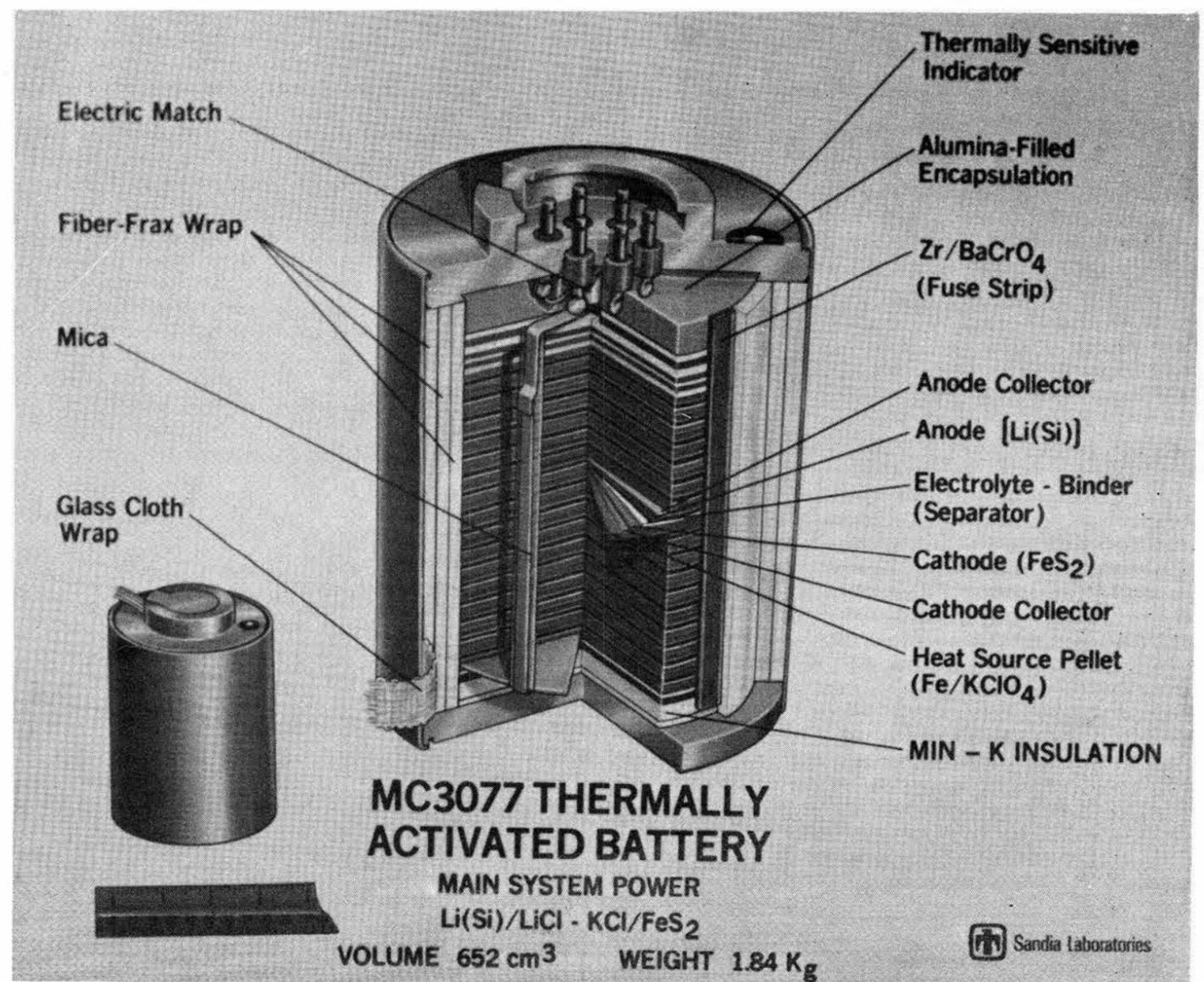
•The first development flight test of the Ground Launched Cruise Missile (W84) was conducted in 1980. Requirements/cost tradeoffs have been completed and a cost savings in production of at least \$10M is expected. (8160)

•An improved chemistry specification for austenitic stainless steels was developed from our studies of the solidification processes in alloys. This specification avoids the hot cracking experienced in weldments and thus provides the capability to improve the fabrication processes for pressure vessels. (8310)

•A computer program has been developed which uses a statistical least squares spectral correlation routine to improve the sensitivity, accuracy, and applicability of quantitative infrared spectroscopy. This method allows quantitative infrared spectroscopy to be applied to the analysis of multicomponent samples with overlapping spectral features. The method is currently being used in the analysis of trace gases generated during the aging of explosive materials. (5820)

•First use of a Sandia-designed and -built silicon gate CMOS in a weapons system. The SA 2908 and SA 2909 were successfully flown in B83 JTA drop test. (2140)

•Cost saving efforts with cables and magnetic products have been aimed at more clearly delineating between design agency



MC3077 is one of new generation of thermal batteries developed in Dept. 2520 that offers longer life and greater flexibility along with reduced cost. Weapon applications include the B83, W85, W84, and W70.

and production agency requirements. By eliminating callout of manufacturing information as a design agency requirement, BKC can project an annual cost reduction of \$390,000 in these production departments. (2150)

- The first firing set (MC3276) with high energy density (HED) Fluorinert capacitor was put into production at BKC for use in the W80 warhead. (2160)

- A Process Analysis Lab is now operational, offering processes for fabricating plastics, ceramics, weldments, glass, photofabricated and plated items. Services include particle and surface measurements, thermally based characterizations, scanning electron microscope, gas chromatograph and Auger spectroscopy. (1470)

- The Physical Electronics Lab was modernized. New capabilities include multiple E-beam deposition systems, sequential sputter deposition of three different materials, higher deposition rates, and higher temperature brazing equipment. (1470)

- B-61 fins, previously machined, were successfully cast in the foundry at an appreciable savings in time and money. Approximately 100 thin-walled fins were cast to size, requiring a minimal amount of machining. (1470)

- Glass ceramics were developed which produced high-strength hermetic seals to corrosion-resistant Inconel and Hastelloy alloys. (1470)

- A passive data acquisition system was developed for the B61 Mods 3 and 4 Joint Test Assembly (JTA). Data are stored (not transmitted via radio frequency) in a non-volatile (requires no power during storage) and reusable semiconductor memory to read out after vehicle recovery. Data acquisition costs are significantly less than for RF emitting systems due to lower production costs and reusability. (1580)

- Novel phosphorous pentoxide glasses and glass ceramics which have high coefficients of thermal expansion and low melting temperatures were developed. Hermetic seals between aluminum and copper or stainless steel were fabricated. (5840)

- Glass for making hermetic seals resistant to attack by lithium metal used in lithium/sulfur dioxide cells was developed. This glass extends the life of these cells at least tenfold. (5840)

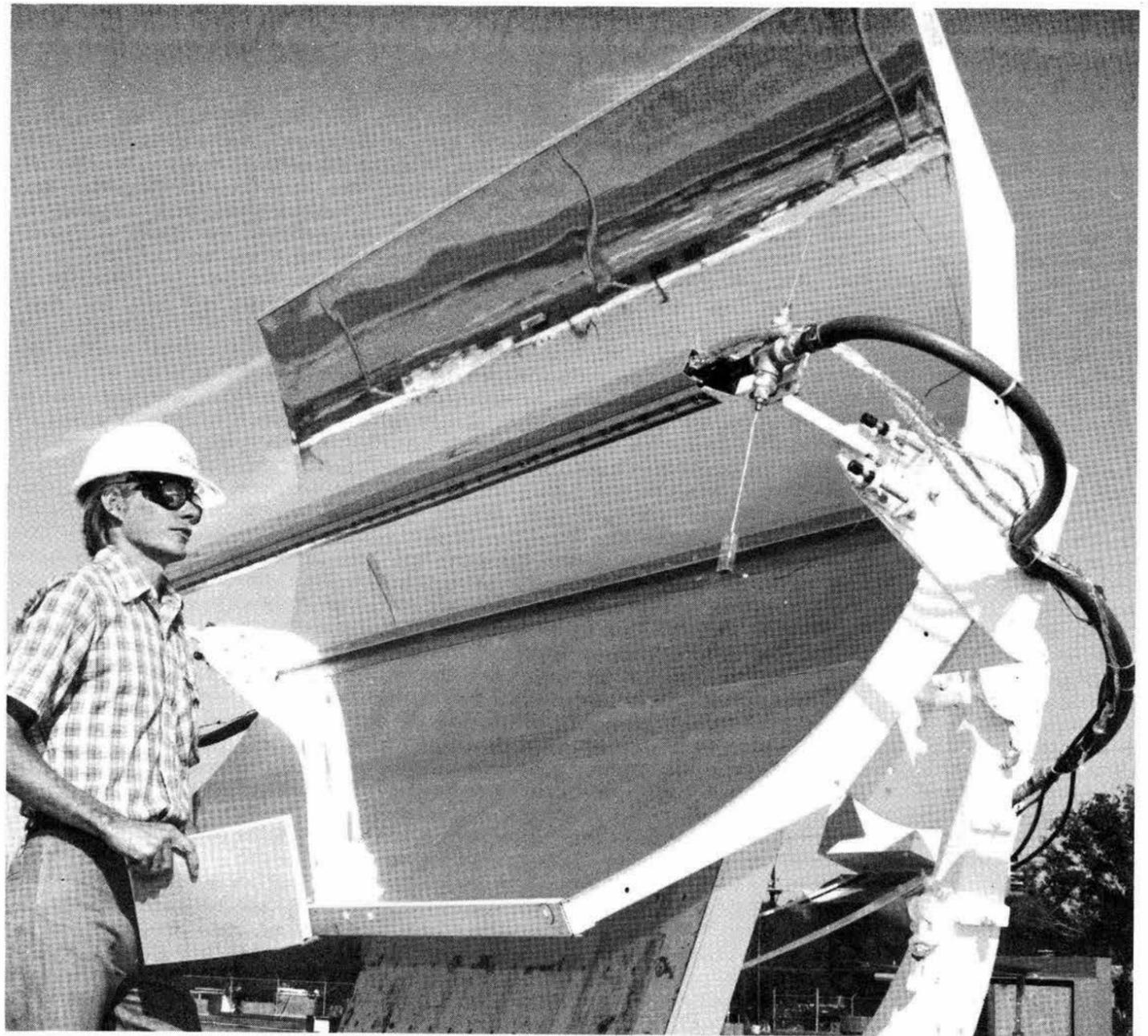
- Completed a data acquisition and reduction system for the various Area V radiation sources. The system provides eight HP9845 computer-controlled test stations for data acquisition. These eight systems are connected, through fiber optic links, to a time-shared HP1000 central computer system which provides mass data storage, reduction, and output facilities. (2530)

- Developed ultracentrifuge (20,000 rpm; 40,000 g's) test capabilities for weapon components at SNLA, SNLL, MF, GEND, BKC, and a commercial supplier. Unique capabilities include the abilities to withstand detonation of up to 9.0 gm of HE in the test package and to communicate electrically with the rotating test package through fluid cooled slip rings. (2530)

Energy

- Computer wavecode studies of polycrystalline diamond compact drag bits, used to cut rock under adverse conditions encountered in geothermal well drilling, have provided insights into rock cutting. The studies will be useful in optimizing drill bit configurations. (5530)

- The development of two reflectometers for use in measuring the specular reflectance of solar mirrors has led to standardization of measurement techniques and has greatly



IN 1980, the Photovoltaic Advanced Systems Test Facility became operational. It has capability for testing a variety of photovoltaic collectors and analyzing test data. Dan Pritchard (4721) stands near an Acurex collector under test.

aided the collection and synthesis of reflectance data for a wide variety of mirror materials and systems. One is a laboratory instrument which determines reflected intensity as a function of collection aperture size while the other is a portable unit which can be used in field installations. (5820)

- The role of storage batteries in residential photovoltaic systems has been analyzed. The study defines the conditions under which batteries are economically useful and the technical requirements for residential batteries. As a result, the study acts as a guide for our research and development program. (2520)

- A sophisticated battery evaluation laboratory, using a computer to test batteries in a simulated photovoltaic power system, has been designed and built. Various types of battery systems for possible use as energy storage systems for photovoltaic power systems are being evaluated. (2520/2530)

- Contracts are in place with NASA/Lewis Research Center and Exxon to develop advanced flow batteries for storage of energy generated by solar power systems. These batteries offer the potential for long life, low cost, and low maintenance—these attributes are required to make storage viable in most solar energy systems. (2520)

- Observations of the physical processes that occur during the combustion of water-in-fuel emulsions have been made by photographing an evaporating emulsion droplet. Circulation and coalescence of the water globules and then vapor explosion of the water, which shatters the drop, have been observed. This represents the first quantitative information concerning the physical processes involved in emulsion combustion and shows how cleaner combustion results from use of emulsions. (2510)

- Geochemical and mineralogical analysis of samples obtained by Sandia during 1978-79 drilling of Kilauea Iki Lava Lake, Hawaii, demonstrated that a residual magma zone of 35 volume percent liquid was penetrated. These data indicate a broad (4 m) transition zone between magma and the upper crust of the lava lake and provide a basis for modeling and interpretation of geophysical data. (5540)

- A wind tunnel test was run on parabolic trough solar collectors measuring wind loads and moments. This provides the only comprehensive set of wind load data for use in design of collector foundations, structures, and drive components. (5630/4720)

- WINMIL, an interactive graphics code, has been developed to calculate the aerodynamic performance of vertical axis wind turbines and gyromills. It uses vortex/lifting line models to calculate the vortices shed by each blade as it revolves into and away from the prevailing wind. Calculations of the strength and trajectory of each shed vortex continue until the vortex's effect becomes insignificant. WINMIL should be a valuable aerodynamic tool for all DOE vertical axis wind machine programs. (5630)

- An experiment was conducted to investigate the departure from nucleate boiling/hydraulic instability in support of the 10-megawatt central receiver solar pilot plant project in Barstow. In the experiment, performed by Departments 1530 and 8450 at the SNLA Radiant Heat Facility, the five-tube panel was tested at heat flux and water flow rates similar to those of the pilot plant, as well as those of proposed commercial plant levels (up to 0.6 MW/m² incident flux). The experiment provided fundamental fluid dynamics data that will improve the understanding of boiling in a one-side-heated single pass to superheat solar boiler panel. (1530)

- Diagnostic failure analysis on Stratapax cutters used in both geothermal and fossil fuel drilling has identified material weaknesses and improper cutter assembly procedures. Correction of these items has resulted in properties and performance characteristics acceptable for commercial bits now being manufactured. (5830)

- Electrodeposited black chrome solar absorbing coatings with greatly improved thermal stability were produced on a laboratory scale. The solar absorptance of standard black chrome degrades approximately 10% after a few hundred hours at 350°C. Modified bath compositions produce coatings that do not degrade after several thousand hours at 350°C, and undergo <2% change in absorptance at 400°C. A process for plating the improved black chrome commercially with only minor modifications was established. The improved coating will be widely used in line-focus collectors which operate in the 250°-350°C range. (5830)

- The capability of melting and casting metallurgical grade silicon into large ingots (~250 mm dia.) has been developed. The resulting material has a grain diameter of ~25 mm and is being evaluated as a low-cost substrate for photovoltaic solar cells. (5830)

- A method of coating low elemental mass materials which can be used in magnetically confined fusion plasma environments has been demonstrated. This is important in achieving a high plasma temperature in magnetically confined fusion reactors. (5830)

- Valve wear is often a limiting factor in coal liquefaction reactors. Chemically vapor deposited coatings of TiB₂ have been developed which can significantly extend the life of slurry valves in coal liquefaction reactors. (5830)

•Low temperature chemical vapor deposition of boride compounds has been performed using diborane (B_2H_6) as a precursor gas. These hard coatings are useful on low temperature substrates such as hardened steels. (5830)

•Laboratory research conducted over the last few years has demonstrated that gamma irradiation with Cs-137 effectively eliminates the pathogen hazard from sewage sludge. A prototype irradiation facility has been designed, constructed and operated. Technology transfer to the private sector began this year. This technology allows a method for municipalities to meet EPA regulations for sludge application as a fertilizer or soil amendment. (4530)

•The development of complex well models for major geothermal resource areas is complete. These models detail the costs that can be expected in drilling and completing geothermal wells and serve as the baseline for assessing potential cost reductions for new technologies. (4740)

•Successfully tested and evaluated a solar system at Coolidge, Ariz., which displaces electricity used to pump water for irrigation. The resulting system has high efficiency and reliability and provides guidance for improving the design of future solar systems. (4720)

•Evaluation has been conducted of parabolic trough thermal collector components including reflectors, structures, drive, controls, receiver, hose, pylons, and foundations. In particular, reflector/structures have been fabricated to required surface accuracies using automotive stamping/molding processes and glass has been formed using automotive windshield manufacturing processes. Development of this solar technology is a major milestone leading to the demonstration of parabolic trough solar thermal collectors with high performance and long life. (4720)

•A turntable on which to mount solar collectors was brought to operation status. This turntable, the largest of its kind in the world, enables maintenance of a constant sun angle on the collector to obtain stable conditions for testing at temperatures up to 425°C. (4720)

•The operational capability has been developed for testing a variety of photovoltaic collectors and analyzing the test data in the most complete facility of this type in the country. Test results and evaluations are used in developing efficient, low-cost photovoltaic power systems. (4720)

•Our electronics technology for 275°C geothermal well instrumentation has been transferred to the commercial sector. The first complete commercial circuits, manufactured by Teledyne-Philbrick, have been successful in laboratory tests and are being readied for use in geothermal wells. The importance of this step in the program is that a new, significantly different electronics technology is available to the well-logging industry. (2150)

•On the basis of laboratory experiments, a computational model has been developed to determine dynamic fracture and fragmentation of oil shale under explosive loading. Application of this computation method may significantly enhance in-situ processing of oil shale. (5530)

•Hydrogen ion bombardment has produced chemical reactions on surfaces of materials in which volatile compounds of hydrogen selectively remove unwanted elements such as carbon, silicon, etc. This technique has applications for surface cleaning or selective modification of materials for processing, e.g., carbon removal from drill bits prior to attachment by welding. (5830)

•Computer codes were developed for inferring the compositions of high-tempera-

ture gases released from erupting volcanic lavas. Identification of gas chemical trends is likely to precede eruptions of basaltic lavas, and the same codes have proven useful in predicting phase equilibria for chemical vapor deposition. (5541)

•The Labs' successful R&D program on the Darrieus vertical axis wind turbine (VAWT) has culminated in its being accepted as a technical and economical tool for generating electrical energy. DOE plans to install four 100-Kw VAWT units at various locations in the U.S. The VAWT program will be a major contribution in the widespread use of wind energy to reduce national dependence on fossil fuels as envisioned by the Wind Energy Systems Act of 1980. (4710)

•Sandia conducted the first field test of a non-oxidizing drilling fluid during drilling of a geothermal well. We found that drill pipe corrosion rates fell by a factor of ten and that no chemical additives were required when nitrogen instead of air was used. We are developing low-cost methods to generate nitrogen at the drill site, which could reduce the cost of drilling geothermal wells. Many other potential applications exist in the oil and gas drilling field. (4740)

•We provided the technical base for and developed the cavern leaching plan for the Brian Mound salt dome, a part of the Strategic Petroleum Reserve (SPR). The effort included computer simulation of cavern development with different input conditions and development of storage volume availability curves for oil procurement scheduling. In addition to providing support for the SPR, this work also has many commercial applications. (4540)

•On the basis of geomechanical analysis, we identified the need for field data from solution-mined caverns and mines used for oil storage in the Strategic Petroleum Reserve (SPR). An instrumentation system was designed, developed, and put into operation. The field data along with geomechanical analysis will allow prediction of the behavior of SPR storage media. This information will also be useful to other storage programs. (4540)

•We completed geological site characterization for four SPR sites, including geology, hydrology, salt properties, and natural hazards. These data are being used to locate, design, develop and operate solution-mined caverns for oil storage. (4540)

•Sandia completed implementation of a video/computer-based heliostat evaluation system to provide data on the alignment, pointing, and tracking characteristics of heliostats, and to measure the peak flux levels and total power in the reflected beam. The side-by-side evaluation of heliostat designs provided by two industrial firms was a key factor in the selection of the heliostat to be used in the DOE 10-MW_e pilot plant. (4710/1520)

•Sandia completed testing of a water/steam-cooled receiver which converts solar to thermal energy and produces superheated steam at outlet design conditions of 100°F and 1450 psia. The tests also demonstrated satisfactory receiver control for both clear and partly cloudy sky conditions. This receiver panel was a prototype of the design to be used to provide steam for a 10-MW_e turbine in the DOE solar pilot plant under construction near Barstow, Calif. (4710/8450)

•The use of propellants (explosives which deflagrate rather than detonate) permits tailoring of pressure pulse risetimes in a wellbore. Tests at NTS showed this creates multiple fractures as opposed to single fractures from hydraulic fracturing significantly enhancing permeability. Many oil and gas reservoirs are uneconomic because

low permeability restricts fluid flow. This tailored pulseloading should prove to be an effective means of stimulating many low permeability reservoirs. (4730)

•We developed a radioactively tagged catalyst to measure catalyst decay rates and mixing effects in a one-ton-per-day coal liquefaction process demonstration unit. We determined mechanisms of deactivation and correlated observed rates with physical/chemical changes in the catalyst. This can be a valuable diagnostic technique for monitoring catalyst aging under actual coal liquefaction conditions. Data can be used to help develop more active and age-resistant catalysts. (4730)

•In the support of the Unconventional Gas Resources Program, in-situ experiments were conducted at NTS to determine factors which control the height of massive hydraulic fractures. Sandia determined, contrary to general belief, that in-situ stresses in geologic formations and not material property differences in adjacent rock strata control behavior. Tight gas sand reservoirs of the west may contain as much as 1000 TCF of natural gas. This Sandia finding may prove a significant step forward in how massive hydraulic fractures can be controlled to unlock these resources. (4730)

•The Seafloor Earthquake Measurement System was deployed in the Santa Barbara Channel and is measuring the response of ocean sediments to earthquakes. Data from the system's accelerometers is stored in a microprocessor and recovered via acoustic telemetry. No in-situ data exists on ocean sediment responses to strong seismic disturbances, which is a major limitation in the design, location and use certification of offshore platforms for oil and gas production. (4730)

•We have developed a method to determine plasma edge temperatures in Tokamak and mirror fusion devices. This method, developed in collaboration with Princeton Plasma Physics Lab, is based on hydrogen saturation trapping behavior in carbon and silicon probes. The result of this work is the first determination of the plasma edge temperature in magnetic confinement fusion energy experiments. (5110)

•The trapping, release and exchange of hydrogen and deuterium in coating materials projected for use in Tokamak fusion devices have been studied using ion beam techniques. A theoretical model has been developed which accurately describes tritium buildup and isotopic exchange in the materials. (5110)

•An unattended wireless telemetry system has been measuring and reporting temperatures from beneath a burning coal seam in Wyoming for over 550 days. The condition of the sensors is also reported. Knowledge of temperatures within an oil shale retort or coal seam is important in controlling the energy extraction process. (1580)

•Silicon solar cells with power conversion efficiency above 20% were developed for use with concentrator systems. (2140)

•Designed and built a high pressure fuel, air and water supply and control system for a small (5,000 BTU/hr) steam generator for application to enhanced oil recovery. The steam was injected into an oil basin to successfully melt high-viscosity, heavy oil in an economical, enhanced oil recovery experiment. (2160/4730)

•Electrical characteristics of polycrystalline silicon have been improved by introduction of atomic hydrogen into grain boundaries. Theoretical models that accurately describe grain boundary electrical transport in this material have been developed. This represents a new and exciting option in the preparation of photovoltaic devices. (5130/5150)

•High-quality gallium phosphide single-crystal materials have been prepared by the techniques of liquid-phase epitaxy and metal organic chemical vapor deposition. We have developed stable diode rectifiers and bipolar transistors capable of operating at 400°C by using these techniques. These electronic devices can be used in a variety of high-temperature environments, such as geothermal and deep oil and gas well logging and in-situ coal gasification. (5150/5130)

•We have discovered a new phenomenon involving differential surface fusion during vaporization of an emulsified fuel droplet by using high-speed photography and laser backlighting. This has important implications in the future use of emulsified fuels and in combustor design, such as the down-hole steam generator for the "Deep Steam" project. (5510/2510)

•We developed a microprocessor-controlled load and data acquisition system for electrical evaluation of photovoltaic arrays of up to 1-KW output. The load operates in a closed loop feedback mode to seek the maximum output power load point. The system is capable of monitoring the maximum power available and integrating the reading to obtain the energy produced over a period of time, making the system ideal for long-term evaluations. (2530)

•A data and information system was established for the National Photovoltaic Conversion Program to collect data on solar photovoltaic systems. A data acquisition system installed at each site continuously records data and transmits it to a data reduction center. (2530)

•The third of three mobile minicomputer-based data acquisition systems has been built to support geoelectric field experiments. These systems are designed to record and display information from the large assortment of sensors used to monitor in-situ combustion recovery from similar experiments. (1120)

•The sol-gel process was used to produce multicomponent borosilicate and titanate glass films. Borosilicate films protected black chrome from oxidation and titanate films provided low-cost, anti-reflective coatings for silicon; these coatings will increase the life and efficiency of solar components. (5840)

•A computer software package, SOLTES (Simulation of Large Thermal Energy Systems), has been developed and made available to the public through the Argonne Computer Center. The code does a complete energy balance analysis and simultaneously checks for second law consistency for any user-specified configuration of an energy source/load system. The code is sufficiently versatile to model both complex and simple power systems. (5510/4720)

•A new heat transfer code has been developed to describe the natural convection of fluid near its critical point through a porous material. This code includes fully time-dependent behavior as well as compressibility effects and temperature-dependent properties. (5510)

•The Combustion Research Facility opened at Livermore in October 1980, grouping many of the ongoing combustion experiments in one area with access to powerful lasers and data acquisition equipment. This facility is open for visitors from industry, universities and other labs to conduct combustion experiments or modeling. (8350)

•Measurements of combustion processes in operating engines have been made. Such experiments may permit rapid improvement in engine design, particularly for advanced engine concepts and engines which burn alternative fuels. (8350)

- Hydrogen gas can be transported through the nation's present natural gas pipeline network if precautions are taken. Hydrogen-accelerated fatigue crack growth and sustained load cracking in weldments must be avoided by either limiting the hydrogen working pressure or by introducing inhibitors into the hydrogen gas. The costs of these precautions would be minor compared with the costs of constructing pipelines dedicated to hydrogen service. This was the culmination of a five-year feasibility study and has large implications if the "hydrogen economy" is developed. (8310)

- The first in-situ observations of the combustion of pulverized coal particles have been made. High-resolution cinematography of 50 to 100 micron bituminous coal and lignite particles revealed a new mechanism for the formation of soot agglomerates as stable intermediates during the first 100 milliseconds of reaction. These studies are developing a scientific basis for engineering techniques to control pollutant emissions. (8350)

- Hydrogen embrittlement, and its effects on materials compatibility for energy and weapons applications, is a strong function of the crystal structure of the material. Tritium autoradiography shows that the segregation of hydrogen to defects is more important in ferritic steels than in austenitic ones. (8340)

- A unique device was built which allows the observation of the interaction of the plasma (in a magnetic fusion device) and candidate first wall materials. These results are being applied to Tokamak diagnostics. (8340)

- Silver agglomeration, not corrosion, has been identified as a major contributor to solar heliostat deterioration. This determination was made using surface-enhanced Raman scattering and other laboratory techniques. (8340)

- The first data have been obtained on the surface processes that are expected to occur on materials in fusion reactors. Removal of surface hydrogen, from materials bombarded by ion beams, has been measured. (8340)

- In collaboration with industry, we have developed a general finite difference technique to solve the heat transfer problem of a wellbore coupled to a geological formation. The resulting GEOTEMP code is general enough for use by industry, and sophisticated enough for research needs. (5510)

- Two new computer codes were developed for use in the Strategic Petroleum Reserve Program (SPR). The first predicts the cavern leaching rate and shape, while the second predicts the temperature response of the salt dome and the fluid included in the cavern. The influence of several field/withdrawal cycles on cavern shape and volume can now be assessed and the influence of temperature on cavern pressure response and creep closure can be evaluated. (5510)

- For uranium borehole logging we developed two methods, the first using a pulsed neutron generator with prompt fission neutrons, the second using gamma ray spectroanalysis to obtain an elemental assay. The former method may also be applied to monitoring of fissile wastes. Both methods will aid in uranium exploration. (2350)

- A comparative assessment of five potential sites for drilling into hydrothermal-magma systems has been completed for the Thermal Regimes part of the Continental Scientific Drilling Program. Sandia coordinated and participated in this joint laboratory (LBL, Los Alamos, LLNL, SNL) program and prepared the overall summary. (5540/4730)

- Fragments of magmatic material which had not degassed during eruption have been found in products of volcanic explosions,

permitting direct determination of volatile contents of magmas involved in these events. The first measurement of volatile contents in explosive silicic eruptions have been made. Results are applicable to eruption prediction and hazards assessment, and feasibility of extraction of energy from magma. (5540)

- Preliminary solubility measurements of UO_2 and ZrO_2 in molten rock materials (e.g., granite and basalt) for the reactor safety program are complete. These experimental measurements are necessary so that the NRC may properly evaluate sacrificial barriers placed on the floor of a nuclear reactor. (5540)

- Mathematical analysis of a fire-spread network will indicate various collections of barriers and areas which, protected from fire, would assure protection of a facility's critical locations from destruction by a single-source fire. The less expensive collections suggest economical fire protection schemes. Potential application is mathematical analysis of nuclear power plant fire protection. (5640)

Research/ Sciences

- Use of a new backscattering electron detector on the scanning electron microscope greatly enhanced microstructural features. It has enabled direct correlation of glass ceramic fracture surface features with the underlying microstructure. The results show that the standard method of characterizing fracture toughness of ceramics must be modified for cases where flaw size is small with respect to grain size. (5820)

- Generation of a phase diagram system for chemical deposition processes has been achieved using advanced multiphase thermodynamic calculations. The technique is a major advance in the thermodynamic treatment of CVD processes and will allow prediction of reaction products. (5830)

- We have demonstrated that the fracture mode of a brittle material is dependent on the chemical environment, principally the availability of hydrogen. The importance of hydrogen in the fracture of brittle materials may necessitate the reassessment of brittle fracture theories and experimental techniques. (5830)

- Experiments and theoretical modeling have started for describing the formation of adiabatic shear bands. These bands of intense local plastic deformation can substantially influence the way in which weapon components fail. The experimental program utilizes shock loading, expanding ring, and Hopkinson bar tests to quantify regions of response where shear banding occurs. These results are correlated with theoretical analyses to develop material constitutive relations which can be incorporated into computer codes for simulating weapons response. (5530/5510)

- A different way of representing numbers was devised that makes it possible to compute arithmetic functions in parallel—in other words, each "digit position" of the result is calculated as a function of only the "digits" in nearly the same position in the arguments. A bit slice microprocessor, designed to work in this number system, is 10 to 30 times faster than the conventional system. (5640)

- Advanced models of dynamic material behavior under general loading conditions are necessary for two-dimensional computer simulations which are used to predict the response of weapons components. Experimental impact techniques have been developed for producing and measuring pressure-shear states. A current application involves study of alumina-filled epoxy which

is used as an encapsulant in ferroelectric power supplied. (5530)

- We developed a new method of measuring the sputter yields for binary alloys which exhibit surface segregation. The time dependence of the ion yield of each species is monitored during sputtering of a segregated surface and the sputter yield calculated from the change in ion yield as a function of time. This provides the capability to rapidly determine sputter yields of both species in a binary alloy. (5820)

- A recirculating-flow catalytic reactor has been constructed and coupled to a Fourier transform infrared spectrometer. The reactor is capable of handling a variety of reactants at pressures up to two atmospheres and temperatures up to 550K. This reactor is being used in the study of catalyst surfaces during actual reaction conditions. Using the newly constructed system, we can examine catalyst surfaces on a molecular level while simultaneously measuring catalytic reaction rates. Since this is accomplished with commercial catalysts under real reaction conditions, basic catalytic reaction mechanisms can be determined. (5820)

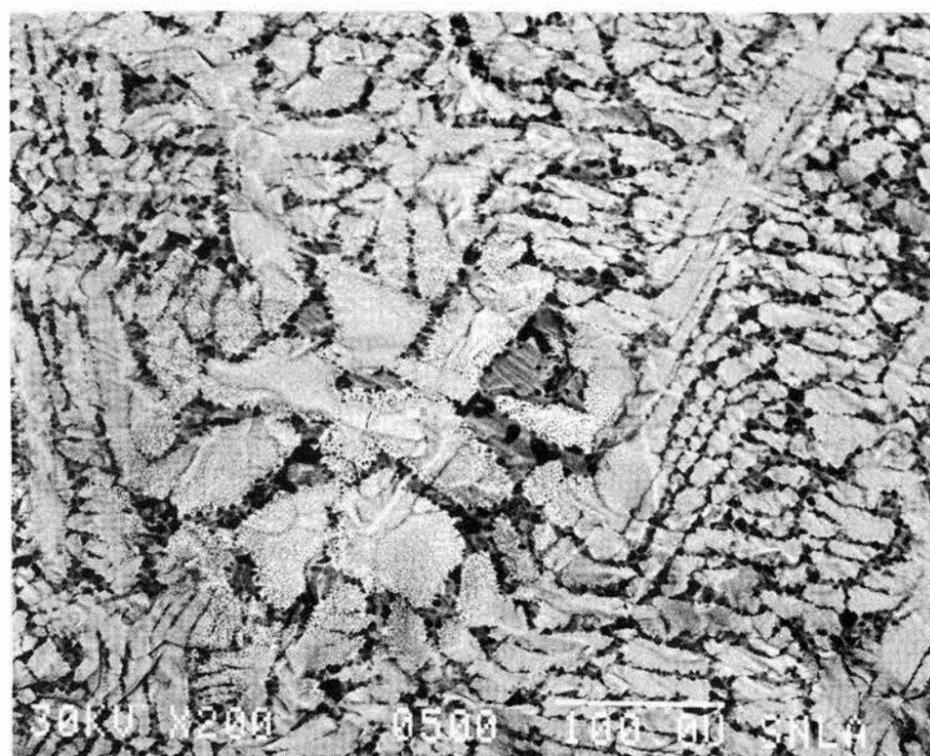
- We applied Auger Lineshape Analysis to the study of the surfaces of polyethylene and poly(ethylene oxide). The study showed that

polymer spectra can be analyzed in terms of spectra from analogous gas phase molecular systems. Auger Lineshape Analysis is a useful technique for studying metal-polymer interactions during the formation of metal-polymer adhesive bonds. (5810)

- A capability to model inelastic response of the earth following earthquakes and volcanic eruptions has been developed. The modeling simulates dynamic processes occurring in the earth which are observable by measurements made of the state of crustal deformation. Modeling and analysis of earthquake-induced effects will allow understanding of earth response and mitigation of earthquake and volcanic risk to structures, nuclear waste repositories, etc. (5540)

- We developed a thin foil thermocouple temperature measurement capability for solids under shock compression and made the first successful measurement of in-situ temperature rise in a high explosive. This technique allows temperature measurements in shock wave experiments and is very important for the development of complete equations of state of materials and for the proper interpretation of shock-induced phenomena. (5130)

- Amorphous metal layers have been formed on iron surfaces by implantation



USING a new backscattering electron detector, Sandia scientists in Dept. 5820 have been able to make a direct correlation of glass ceramic fracture surface features (top) with the underlying microstructure.

with titanium ions. The amorphous phase is stabilized by the presence of carbon impurities, and is found to have improved corrosion resistance. (5110)

• We have discovered that ion implantation can be used to increase (by almost a factor of 10,000) the photosensitivity of lead-lanthanum-zirconate-titanate (PLZT) photoferroelectric image storage and display devices. We have developed a theoretical model for quantitative evaluation of the ion-implantation-induced photosensitivity enhancement. This development makes possible electrically alterable nonvolatile optical image storage and processing with greater sensitivity than existing technology. (5130/5110)

• In covalent systems we have discovered a new type of electronic excitation in which the energy is localized for a time sufficient for bond breaking to occur. A predictive theoretical understanding of the phenomenon has been developed. This phenomenon relates to the understanding of electronically induced radiation-damage, desorption and surface chemical reactions. (5150/5110/5810)

• The growth of high quality, single alpha-quartz crystals directly from a fused silica nutrient has been demonstrated for the first time. This capability is unique to Sandia and is important because it reduces U.S. dependence on foreign sources of natural quartz crystals. (5150)

• We discovered the phenomenon of photon-stimulated desorption (PSD) of ions from surfaces and applied it to the study of chemical reactions and physical and chemical properties of metals, semiconductors and oxides. This phenomenon is particularly sensitive to studies of hydrogen adsorption on surfaces. PSD studies promise to provide new insight into surface properties such as site and adsorbate-specific information on the electronic and structural nature of surfaces important to catalysis, corrosion, and adhesion. (5110)

• Three expendable, airdropped thermal probes, assembled from scrounged components and plumbing shop parts, were dropped from a helicopter into the ash flow and central dome at Mt. St. Helens. A capability for obtaining low cost, remotely reporting, thermal measurements in a hazardous environment was successfully demonstrated. (1580)

• The first experiments using spontaneous Raman scattering for the in-situ study of surface oxides at elevated temperatures are completed. This method is being applied to laboratory studies of high temperature oxidation and corrosion. (8340)

• A new Special Materials and Special Handling Laboratory is now operational in Livermore. Studies are carried out on materials without exposing them to air. Toxic, pyrophoric or fine-powdered materials are worked within this facility. (8310)

• We installed two Sandia-designed advanced laser systems in the Combustion Research Facility in Livermore. The frequency-doubled neodymium laser has a 1-joule-per-pulse, 1-microsecond-pulse-width output at 3 pps and the dye laser has a 5-joule-per-pulse, 1-microsecond-pulse-width output at 10 pps. These laser systems will be used to make time- and space-resolved Raman measurements of gas temperature and density in combusting media. (4210)

• The Primary Standards Laboratory has established a calibration facility for liquid flow measurements covering the range from .1 gal/minute to 170 gal/minute with an accuracy of $\pm 1\%$ which will find application in solar energy programs; it now uses a satellite clock to determine absolute time to accuracies better than 100 microseconds;



UNDER the Labs' pulsed energy program, construction was high-current, radial-pulse line, linear accelerator in this completed and initial operations started with the first country. (4250)

and has extended force measurements to 100,000 lbf. with an accuracy of $\pm .0125\%$. (2250)

• We developed a chemical system that is 100% efficient in producing excited oxygen molecules, which, by energy transfer, will be used to excite an atomic iodine laser. This system is inherently simpler and more efficient than any electrically pumped fusion laser, and is an outstanding candidate as the driver for a laser-fusion power plant of the future. (4210)

• We demonstrated that resonance multi-

• Construction was completed and initial operation of the first high-current, radial-pulse line, linear accelerator in this country was achieved. A 26-thousand-ampere, two-million-volt electron beam was generated and post accelerated through four cavities achieving a final beam energy of 10 million volts without detectable loss of current. This sets the stage for making very-high-current, relatively small linear accelerators that can operate at any desired voltage level with short pulse durations. (4250)

• First successful full-power experimental firing of PBFA accelerator was achieved on June 28, 1980. Achievement of design electrical parameters (1 MJ, 30 TW) was made on Nov. 7, 1980. The facility is now operational. (4250)

• We completed experiments with Phoenix II, a 2000-J, hydrogen-fluoride laser system. This was the first large-scale demonstration of a high-power system amplification of a train of laser pulses without temporal distortion. Each pulse was approximately 20 billionths of a second in duration. The short-pulse amplification scheme demonstrated here is crucial for efficient operation of high-gain lasers for laser fusion research. (4210)

• Ion beam transport in an electrical discharge which is initiated by a laser is the

photon ionization is a powerful diagnostic tool for trace detection of atoms and molecules with no chemical separation. We applied it for the first time to the study of rotational relaxation of molecules. We accomplished (1) trace detection of molecules at low concentration levels that previously were virtually impossible; (2) devised a new method for the study of rotational relaxation in ground and excited electronic levels; and (3) demonstrated an ionization source for mass spectrometers that will allow isomer identification. (4210)

Pulsed Energy

means by which intense beams of ions will be transported to thermonuclear targets in fusion reactors. We are testing this concept with a single-beam transport experiment on the Hydra accelerator in Area V. Using a CO₂ laser to initiate a discharge channel in ammonia gas, we can transport most of our beam over a one-metre distance. (4240)

• After several years of intensive effort, ion source intensities have reached one trillion watts per square centimeter. Using these powerful beams, it has been possible to study the first ion-induced ablative implosions. The data, recorded using a holographic technique, show that highly uniform implosions can be produced. Intense light ion beams are believed by Sandia scientists to offer the best chance to prove the principles of inertial confinement fusion. (4240)

• Two recently developed techniques, magnetic insulation and magnetic flashover inhibition, have made it possible to build high-power, low-impedance machines which are capable of delivering the high currents (~ 5 MA) and short pulses (< 50 ns) necessary to magnetically implode foils at interesting energy levels. With possible applications to inertial confinement fusion, these techniques are especially attractive because of their simplicity and efficiency. Experiments at the 200 kilojoule level will be

• In the technology of chemical vapor deposition, two developments are noteworthy. A sophisticated computer model of the chemical vapor deposition of silicon metal, important in fabricating integrated circuits and solar cells, has been developed. The code has potential use as a design tool for CVD cells. In addition, a linear chemical vapor deposition cell suitable for molecular species monitoring with a laser has been developed. Potential results include improved microelectronic circuits. (4210)

conducted in the immediate future. These tests will provide the data base necessary to field breakeven experiments on PBFA-I and PBFA-II. (4230)

• We demonstrated subnanosecond jitter of high-current, one-half megavolt switches using an intense laser beam to command trigger the breakdown of a gas-dielectric spark-gap switch. Laser triggering of multi-megavolt gas switches may provide the best way to obtain subnanosecond triggering of parallel gas switches in large pulse power systems, such as PBFA. (4210)

• We have demonstrated the Metglas 2605SC could be used as a saturable inductor switch to achieve significant pulse compression at the 100-kV, 50-nanosecond level. This technique may provide a replacement for spark gaps in certain situations. Future experiments will test power and repetition rate characteristics. (4250)

• We have completed our first series of tests of an explosively activated opening switch which diverts large current pulses into an electrical load on a submicrosecond time scale. Results from a small-scale device have been encouraging and scaling test results predict that the switch will operate even faster at a larger scale. Successful operation of a very fast opening switch would allow us

to use inductive energy storage devices, such as magnetic flux compression generators, for a whole new generation of experiments at very high energy levels. (4250)

•We completed installation of a closed cryogenic system at the Electroexplosive Facility (Bldg. 9990) and can thus continue development of a new pulse generator which combines explosive fuel with large superconducting magnets. The objective is relatively convenient and inexpensive access to high-power electric pulses of unprecedented energy. This is a relatively inexpensive and convenient pulse power source for pulsed fusion, electromagnetic launching, or directed energy weapons. (4220)

Nuclear Fuel Cycle

[Note: Org. 4400 projects listed are NRC reimbursed.]

•The single-drop steam explosion experiment uses a CO₂ laser to prepare single drops of molten oxides at very high temperatures for release into water. Shortly after injection, a vigorous explosion can occur if triggered with a small underwater pressure pulse. The data obtained is used (a) for theoretical modeling of the steam explosion process, and (b) for quickly and cheaply extending the scope of field scale steam explosion experiments. (5830)

•The Instrumentation and Electrical Equipment Survivability Group (IEPG) final report was completed. This group provided planning guidance for the recovery of instruments from the Three Mile Island, unit 2 nuclear reactor. As a result of this work, it was possible to focus the efforts of the TMI reentry and recovery teams on those instruments which had a high probability of providing significant information on the consequences of exposure to the environment resulting from the TMI/2 accident. (2350)

•A high-output, transportable neutron generator has been developed to measure mass flow velocities in reactor safety tests using the Pulsed Neutron Activation (PNA) technique. The PNA generator produces $>10^{10}$ 14 MeV D-T neutrons in a 1.2 ms pulse, and its output, flexibility, and constructibility are unsurpassed by any commercially available unit. The PNA generator is a critical component of reactor coolant flow measurements using the PNA technique, and has been crucial to the measurement of reactor coolant velocities <1 m/s and of flow velocities in coal gasification plants. (2350)

•Code Comparison Tests: Two tests of the interaction of about 200 kg of molten stainless steel with concrete were run. The purpose was to provide realistic data on melt/concrete interactions that could be compared to predictions from computer models developed at Sandia and at other institutions throughout the world. As these codes and tests are compared, an accurate picture of base mat penetration during a meltdown accident at a nuclear power plant will develop. This is part of Sandia's effort to better understand severe accidents at nuclear power plants and the risk these accidents could pose to the general public. The tests also reveal ways to reduce the risks. (4420)

•A unique diagnostic tool for use in reactor safety experiments has been developed to record the motion of reactor fuel under simulated accident conditions. This device uses a coded aperture imaging system (CAIS) to provide high spatial and time



WHAT HAPPENS when molten sodium is spilled on tests simulating molten sodium spills were run with concrete is a reactor accident scenario under investigation in Advanced Reactor Research Dept. 4420. In 1980, several concrete containers like this.

resolution of fuel motion inside opaque containment. Understanding fuel motion during an accident is a first priority in assessing the safety of advanced reactor systems. The CAIS is the state-of-the-art tool in providing this information for reactor safety analysis. (4420)

•We have conducted nuclear fuel disruption experiments under loss-of-coolant flow (LOF) conditions as simulated in the Sandia ACRR. The knowledge gained has led to fuel response predictive model verification and development. For licensing of liquid metal fast breeder reactors, data to be gained on the sodium coolant LOF hypothetical accident sequence are especially needed. (4420)

•A high-temperature sensor has been developed and tested in Sandia's ACRR reactor for the accurate measurement of temperatures to 5150° F and to measure temperature gradients with a single sensor. Understanding of events leading up to and following a core meltdown accident at a nuclear power plant requires that there be high-quality temperature data. The ultrasonic thermometer provides this data in situations where conventional devices would fail. (4420)

•As part of Sandia's post-accident heat removal experiment program, a model has been developed to predict the heat removal capability of a post-accident rubblized core of a nuclear power plant. The model can determine whether a rubblized core can be cooled or whether it will heat up and melt down. If it melts, the reactor containment may be threatened and radioactivity may escape into the environment. (4420)

•Several tests involving pouring about 400 lbs. of molten sodium at about 1100°F onto concretes of various types have been run. The tests illustrate the nature of an accident at a liquid metal fast breeder reactor involving a sodium spill. The tests have attracted world-wide attention because they reveal all the phenomena that would take place in a real accident. Among these

phenomena is the transition of the interaction to a highly energetic state that was first discovered at Sandia. Modern concepts for nuclear reactors involve using liquid sodium as the coolant rather than water as in conventional reactors. The above tests were run to determine what hazards might arise in liquid metal cooled reactors should the liquid metal spill onto concrete in the reactor. (4420)

•A series of advanced reactor safety tests have been completed in the Sandia ACRR under the joint sponsorship of the USNRC and the United Kingdom AEA. These tests provided unique high-speed photographic records of reactor fuel failure under simulated accident conditions. A detailed understanding of fuel failure under realistic conditions is essential to the estimation of the potential severity of an advanced reactor accident. These international tests have provided the first definitive data for developing the necessary understanding of fuel failure. (4420)

•The first experiment of a unique series of reactor safety tests has been successfully performed in the Sandia ACRR. These tests used fission heating to create extremely high temperature melts for safety-related dynamic heat transfer measurements. The techniques developed significantly extend current capabilities for measurements in relevant safety responses. Realistic simulation of the thermal and fluid behavior of molten fuel is a key aspect of estimating accidents, particularly for state-of-the-art core designs. (4420)

•Completed Phase I of the Liquid Metal Fast Breeder Reactor Accident Delineation Study—the first dealing with hypothetical accidents that could occur in a breeder reactor and the possible consequences. The material assembled during the first phase provides the basis for further work leading to a risk assessment of breeder reactors and the establishment of design criteria. (4420)

•Large-scale tests of the interaction of about 50 lbs. of molten UO₂ at 5100°F with liquid sodium at about 100°F have been

run, which show that the molten UO₂ is quenched and shattered into small fragments. These tests realistically simulated reactor accident situations and have been about an order of magnitude larger than previous tests. If molten reactor fuel (mainly UO₂) can be quenched and fragmented such accidents will be stopped and not pose a major risk to the public. (4420)

•A comparison of the fragmentation of nuclear reactor fuel exposed to an in-pile neutron pulse and to out-of-pile electrical pulses has been completed. The comparison of these results has been a major addition to the information available on processes that could occur in a severe accident. Studies of this disassembly process are essential to the understanding of hazards associated with accidents at nuclear reactors. (4420)

•A furnace facility for heating and melting up to one-half ton of UO₂ at temperatures to 5100°F has been constructed at Sandia. This is one of the largest ultra-high temperature experimental installations in the world. It is recognized as the only place in the world where realistic experiments on severe reactor accident processes can be performed. The Large Scale Melt Facility will be used to test various schemes to protect the public should a nuclear reactor experience a severe accident that results in meltdown of the reactor core. (4420)

•Two major tests were performed on the material interactions of nuclear reactor core debris as the materials approach melt. One was with a potential "core catcher" material; the other was with fragmented and mixed core materials (uranium and steel). Results will aid in the design of meltdown retention devices which may help to prevent radioactivity dispersal after a meltdown in a nuclear power plant. (4420)

•A multinational program to study the coolability of damaged nuclear power reactor cores was initiated in 1980, and involves experimental techniques developed by Sandia. The program will permit a systematic development of a technology base for use in assessing the adequacy of

containment of damaged reactor cores, and in supporting the design of future reactor containment systems. (4420)

- We have been conducting an extensive long-term accelerated radiation aging program on numerous commercially formulated cable insulation and jacketing materials and have proved the existence of dose rate effects in every material studied. These results have important implications for the qualification of flexible materials for nuclear power plant safety applications since they indicate that dose rate effects must be considered before extrapolating high dose rate accelerated simulations to low dose rate ambient conditions. (5810)

- We have completed construction of a facility, developed a unique experimental method, and completed the first series of intermediate scale steam explosion experiments. The main objectives of this NRC-sponsored work is to quantify the mechanical-to-thermal energy conversion ratios as a function of fuel-coolant parameters and to provide data related to the physics of fuel-coolant interactions. Data from the experiments are being used to construct mathematical models used to predict the consequences of steam explosions due to a core melt accident in an LWR. (2510)

- The Reactor Safety Study consequence model was modified and applied to provide technical guidance for major NRC policy-making decisions, including the use of potassium iodide as an emergency protective measure for reactor accidents and the establishment of new reactor siting criteria. An international comparison study of reactor accident consequence models was initiated. (4410)

- Analysis of the environmental impact of radioactive material transport in densely populated urban areas was performed. In addition to radiological impacts, social impacts of radioactive material transport were investigated as were other non-radiological impacts. This analysis provides the technical basis for the Nuclear Regulatory Commission policy on transportation of radioactive materials. (4410)

- Risk assessments were completed for four operational nuclear power plants in the Reactor Safety Study Methodology Applications Program. These studies provided engineering insights regarding the effects of design features of nuclear plants on public risk. (4410)

- We developed a technique for simulating the migration of trace constituents within a convecting medium. This technique does not suffer from the numerical restriction (i.e., limitations on the space and time steps) that standard finite-difference, finite-element schemes do. Furthermore, it does not have the difficulty that other direct-simulation approaches have in treating radioactive decay chains in which the different species have differing retardations. (4410)

- An investigation of electrical insulators in a reactor accident environment has identified connection boards or "terminal blocks" as the weakest links of the electrical system in a reactor containment. Deterioration and breakdown statistics for a wide variety of accident situations have been established. (2160)

- The ability to maintain a high-density water fog inside a nuclear reactor containment building to prevent over-pressurization following a hydrogen fire has been shown to be highly dependent upon droplet/droplet interactions. Modeling results show that if all droplet collisions result in coalescence it is impractical to attempt to maintain a water fog of sufficient density to cool the combustion products enough to prevent overpressurizing the reactor containment. (5510)

- A new theory of heat transfer due to natural convection in horizontal annuli was developed and tested. A typical application involves nuclear spent-fuel shipping casks. The theory has full predictive and correlative capability for arbitrary, irregular annular geometries and boundary conditions. This theory will reduce or eliminate the need for extensive experimentation for heat transfer rates. (5510)

- Assisted in the development of an NRC document, "Fixed Site Physical Protection Upgrade Rule Guidance Compendium." This publication was designed to aid fuel cycle licensees in the development and submittal of security plans in compliance with the new upgrade rule requirements. (4410)

- The first instrument (a radiation detector) removed from the Three Mile Island containment building has been evaluated. Failure modes and estimated total radiation dose and dose rate history for this location in the building were determined. (4440/2340)

- Determined for the first time that adequate simulation of radiation effects in reactor safety components can be achieved using laboratory sources. This evaluation is based on computer models and known failure mechanisms of certain materials. (4440)

- Developed a design and implementation plan for the NRC Nuclear Data Link. This computer-controlled system would significantly upgrade NRC emergency response capabilities by automatically transmitting data from nuclear power plant sensors to the NRC Operations Center in Bethesda, Md. The NDLink allows the NRC to monitor and assess plant safety status during an emergency and provide assistance to licensees. (4440)

- Tested known defective terminal blocks under severe reactor accident conditions to determine failure and failure-propagation modes. Thousands of such terminal blocks are used in nuclear power plants. Our tests indicated they would still function even if certain structural defects were present. (4440)

- The aging of important safety systems in nuclear plants may affect their ability to function during a reactor accident. We conducted numerous experiments to determine the aging characteristics of elastomeric materials used in nuclear power plants. Significant dose-rate effects and combined radiation-thermal synergistic effects were found for many materials. (4440/5810)

- Completed evaluation of the performance of electrical terminal blocks when subjected to reactor accident environments characterized by steam, heat, and contamination. Estimated the number of failures expected due to voltage breakdown during accidents. (4440/2160)

- Completed construction of a facility to conduct tests in environments postulated for light water reactor accidents. The tests are being run to determine if reactor safety equipment will function properly. (4440)

- Sandia's fire research facility was completed in 1980, and a series of tests have been run to assess the effectiveness of Halon-1301 as a fire-suppression system in extinguishing deep-seated cable tray fires. (4440)

- Completed four full-scale experiments to study the effects of the impact of a large fragment of a power generation turbine hub section into a wall section typical of a nuclear reactor containment building. Ultimately, these experiments will help ensure safety in nuclear power plants. (4440)

- As a result of the TMI accident, hydrogen generation has been recognized as a potential threat to reactor safety. Following research, we have published a

document in which the behavior of hydrogen during hypothetical LWR accidents is characterized. This research has begun to quantify the threat from hydrogen. (4440)

- We have begun evaluation of data from a facility that simulates the behavior of emergency sumps in light water reactors during hypothetical accidents. After an accident in an LWR, the sump and associated plumbing must provide long-term cooling to the reactor. The capability and adequacy of existing sump systems is being evaluated. (4440)

- Progress has been made in understanding the behavior of steam explosions during hypothetical reactor melt-down accidents. Small- and large-scale experiments and theoretical analysis have been combined to study the possibility of reactor containment failure due to such explosions. Results of this study will be used to assess the risk to the public of severe reactor accidents. (4440)

- A study of the vapor phase transport of fission fragments has produced data which are being used to explain the low level of radio-iodine released in the Three Mile Island reactor accident. That low release rate may lead to substantial changes in safety considerations for nuclear reactors. (5840)

- Operational status of the Glove Box Laboratory (GBL) was achieved in 1980. The GBL has been under construction for approximately two years and is unique in that a high purity argon atmosphere is maintained during work with radioactive materials. (4450)

- Completed development, installation, and checkout of a test system that simulates effects of a loss of coolant accident. Purpose is to develop test methods for qualification of power reactor safety equipment. The system produces simultaneous environments of saturated or superheated steam, chemical spray, programmed temperature, programmed pressures, and gamma radiation levels up to four megarads per hour. (2530/4550)

- The OECD/NEA working group on seabed disposal of nuclear wastes has grown under Sandia leadership to include eight member nations. Total level of effort in seabed disposal research of other member nations now matches that of the United States. (4530)

- After two years of preliminary laboratory testing and physical modeling, extensive field testing has begun to determine the suitability of welded tuff at the Nevada Test Site as a medium for geologic isolation of high-level nuclear wastes. (4530)

- Continuation of a laboratory test program has led to development of a thermo-mechanical model for the response of rock salt. This model, used in computer analysis of the consequences of excavating underground structures, describes the long-term deformation of salt under compressive loads. (5530)

- The Bell Canyon borehole plugging test provided an in-situ evaluation of special grouts used to seal penetrations into nuclear waste repositories. A two-metre-long plug, emplaced in a borehole at a depth of 4400 feet, was subjected to 1800-psi pressure from a natural aquifer. Tracers were released at intervals and permeability of the plug system was determined. (4510)

- The Final Environmental Impact Statement for WIPP was released by DOE. Sandia was the primary agency responsible for this effort. The conclusions show no unacceptable impacts of a radiological nature. The most severe unavoidable impacts are those deriving from any large construction effort of this type. (4510)

- As part of an extensive program to characterize the WIPP site, a typical "breccia pipe" was cored from top to bottom. This feature, generally believed to originate with salt dissolution at depth, was found to have its origin below the salt in carbonate beds. (4510)

- Planning, research and development plus preparation of documentation was started for the DOE/ALO program for remedial action at the nation's inactive uranium mill tailing sites. The remedial action will minimize health hazards to people living near the sites. (4540)

- A course, "The Practice and Process of Auditing," was developed and presented to 53 Quality Assurance auditors of waste management projects, both nuclear and non-nuclear. Teams are being selected for both internal (SNL) and external contractor audits as part of federal quality assurance regulations. (1410)

- A polymer concrete formulation developed at Brookhaven National Laboratories has been selected as the castable filler material for the heat source implantation rod in the in-situ heat transfer experiment. This material was shown to maintain a high compressive strength and not undergo significant corrosion even after long-term exposures to 300°C seawater, making it an excellent candidate for many geothermal applications. (5840)

- The use of tuff as a geological barrier for nuclear waste disposal has required a clearer understanding of the thermally-driven fluid flow in tight rocks. For extremely small pore size, a new model was needed to account for Knudsen diffusion and capillary effects, as they dominate the flow. Such a model has been developed and proven to give very good results for water migration and loss in a heater test conducted at NTS. (5510)

- As part of the NTS Nuclear Waste Disposal Program, a study of the effects of joint spacing, orientation, and width on thermo-hydrological flow in tuffs is underway. To account for these effects, a probabilistic model has been incorporated in existing finite element, heat transfer codes, COYOTE and MARIAH. Studies of the effect of joint orientation on draw-down into mine drifts has demonstrated the significance of including the jointing in subsequent mine design studies. (5510/5520)

Components

- We completed development and production of ceramic varistor materials for W79 lightning arrestor connectors (MC3550 LAC). The MC3550 LAC has reproducible electrical breakdown characteristics and will serve as a model design for future LAC components. (2520)

- Increased production yields on high-current ferroelectric power supplies for neutron generators vary from 30-40% to 70%. The yield was raised by developing ceramic processing techniques which control grain size and increase mechanical strength. Low yields were jeopardizing weapon production schedules, increasing costs, and causing vendor dissatisfaction. (2520)

- The MC2949A explosive actuator is a hot-wire-initiated device that successfully incorporates a significantly increased pressure capacity, electrostatic discharge safety, and a no-orientation connector. The increased pressure capacity and the no-orientation connector resulted from fabrication of the actuator's header from a high-strength glass ceramic and a matching stainless steel. The result is a compact, large-output actuator with improved safety

that has widespread application in the W79, B83, and W84 systems. (2510)

- Testing of lithium-sulfur dioxide cells revealed they were not capable of the needed continuous operation for five years. Specific causes for premature failures have been identified and corrected. Designs modified by SNLA are now available from two commercial suppliers for programs requiring five years' continuous service. Potential applications in weapons (e.g., CMCS), safeguards/surveillance, telemetry, energy (e.g., seismic sensors). (2520)

- We achieved the first development and production of a lightning arrestor connector (LAC) utilizing a varistor stimulated arc mechanism. The varistor LAC is an important improvement upon the existing dielectric stimulated-arc LAC. The V-LAC has lower breakdown voltage, much tighter distribution without a high voltage tail, and is trouble free in manufacture. (2150)

- A neutron tube capable of generating 10^{10} 14 MeV neutrons in a 1.2 ms pulse has been developed. A unique feature of the design is its complete demountability, permitting easy replacement or modification of critical components. The ultimate operational lifetime is expected to be in excess of 3000 operations. The tube represents a significant improvement over other neutron tubes because of its reparability and ease of fabrication. (2350)

- Development is complete and production started on thermal flashblindness protective goggles for the Strategic Air Command (SAC). The devices use electrooptic ceramic titanate). Deployment of these devices with SAC is underway. (2520)

- Evaluation of tunable-diode laser infrared spectroscopy is complete for the measurement of gas concentrations in samples at atmospheric pressure. A potential application of the instrument is determining decomposition rates of small samples of explosive materials by measurement of their evolution of simple gases (CO, CO₂, N₂O, NO). (2510)

- Time histories of the pressure pulse generated by underground nuclear tests were measured by parachuted instruments deployed from an aircraft. These histories were compared with histories calculated from observed ground motion, and excellent agreement was obtained. The measurement system is being considered for large HE tests. (1110)

- Construction is complete and operation checkout has started on the Large Melt Facility. It will provide several hundred kilograms of superheated (temperatures to 2750°C) melts of oxide fuel materials for use in material interaction studies related to reactor safety programs. (1530)

- Gamma-ray spectra were obtained from specific celestial sources and digitized by an 8192 channel, balloon-borne telescope 140,000 feet over Palestine, Texas. (1580)

- Continuous measurement of the recession of nose tips and ablation of heatshields on experimental reentry vehicles has been achieved with cadmium telluride crystals detecting gamma ray backscatter from the outside surfaces. (1580)

- Techniques, processes and equipment were developed to centrifugally cast glass ceramic materials into intricate cylindrical shapes. (1470)

Microelectronics

- Performed LSI (large-scale integrated circuit) testing in support of Sandia-fabricated radiation-hardened ICs. For some 70 circuit types, a total of 12,000 silicon slices with approximately 750,000 IC chips, plus an additional 200,000 packaged ICs, have been evaluated in the LSI tester facility. This activity is in direct support of the CRM. (2110)

- An agreement has been signed with Intel to allow Sandia to design and build radiation-hardened CMOS versions of a three-chip 8085 microprocessor family. These ICs will use latest silicon gate CMOS technology and provide new satellite and weapon electronic systems with a powerful microprocessor system. (2110)

- Considerable progress has been made toward providing a complete computer-aided design capability (including simulation, layout, testability analysis, design verification, and documentation) through a single uniform designer interface. (2100)

- Programs have been developed to place and interconnect subcircuits of large scale and very large scale integrated circuits. The programs lay out circuits which approach the efficiency of manual designs. (2110)

- A three-dimensional indexed-sequential file structure has been developed which is used as a generalized data base for computer-aided design of large-scale integrated circuits. All computer codes for CAD will interface through a common data structure. (2110)

- A new Lorlin automated test system which has the capability of testing all discrete semiconductor devices is now operational. This test system adds to Dept. 2110's ability to test large quantities of any type of semiconductor in an automated, data taking mode. (2110)

- Sandia's Semiconductor Device Lab supported a wide range of weapon and space programs by delivering several thousand integrated circuits for development and WR use in high reliability systems. (2140)

- The first microprocessor-based telemetry system was flown at Tonopah on a B83 drop test. This microprocessor system has an inherent flexibility permitting it to be used in various programs with only software changes. This capability offers significant savings in development efforts and production costs. The telemetry electronics include two custom gate LSI chips designed and fabricated at Sandia. (8450)

Quality Assurance

- A comprehensive, unified theory of managing environmental, safety and health programs which provides cost-effective, "systematic assurance of safety" (a vital need identified by the President's Commission on the Accident at TMI) has been completed. This new approach appears to provide a realistic and flexible framework in which the reduction of detailed regulations and the decentralization of government responsibilities may be logically accomplished without sacrificing national environmental, safety and health goals. (1410)

- Some 70 quality program plans have been developed and implemented among various Sandia technical and administrative organizations. The plans provide confidence that facilities, operations, systems, material or components adhere to contractual and/or design requirements. (1410)

- A formalized Receiving Inspection function has been reactivated at Sandia in compliance with ALO Quality Program requirements. The inspection activity has been initiated to reduce the possibility of potentially nonconforming material being accepted and paid for by SNLA. (1410)

- Significant improvements were made in the Welding Lab to enable a more complete welding development function. The support includes the following processes: electron beam, laser resistance, pulsed gas tungsten, and metal arc welding. A staff of process engineers and craftsmen support this activity. (1470)

- Energy-saving measures, applied to Machine Shops and Process Development Labs equipment, include installation of Power Factor Controllers which are saving 25% of the energy formerly used by the equipment. (1470)

Computing

- A computer code (ZAP) has been developed to model the vacuum consumable arc remelt process. This code is based on a magnetohydrodynamic flow model which is capable of producing time-accurate solutions of the interdependent fluid flow solidification processes in the ingot. Mathematical simulation of this process will enable the experimenter to attempt to control macrosegregation by application of external magnetic fields. (5830/2640)

- A network linking dedicated stand-alone minicomputers throughout the Labs to each other and to the central computing facility was completed and became fully operational. It provides communications and file transfer and a job dispatching exchange which greatly expands minicomputer usefulness. (2640)

- A distributed computing network has been started. It will connect general purpose super minicomputers in technical line organizations to the central scientific computing complex. (2640)

- The new Cray 15 computer installed at Livermore permits our staff to solve problems that were previously beyond our computer capability. Computer users are already using 80% of the Cray's available time. (8330)

- A purchasing document production system was completed. This system, which runs on a DEC PDP 11/70 and DEC word processing equipment, assists in the preparation of complex purchasing documents. Features include automatic paragraph selection, signature page preparation, and reference to documents known to be in the supplier's possession. (2640/3730)

- The nuclear materials management system was completed. This system, which runs on an HP3000 minicomputer, tracks movement of nuclear materials at Albuquerque, maintains an inventory and interfaces with DOE standard reporting systems. An audit by DOE of the systems resulted in an "outstanding" rating, only the second ever given. (2620/3430)



IN Dept. 2520, development was completed and production started on thermal flashblindness protective goggles for use by the Strategic Air Command.

Testing

•An unusual instrumentation photo (see cover photo) of a weapon test was made by photographers of Section 8413-1. The photo catches the flight of a W79 projectile as it emerges from the muzzle of an artillery piece at the Army ordnance facility at Yuma. (8410)

•A swept random vibration superimposed on a stationary random vibration profile digital control technique was developed to control electrodynamic vibration shakers. This allows a better simulation of certain time-varying real world environments. It also allows some modified random vibration tests to be conducted that would be beyond the power rating of the shaker systems if conducted in the usual manner. (1540)

•A tracking system which can document with high-speed photography critical areas in the trajectory of bombs and missiles has been designed and built and is now in the implementation stage in the Coyote Test Field Complex. This system, which is slaved to Sandia's Laser Tracker at distances up to two miles, can provide extended coverage of longer testing trajectories and superior high-speed photography data. In addition, since the system is unmanned it may be placed in potentially hazardous areas without involving personnel risk. (1520)

•The end of a computer era occurred when the Sigma-5 Xerox computer system in Area III was replaced with an HP1000 computer system which occupies about 18% of the space and consumes less than 2% of the power. This system processes data from the sled track, cable facilities, drop tower, etc. (1520)

•A facility permitting exposure of devices to carefully controlled fires simulating aircraft crash conditions has been built. With it, the first x-ray motion pictures verifying nuclear weapon safety were filmed. The facility aided in development of the LAARC shipping container for nuclear material. (1530)

•A new digital data acquisition system for underground testing was developed and successfully fielded on a nuclear test. The system will digitize up to 256 transient data channels, store them in temporary memories underground, then retransmit the data to a recording trailer and to the test control center. This system provides the experimenter with report quality data plots minutes after the event. (1120)

•Designed, pre-flight tested, and launched two 2-stage STRYPI VIII-R rocket systems for a re-entry test of a SWERVE II payload. All systems performed successfully. (1520/5630/1580)

•A digital acquisition and analysis system (DASSY) has been designed and built to record up to 70 channels of low signal level data at sample rates selectable from 0.5 sample/sec. to 400K samples/sec. Up to 4096 samples are simultaneously stored for each channel and are available following an experiment in a format that allows immediate and complete analysis. (1120)

•A verified theoretical model of a "residual stress cage" for underground explosions with HE experiments in tuff at NTS has been developed. This residual stress cage is vital for the containment of underground nuclear tests, and its confirmation and understanding will contribute to the economy and safety of future test programs. (1110)

•On April 21, 1980, the new 8500-sq.-ft. Operations Center was dedicated at TTR. It is the most visible portion of an \$8 million modernization of the TTR that included a new dual CPU central computer system with interactive graphics displaying tracked target parameters, improved data transmission and telemetry recording capabilities as well

as new mobile cinetheodolites. With improved flexibility and reliability, the new equipment provides real time display of tracking parameters, greatly improved quick-look analysis of radar and TM data, and speeds up by a factor of 30 the film-reading data reduction step for cinetheodolite film. (1170)

•A testing method has been developed allowing rapid heating of a reentry vehicle nose tip for a few seconds prior to striking it with an explosively accelerated target moving at thousands of feet per second. This testing allows verification that impact sensors operate properly under extreme conditions of flight and impact. The expense of full scale flights is avoided, and wide bandwidth measurements not otherwise attainable are possible. (1530)

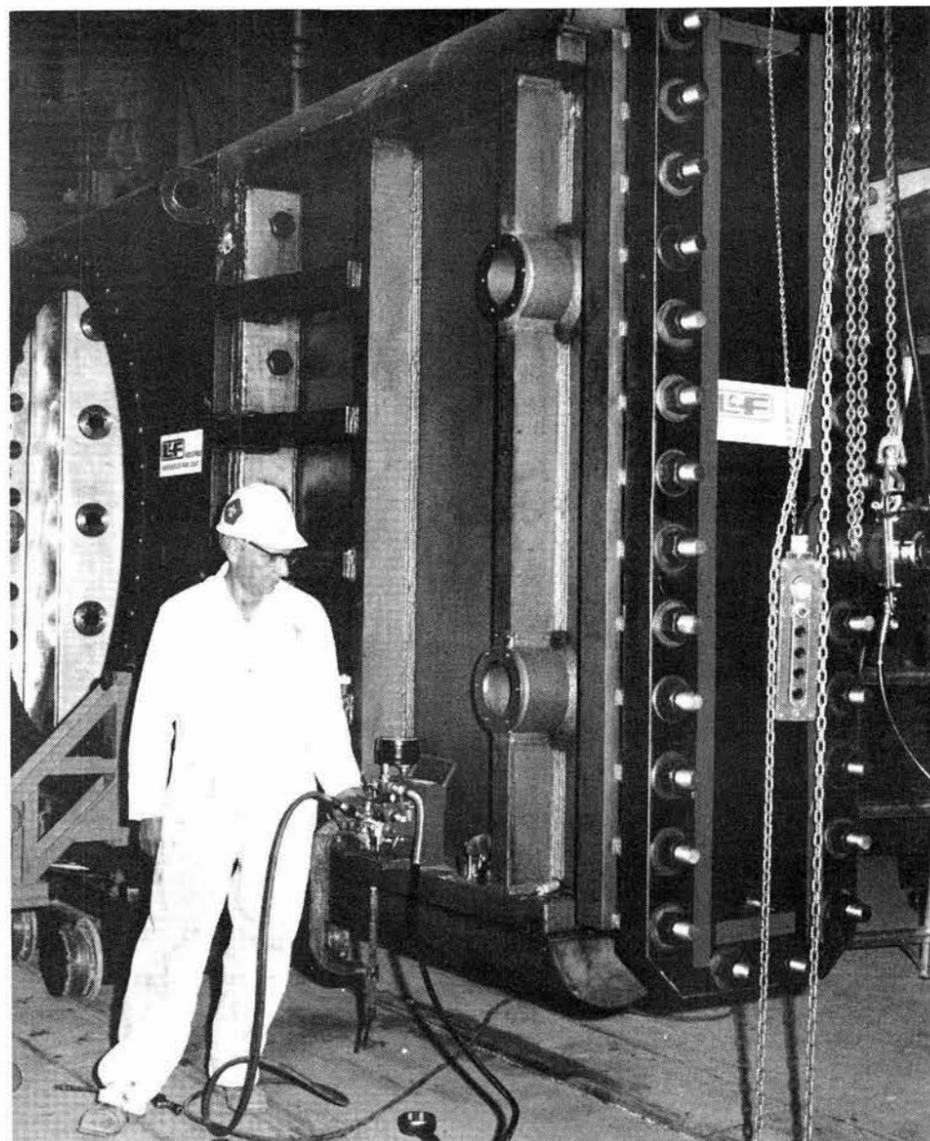
•Sandia-designed auxiliary closures are used as experiment protection mechanisms in horizontal line-of-sight underground nuclear effects tests at NTS. High pressure gas drives two massive overlapping 12-inch-thick aluminum sliding gates across a 72-inch-diameter pipe in about 35 ms. One new unit, designed to provide gas sealing in addition to debris arrest, was functionally tested during MINERS IRON in October 1980. Results indicate gas sealing can be achieved. This gas-sealing capability in the 72-inch auxiliary closure may permit the elimination of a tunnel and pipe seal unit with a considerable savings in cost and time, and up to \$2 million per nuclear effects test. (1130)

•We have developed a detection method for protecting a particular special nuclear material (enriched ^{235}U) from diversion; the method monitors items that may contain ^{235}U and which may be shielded for concealment. The detection of ^{235}U , directly or by implication, through neutron shield detection provides the necessary information to prevent passage. This method is being developed for the international safeguard requirement calling for an unattended material/equipment pass-through for nuclear facilities. (2350)

•We have completed production of equipment for a communications and display system designed and developed for the Air Force Base Security Upgrade Program. The system interfaces with intrusion sensors and communicates data to a remote display manned by Air Force security police. System equipment is being deployed to Air Force bases worldwide to upgrade security for weapon storage areas and alert aircraft parking areas. (1730)

•The first of seven special escort rail coaches for the Transportation Safeguards Division at ALO was delivered. Each coach provides safe, comfortable living quarters for couriers who accompany special rail shipments. (1710)

•An automated portal system has been developed that automatically controls access to a high security area without guard intervention until there is an alarm. It utilizes positive identity verification (hand geometry), a weapons detector, a nuclear material detector and an explosives detector to prevent the entry of contraband (explosives and weapons) and the theft of



TO CLOSE AN OPENING across a six-foot-diameter line-of-sight pipe, Dept. 1130 came up with two overlapping 12-inch-thick gates which achieve closure in 35 milliseconds. Here Dick Teisher (1130) examines one of the gates, tested in the MINERS IRON experiment in Oct. 1980.

Safeguards

nuclear materials. This system will shortly be delivered to Hanford for test and evaluation. after which a six-portal system will be built and installed at the fuels and materials examination facility at Hanford. (1720)

•We have developed a system for monitoring the movement of light water reactor (LWR) spent fuel passing into or out of a spent fuel storage facility. This system automatically stores the time and date of each fuel movement along with an annotated picture to document the event, and it incorporates self-protecting features to deter tampering or deception. This system will aid the IAEA in monitoring compliance with international agreements by foreign and domestic fuel storage or reprocessing facilities. (1760)

•We have built boiling water reactor fuel assembly identification devices (FAIDs) and use their inherent and designed ultrasonic characteristics for unique identity and for tamper indication. International safeguards for power reactor fuel require a unique fuel identification system which can also detect any tampering with the fuel assembly. (1760)

•We developed for the Air Force a digital signal processing method for intrusion sensors using adaptive signal processing. The technique significantly reduces alarms caused by nuisance sources and, at the same time, maintains a high probability of detection. The method will materially improve performance of deployed sensors. (1730)

•A prototype weapons storage vault has been designed, built, and is currently under

Air Force evaluation. A system for evaluation is planned at an Air Force base in Germany and, if successful, it can provide the Air Force in Europe with a significant improvement in operational readiness with enhanced weapon survivability. (1720)

•The experimental computerized alarm display system (ECADS) was upgraded to include closed circuit TV for alarm assessment purposes. This facility can provide highly realistic simulation of security consoles for safeguards equipment planning, evaluation, and training. (1720)

•We completed installation of closed circuit television systems at 22 Air Force high-value storage sites. These systems help assess the causes of alarms generated by intrusion detection sensors. Availability of this system reduces the requirement for personnel to perform assessment functions, thus releasing them for other security duties. (1730)

•An unattended-personnel portal for use in an international safeguards system for fast critical facilities has been designed, built, and evaluated. Features include special nuclear material detection using both gamma and neutron detectors, metal detection, tamper-safing features, and alarm recording equipment. This device, an R&D vehicle, allowed investigation of portal design features such as background shielding, unattended operation, volumetric metal detection, the integration of both gamma and neutron detection, and tamper safe designs. (1750)

Technical Accomplishments 1980

•A closed-circuit TV has been developed through the production stage to provide an unattended surveillance capability for international safeguards. The International Atomic Energy Agency will use the system to help verify that nuclear material is not being misused. (1750)

•Working for the Department of State, we are applying technology developed in nuclear safeguard programs to enhance physical security at foreign service posts. This program will give increased protection to Americans and American property at more than a hundred diplomatic posts. (1760)

•Our security forces experimentation and evaluation activity involving laser-equipped weapons and detector-equipped "players" has been used for tactical training of over 200 DOD personnel and some 1550 security personnel at 12 DOE facilities. For the first time, security personnel can realistically experience force-on-force simulated combat in a safe environment, enhancing their preparedness for threats to nuclear materials storage and transport. (1710)

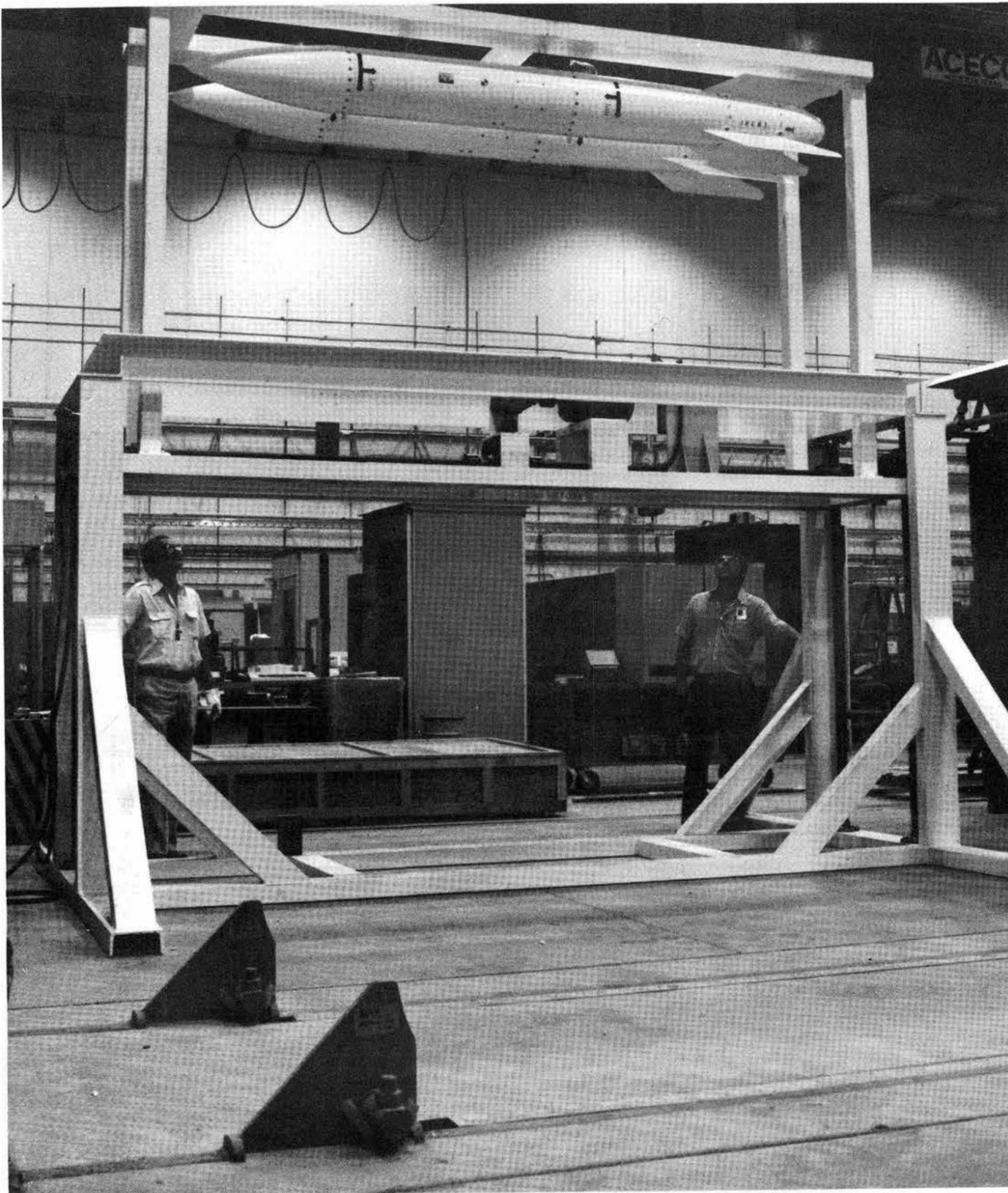
•We have designed, developed, and demonstrated to international users an extremely safe air-transportable plutonium

safeguards shipping package. This package, known as the PAT-2, was developed in the LAARC (lightweight air-transportable accident resistant container) program, will be licensed for international safeguards nuclear material shipments, and will support IAEA non-proliferation efforts. (1720)

•A portal for reading more than 11,000 personnel credentials (badges) per hour was developed. The electronic credential may pass through the portal with any orientation, does not have a battery, but is energized by the portal's magnetic field. Multiple portals

can be used to admit people to specific locations and to monitor emergency exits in hazardous areas. (1580)

•Safeguards Automated Facility Evaluation (SAFE) and Safeguards Network Analysis Procedure (SNAP) has been transferred to NRC for use in safeguards assessment of reactor facilities. These methods have also been transferred to the Naval Surface Weapons Center (NAVSWC) for analysis of shipboard security problems. SAFE and SNAP, developed by Sandia, represent state-of-the-art safeguard modeling. (4410)



PROTOTYPE weapons storage vault was designed and built by Dept. 1720 and is being evaluated by the Air Force for use at its bases. Work falls under safeguards program.

Reimbursable

•More than 15,000 CMOS, digital logic devices, neutron irradiated and then 100% re-tested, were produced for an Air Force satellite program. This irradiation precludes device latch-up in a high gamma dose rate environment. (2110)

•An implantable insulin delivery system for treatment of diabetes has been developed in a cooperative program between the UNM Medical School and Sandia. The device is remotely programmable and delivers insulin of a wide range of background (basel) and mealtime (bolus) rates. Several units have been implanted in dogs and implantation in humans is planned. In another aspect of this project, a newly installed 400 watt pulsed laser welding system has been used to show feasibility for completing hermetic closure welds in hardware associated with the project. (2150/5830/2320/2330)

•The feasibility of building an intense neutron source for use in cancer therapy has been demonstrated. Recent achievements indicate that neutron intensity and system lifetime are adequate for a hospital-based neutron source. (2350)

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