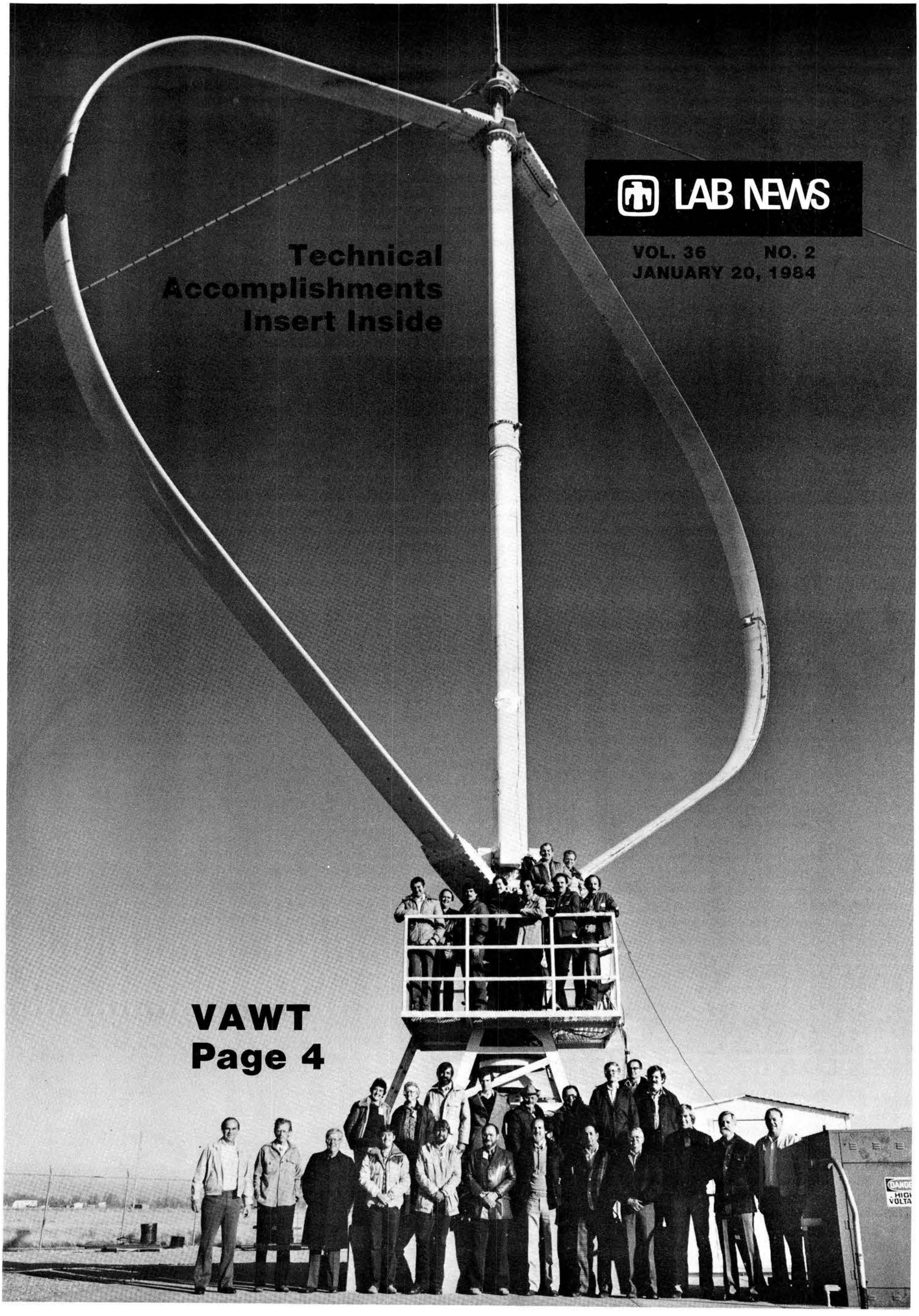
LAB NEWS

VOL. 36 NO. 2
JANUARY 20, 1984

Technical Accomplishments Insert Inside



VAWT
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Antojitos

That's All of Us We're Talking About!--Those of us in the LAB NEWS are pleased to bring to our readers the annual Technical Accomplishments issue. This year we're presenting the write-ups as a special insert that makes up the center pages of today's paper.

First of all, we want to thank all the people who made the special insert possible: Al Narath, who said "Let's do it again; it's worth the effort"; the people in the technical divisions and departments who actually put together the draft write-ups; the vice-presidents and their immediate staffs who tweaked and tuned each one and who made the often difficult choices as to which ones to submit; Dick Craner and his people in Classification and Joe Szymanski in Patents who (in just a day or two) reviewed the drafts to make sure they were okay for publication; and Charlie Winter of Management Staff who was invaluable in helping us make each write-up as clear as its complexity would allow.

Second, it almost goes without saying (but not quite, so here goes) that we congratulate those who worked directly on the projects and programs described. I believe, and my manager agrees, that each year Sandia does a bit better than the year before--pushes the frontiers of technical achievement just a bit further in terms of both breadth and depth. Having a project you've worked on included here gives you the right to pause for a moment and enjoy some well-justified pride.

Third, we want to point out that all 8201 of us Sandians can legitimately share in that pride. Graded or staff or supervisory, technical or administrative, we all worked to make these accomplishments possible. If you're in Stores or Purchasing or Safety or Field Test or Personnel or the Mail Room or any of the other groups listed as "Services" in the phone book, it's easy to assume that you had nothing to do with any technical accomplishments--after all, you may not know a strained layer superlattice from a screen door. But, one way or another, what you did allowed the researcher to do what he/she did. To paraphrase the United Way slogan, we work for all of us. •BH

* * *

Allégate a los buenos y serás uno de ellos. (Approach the good and you will become one of them.)

Congratulations

Henry (1543) and Mary Westrich, a son, Thomas Alan, Dec. 25.

Bob (132) and Mary Banwart, a daughter, Beth Christine, Dec. 25.

Sympathy

To Harold Rarrick (5254) on the death of his father Jan.2 in Gulfport, Miss.

Star light, star bright,
First star I see tonight,
I wish I may, I wish I might —
Oh nuts! You're a satellite.

It's a common dilemma. Grover Hughes (5323), Sandia's astronomer, tells us that 4900 to 5000 satellites are now circling the earth. About 2600 of them are American, about 2000 are Russian.

LAB NEWS

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Events Calendar

Jan. 22 — Sinfonietta, "In the Company of Classics" (all Mozart program), 7:30 p.m., First United Methodist Church, 4th and Lead.

Jan. 22 — NM Watercolor Society Art Show, Fine Arts Gallery, State Fairgrounds, 898-8871.

Jan. 22 — "Music at the Museum," Ross Holman, French horn, and Bill Mullen, violin; 3 p.m., Albuquerque Museum.

Jan. 22-23 — Annual San Ildefonso Feast Day: vespers, procession in farolito-lit plaza on 22nd; daybreak animal dances in all four plazas: Buffalo, Comanche, and Deer dances on 23rd. San Ildefonso Pueblo, 455-2273.

Jan. 24 — Travel Film, "The Three Rivieras," 7:30 p.m., Popejoy.

Jan. 27-29 — The Albuquerque Opera Theatre, "The Coronation of Poppea," (in English), 8:15 p.m. Fri. and Sat., 2:15 p.m. Sun.; KiMo.

Jan. 28 — St. Olaf Choir, 8 p.m., Popejoy.

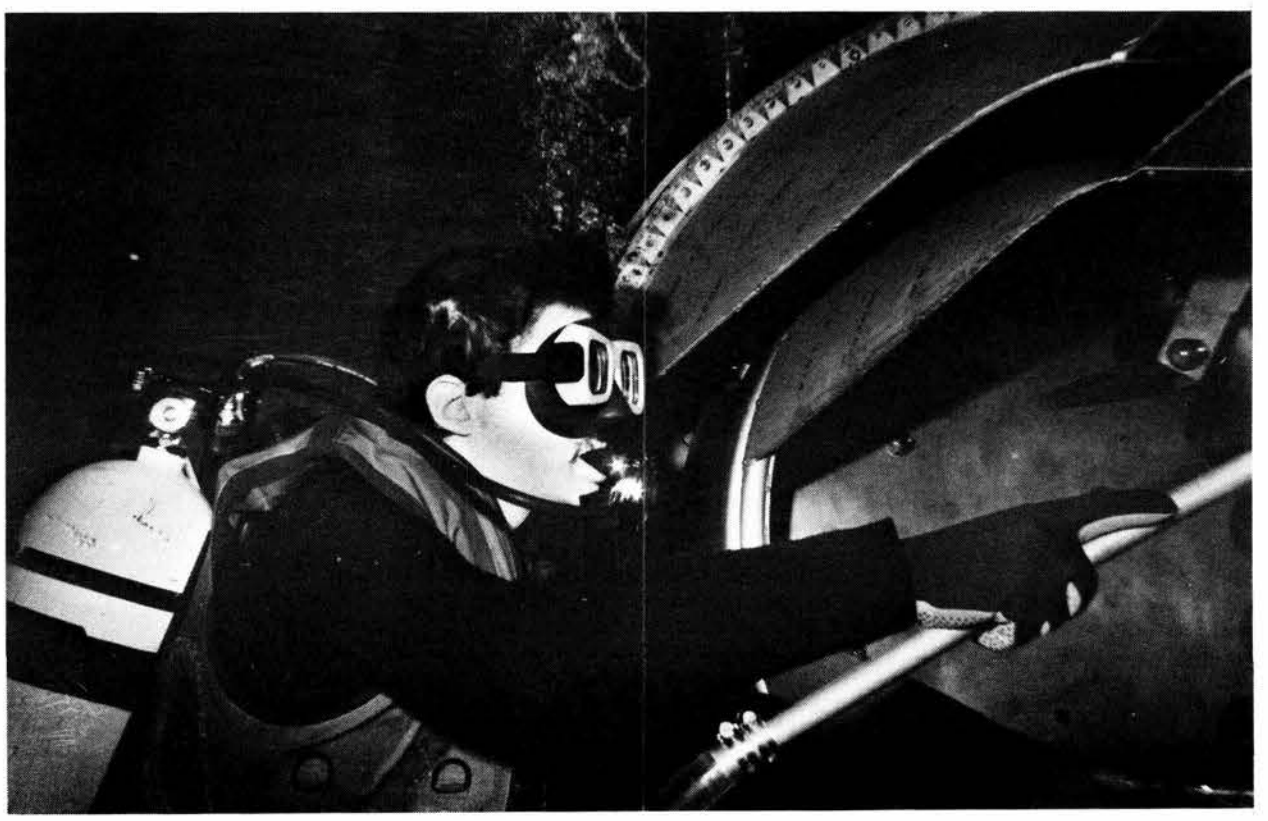
Jan. 28-29 — Albuquerque Children's Theater, "The Round-Eyed Rumpelstiltskin," and "Les Patineurs," by the ACT Ballet Co., 1:30 and 3:30 p.m., Popejoy.

Jan. 30-31 — "Evita," musical with seven major awards, 8:15 p.m., Popejoy.

Feb. 1-March 7 — The Chaco Phenomenon Series: Six evenings with the experts on Chaco Canyon, discussing the Great Houses, roads, pottery, social organization, outlier system, and Mexican connection. 7-9 p.m. each Wednesday, Maxwell Museum of Anthropology, 277-5813.

Feb. 2 — Annual Candlemas Celebration at Picuris, San Felipe, and Santo Domingo Pueblos: Buffalo and other dances; contact pueblos.

Feb. 4 — Julliard String Quartet, 8:15 p.m., Woodward Hall, UNM, 843-7657 for tickets.



IN-DEPTH TECHNOLOGY — Richard Cleary of K-Tech and his SCUBA gear remove bubbles from the transition section of a PBFA-II module now being tested in the Demon facility in Area IV. (Underwater photography by Mike Eaton, K-Tech)

Visiting Professor/Foreign Scientist

'CRF Is the Place To Be'

Claus Borgnakke likes his scholarly work to be used in a practical way to make practical decisions.

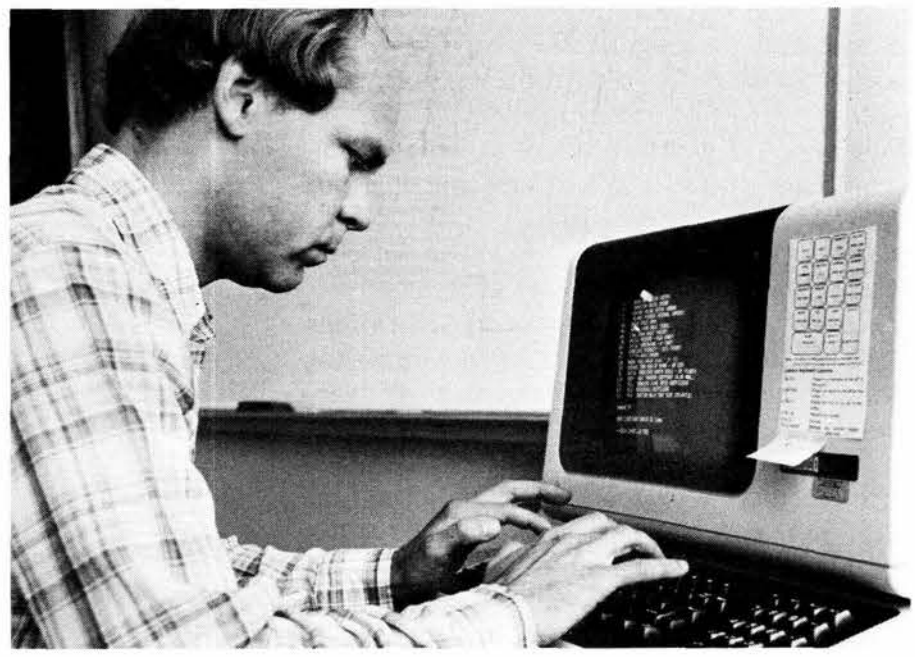
That's why he returned to the Combustion Research Facility for a second summer in 1983 from his assistant professorship at the University of Michigan's Department of Mechanical Engineering and Applied Mechanics.

A native of Denmark, Claus first came to this country as a post-doctoral student at Michigan and accepted a teaching post there in 1979. With English mandatory in Denmark's grades 4-11, he had few difficulties in communicating with Americans, at least on the professional level.

He does confess to an early eyebrow-raising request when he needed a temporary replacement for a missing button on his trousers and asked the department store clerk for a "security needle." In fact, he *insisted* that he needed one and that the store *must* have them. Finally, some friends joined him and explained to the clerk that he wanted a safety pin.

At the University Claus does research on thermal science, in particular the turbulent combustion of gases. In developing mathematical models of these phenomena, he learned of Sandia's CRF and arranged to serve as a visiting professor here. During both of his summers he's worked at simulating the flow field — turbulence and mean velocities — inside an engine. Data for the simulation depend on measurements of flame propagation and flame arrival times at specific locations within the combustion chamber.

One of Claus's PhD students, Jay Martin, does the experimental work; Claus does the theoretical. Jay came to Sandia in January 1983 and has since co-authored with Claus and Pete Witze (8362) several reports on velocity and turbulence measurements in spark ignition engines.



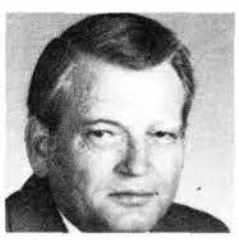
VISITING PROFESSOR Claus Borgnakke, originally from Denmark, has spent two summers at the Combustion Research Facility.

Claus has also worked with Ray Smith (8362) on heat transfer aspects related to the problem of engine knock and on several Ford Motor Company projects. One of the latter, Ford's "PROCO" (programmed combustion) project, made it to the prototype stage. With direct injection of the fuel, high swirl rates, and a cupped piston, the development increased efficiency of an engine measurably — "but not enough to justify perhaps $600 million for new tooling," says Claus. "Even so, it was an exciting project because of the very real chance for practical research leading to practical solutions of real problems."

In Claus's Danish eyes, Americans appear open and friendly — "so long as you keep a certain distance," reports Claus. "It's only a generalization, but Americans seem determined to achieve their own goals, to follow the 'American Way,' to 'make it.' And that's not unrealistic — opportunity levels are higher here than in Denmark. But cultures are similar in both countries, and values are too, though here material possessions are somewhat more dominant — comfort is certainly important to Americans."

Claus finds San Francisco "an appealing, cosmopolitan town that's quite different from Detroit, the nearest big city to Ann Arbor." And he's found time for some traveling — Yosemite, Napa Valley — some wind surfing at Del Valle, and a few rock and classical concerts. He does miss his Scandinavian Club contacts back in Michigan.

But he'll return if it's possible — "The CRF is the place in the world to be today if you want an understanding of combustion phenomena."



Death

Bill Zinke, supervisor of the Experimental Solid Mechanics Division 8123, died Jan. 1. He was 54.

Survivors include his wife, three daughters, and four grandchildren. He had been a Pleasanton resident for 24 years.

New Cray On Way

Sandia Livermore is installing a new Cray 1S/1000 computer system this month, the second one in three years. The new $6.5 million system will arrive with a one million word capacity and will be upgraded to two million words in July.

The first Cray 1S for Livermore arrived in September 1980 and had a half million word capacity. It was upgraded in February 1983 to one million words.

The next Cray for Albuquerque is scheduled for delivery in February 1985.

SANDIA LIVERMORE NEWS

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RETIRING — (left to right): Bob Hofford (8272), Walt Dzugan (8424), Mo Jones (8168), Cathy Banks (8264), Merle Snyder (8412), and Karl Livingstone (8412).

Second Generation VAWT Being Designed

"Wind farms" around the country, their eggbeater shapes catching the eye, testify to the success of Sandia's Vertical Axis Wind Turbine (VAWT) in technology transfer.

Five commercial manufacturers are now producing and marketing machines (see box). Their combined output is about one machine per day.

Fifty wind turbines are currently producing power or are under construction to become part of the nation's electrical power grid.

There are 48 of the machines in California (where tax considerations and strict pollution control laws create a favorable economic climate for VAWT installations), including 35 on the Altamont Pass east of Livermore. In addition, one is operating in Texas and another on the Caribbean island of Antigua.

The machines resemble the research VAWT on Sandia's east mesa. The eggbeater blade configuration towers 17 metres (55 feet) above the ground; the diameter of the blades is also 17 metres. The unit can generate as much as 60 kilowatts of power in winds of 12 to 45 mph.

The design was proved in three DOE demonstration projects under Sandia's technical direction. VAWTs were constructed in 1980-81 at Rocky Flats, Colo., at Bushland, Texas, and at Martha's Vineyard, Mass. After a year of operation, these machines were modified to reduce structural vibration, and this modified design became the basis of the commercial machines now in production.

Dick Braasch, supervisor of Wind Energy Research Division 6225, was recently honored by the American Wind Energy Association (LAB NEWS, Nov. 11, 1983) for "commercially important" technology transfer. He has headed the Sandia program since 1975.

Our work continues in the research and development areas," Dick says. "We are designing a new second-generation VAWT capable of generating 600 kilowatts of power. This research test bed will be 150 feet tall with a rotating blade diameter of 110 feet. More important, it will enable testing of new system concepts and new aerodynamic designs."

Until now, VAWT blades have used airfoil designs adapted from aircraft wings or propellers. The airfoil creates "lift" and enables the blade to drive into the wind.

Using new analytic tools (computer models validated by millions of measurements made during the operation of the demonstration machines and the Sandia research VAWT on the east mesa), the airfoil of the new blades will be specifically designed for VAWT use. The new concept calls for the blades to have a large chord (width) at the ends where they join the vertical shaft and taper to a narrow chord at the center. The analytical codes address aerodynamics, structure, and system performance. (The codes were originally developed to study weapon program problems, such as bombs separating from aircraft.)

"Using the codes, which allow analysis and prediction of behavior of complex systems, we plan to build the very best VAWT that we can, but we're also building in some flexibility — provisions for blade interchangeability so that new blade designs may be tested as we find ways to improve aerodynamic performance," Dick says. "Another objective is to provide a wide operating range without excessive control equipment."

Construction of the new machine starts next fiscal year. A five-year plan for operational testing and modification is proposed.

Emil Kadlec (6225), VAWT project

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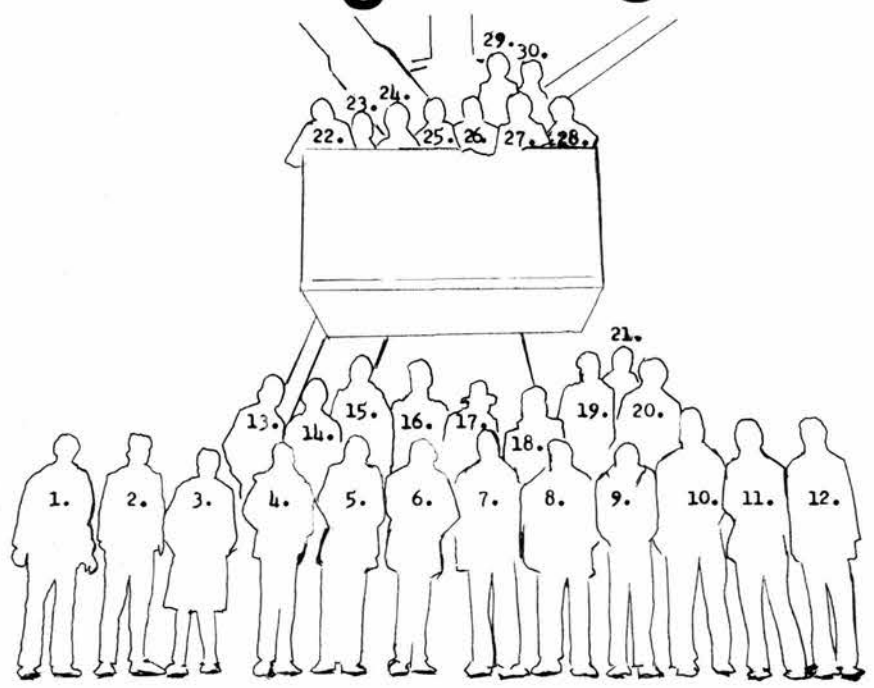


VAWT PROJECT PEOPLE include (1) Emil Kadlec, 6225; (2) Dick Braasch, 6225; (3) Randy Maydew, 1630; (4) Cyrus Tait, NMERI; (5) Paul Klimas, 6225; (6) Robert Sheldahl, 1633; (7) Ben Blackwell, 7537; (8) Ken Grant, 3643; (9) Chuck Grassham, 7542; (10) Mark Worstell, 6225; (11) Mark Grover, 6225; (12) Jack Cyrus, 6225; (13) Debby Oscar, 6225; (14) Zelma Beisinger, 1521; (15) Bill Sullivan, 1524; (16) Bob Nellums, 6225; (17) Matt Mattison, 6225; (18) Tom Gardner, 7655; (19) Arlo Nord, 7542; (20) Tom Carne, 7542; (21) Joe Lackey, 6225; (22) Dale Berg, 1636; (23) Carl Longfellow, 6252; (24) David Clauss, 1523; (25) Paul Veers, 1524; (26) Johnny Biffle, 1521; (27) Don Lobitz, 1523; (28) Tim Leonard, NMERI; (29) Jack Burkhardt, 5111; and (30) Len Wilhemi, 5216.

WHAT VAWT HATH WROUGHT — Rows of vertical axis wind turbines can be seen along the Altamont Pass off Interstate 580 these days as the FloWind Corporation of Kent, Wash. erects the 92-foot-tall windmills to harness the abundant wind energy blowing through the hills. This model can produce 170 kW peak power. FloWind plans to install 400 machines this year east of Livermore. (Photo by Dick Jones, 8441)

Continued . . .

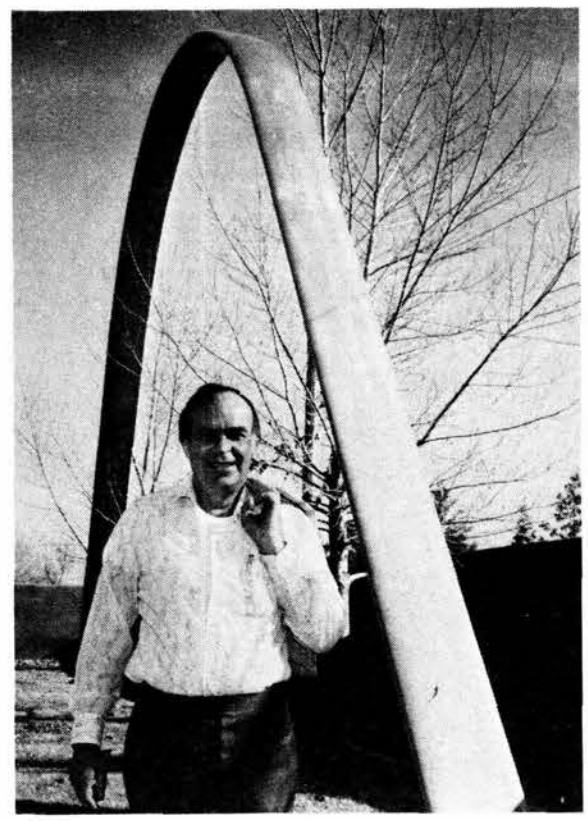
New VAWT Being Designed

leader, emphasizes that economics will continue as a prime concern in the project: "From the beginning of the project in 1973 when Randy Maydew, Ben Blackwell, and Lou Feltz first proposed the project and guided the prototype through the Development Shops," Emil says, "economy and ease of construction have been of utmost importance. We've come a long way since the first blades were laid up on a long table and hand crafted in the shops, but we still worry about the best and most economical way to build a VAWT."

A milepost in the VAWT program was publication in 1979 of a four-volume SAND report, "Economic Analysis of Darrieus Vertical Axis Wind Turbine Systems for Generation of Utility Grid Electrical Power."

"This report was written as a model for business people to study," Emil says. "It was a textbook approach, starting with site selection, building facilities, production, and marketing. We calculated all capital costs. This report, along with our demonstration machines, was responsible for our technology transfer success.

"We will continue the economic analysis as the work on the new VAWT research machine continues. In two or three years we will repeat the technology transfer with a new, much improved VAWT. Our current data project about a 30 to 50 percent cost reduction in the expense of producing energy with the new design."



VAWT BLADE frames project leader Emil Kadlec (6225). This 80-ft. aluminum blade was one of the first fabricated with the extrusion process. It now resides at the Albuquerque Museum.

VAWT Manufacturers

Current manufacturers of Vertical Axis Wind Turbines are:
Aluminum Company of America, ALCOA Center, Pa.;
Dominion Aluminum Fabricating, Ltd., Mississauga, Ontario;
FloWind Corporation, Kent, Wash.;
Tumac Industries, Colorado Springs, Colo.;
VAWTPOWER, Inc., Albuquerque, NM.

VAWT Milepost

Extruded Aluminum Blades

"One of the more important reasons the VAWT is commercially viable," Emil Kadlec (6225), VAWT project leader, says, "is that the hollow aluminum blades with their internal rib supports and airfoil surfaces can be extruded. This means that in the fabrication process, melted aluminum is pushed through a die to form the blade as a single piece of metal in any length desired. The blade comes out of the extrusion machine as a straight piece. It is then bent, using a three-point press, into its final curved shape.

"In the beginning, we visualized a blade with aluminum leading and trailing edges connected with a honeycomb structure and covered with fiberglass. It was at a technical conference in late 1975 that an ALCOA rep told us that his company could extrude the design. We had called for proposals and we had one in the fiberglass configuration — the production price was $28 per pound. The ALCOA price for the extruded blade was $2 per pound. There are about 1400 pounds of material in each of the 80-foot-long blades for the 100 kilowatt turbine."

Answers to Frequent AT&T Stock Questions

The following information should be of special interest to employees who own AT&T stock — either on their own or through one of the savings plans.

Though this information has been published before, it has been condensed here to answer employees' most frequently asked questions.

If you purchased AT&T stock on your own before Dec. 31, 1983:

You will receive a statement of your account on or about Jan. 20. This statement will show how many shares of AT&T and the seven new regional holding companies you own. (Remember, you will own one share in each of the seven companies for every 10 shares of AT&T you own. Your regional holding will be *in addition to* your AT&T holdings.)

If you own less than 10 AT&T shares, you will receive a check for the fractional shares of regional stock to which you're entitled.

If you own at least 10 but fewer than 500 shares, you will receive an option card in January when your statement of account is mailed. The card will provide four options. You may:

- Make no change in your regional company shareholdings;
- Consolidate your regional company holdings for a modest fee by selling shares of one or more regional companies and buying shares of one or more regional companies;
- Receive certificates for your regional holdings; or
- Deposit your shares in the regional companies' dividend reinvestment plans.

If you do not return your option card by April 16, you will receive certificates for the regional shares to which you're entitled and cash for the fractional shares.

If you own 500 or more AT&T shares, you will receive stock certificates for your regional shares and a check for any fractions of regional shares. You will *not* receive an option card.

If you own AT&T stock through the company-sponsored savings plans and you are not taking a periodic partial distribution:

No action is required by you, and you will not receive an option card. In January, the trustee of each savings plan will automatically add to your AT&T shares the number or regional shares to which you are entitled.

This information applies if you have current *or* past investments in the AT&T shares fund or one or more of the company's savings plans.

There were three company-sponsored savings plans through which you may own AT&T shares: the Bell System Savings Plan (BSSP) for salaried employees, the Bell System Savings and Security Plan (BSSSP) for nonsalaried employees, and the Bell System Voluntary Contribution Plan (BSVCP) for all employees.

At divestiture, the AT&T shares fund became the Diversified Telephone Portfolio. It will continue to hold the AT&T shares you bought before divestiture as well as the proportionate number of regional-company shares to which you're entitled. The portfolio is a "frozen" fund. You can't invest in it, but you are able to transfer funds out of it. Your earnings on the portfolio will automatically be invested in the AT&T shares fund.

If you elected a periodic partial distribution of AT&T stock in November 1983:

You will receive your AT&T certificates in late February or early March.

And, if your distribution is at least 10 but fewer than 500 shares, you also will receive an option card entitling you to rearrange your holdings according to the same options all AT&T shareowners will have. This option card, which you will receive in February, will be *in addition to* the option card all other AT&T shareowners will receive in January if they own at least 10 but fewer than 500 AT&T shares.

You must return this second option card by April 16, or you will automatically receive certificates for your regional shares and cash for any fractions.

You may *not* combine the option card you receive as a result of your periodic partial distribution with the card you may receive as an existing AT&T shareowner. If you receive two options cards, complete and return both of them.

If you retired in November or December 1983 or terminated employment in December 1983:

If you own AT&T stock through the savings plans, you will receive your AT&T certificates in February 1984. If you own at least 10 but fewer than 500 AT&T shares, you will receive an option card at the same time. The card must be returned by April 16; otherwise, you'll receive your regional company certificates and cash for fractional shares.

What happened to the savings plans at divestiture?

At divestiture, each of the savings plans was renamed for AT&T. Your account was automatically continued in each plan in which you were participating on Dec. 31, 1983.

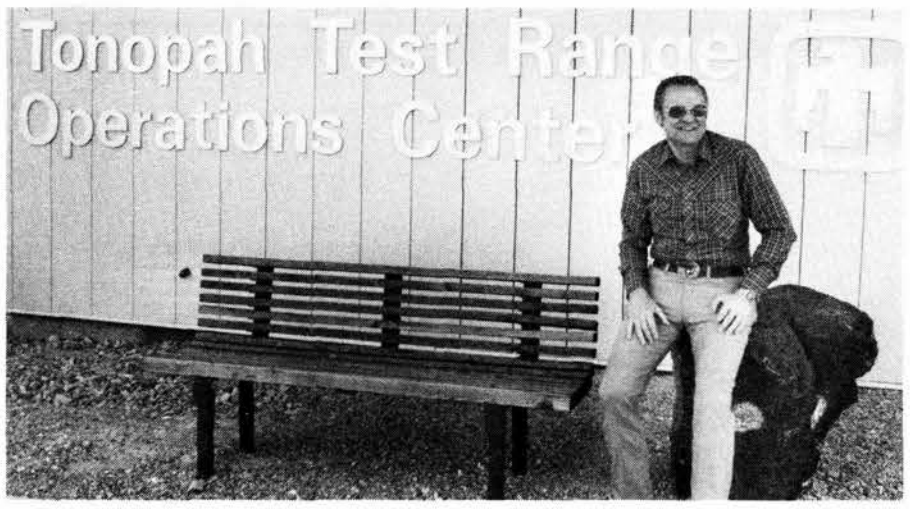
AT&T will continue to maintain savings plans for its employees and those of its remaining group of companies.

What happened to your AT&T shares in the employee stock ownership plan (ESOP)?

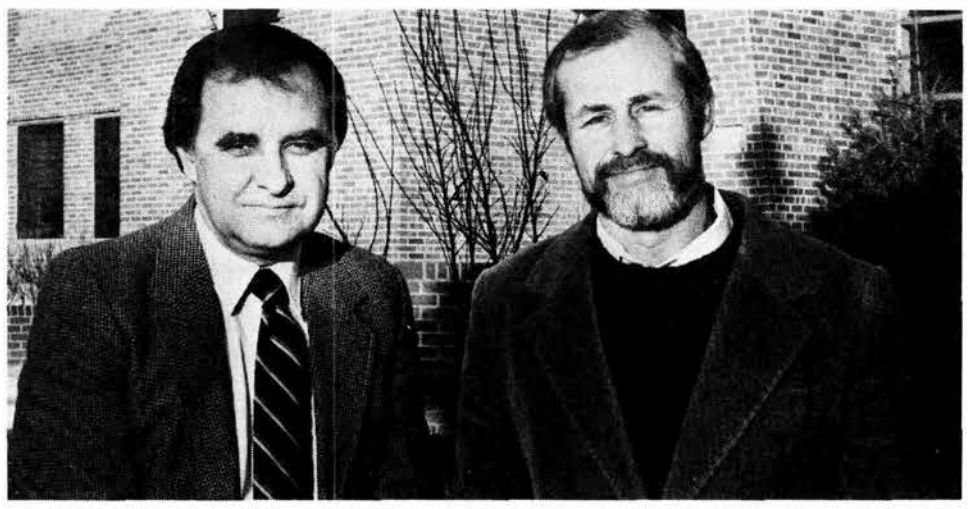
ESOP is the plan in which the company allocates a certain number of AT&T shares to employees based on their annual compensation. Active employees will not receive a distribution of ESOP shares at divestiture: the shares must be kept in trust for at least 84 months unless the employee becomes disabled, resigns, retires, or dies before the 84-month holding period expires.

However, employees who terminated their employment in 1983 will receive AT&T shares and related regional company shares, along with an option card if their distribution is at least 10 but fewer than 500 shares. They also will receive an ESOP distribution in February 1984, attributed to their 1983 compensation.

After divestiture, the new AT&T established ESOP accounts that contain only AT&T shares.



RON BENTLEY (7170)



LEWIE SISNEROS (3731) and MALCOLM BUTTRAM (1248)

Supervisory Appointments

RON BENTLEY to manager of Tonopah Test Range Department 7170, effective Dec. 16.

Following his graduation from the University of Florida with a BS in EE, Ron joined the Labs in 1965 as a member of the Technical Development Program. He later received his MS in EE from UNM. During his 10 years at SNLA, Ron worked in the telemetry development and telemetry applications divisions. He was promoted in September 1975, and transferred to Tonopah Test Range as supervisor of the Electronic Measurements Division. In 1977, when TTR began a large modernization effort, Ron headed the Range Modernization Program. Most recently he has supervised the Instrumentation Development Division 7172.

Ron is a member of IEEE and is president of the International Foundation for Telemetry. He also serves on the Engineering Advisory Council at the University of Nevada at Las Vegas. Ron enjoys camping, fishing, and jogging. He and his wife Gloria have two children. They live in Las Vegas.

* * *

MALCOLM BUTTRAM to supervisor of Pulsed Power Components Division 1248, effective Oct. 16.

Malcolm has worked with the pulsed power organization since joining Sandia as a staff member in 1975. Specifically, his work has involved repetitive pulse power systems for long-term ICF or reimbursable DoD applications.

He received a BS in physics from Rice University and a PhD in physics from Princeton. Malcolm is a member of the American Physical Society. He enjoys gardening, fishing, and softball. He and his wife Paula have three children and live in NE Albuquerque.

* * *

LEWIS SISNEROS to supervisor of Small Disadvantaged Business Relations Division 3731, effective Dec. 16.

Joining Sandia in May 1957 as a messenger, Lewie then progressed through a number of assignments in the accounting department. Under the Labs' Educational Aids Program, he attended the U of A and received his BS degree with a major in accounting. He was promoted to a buyer in purchasing in 1969 and has been with that organization since then.

Lewie, a Certified Purchasing Manager, is past president of the NM Purchasing Management Association. Currently, he is director for National Affairs of that group, and is a member of the Board of Directors for District 2 (a five-state area) of the National Association for Purchasing Management. Lewie enjoys golf and tennis. He and his wife Virginia have six children and one grandson. They live in the SE heights.

Take Note

"Recent Developments in Computing, Processor, and Software Research for High-Energy Physics" is the title of a symposium to be held in Guanajuato, Mexico, on May 8-11. Sessions include reconstruction processors for triggers and off-line analysis, new software developments and physicist productivity, beam orbit processors, lattice gauge processors, and a summary of recent developments in computer science. Suggestions for invited papers go to T. Nash, requests for information to Rene Donaldson, both of Fermilab (Box 500, Batavia, Ill. 60510; phone 312/840-3278). The symposium is sponsored by research groups in both Mexico and the US (Fermilab, the National Science Foundation, and the DOE).

* * *

If you've always wanted to get into the graphic details, sign up for the 10-week evening course in Basic Graphic Design offered through UNM's Continuing Education Office. It runs from 6:30 to 8:30 each Tuesday beginning Jan. 24. The course includes all the basic skills needed to design both print and film graphics — layout preparation, finished art for ads, brochures, slides, view-graphs, lettering, posters, etc. Registration info from UNM on 277-3751; course info from instructor Paul Regusis on 836-0319 evenings.

* * *

Or, if French gives you joie, join the spring session of l'Alliance Française. These classes in conversation, business, and cooking begin Jan. 30. Call instructor Margery Storrs on 821-5788 for the schedule and further info.

* * *

How about Chinese? The Chinese Language School offers courses in beginning, intermediate, and advanced. Classes run from 2 to 4 p.m. on 14 Sundays beginning Jan. 22. Register at UNM's Ortega Hall at 1:30 on Jan. 22; $30 per person. More info from instructor Margaret Chu (6431) on 293-4375.

* * *

The Masterchorale of Albuquerque, a "32-voice professional choral ensemble," will celebrate the 300th anniversary of George Frederick Handel's birth. Hallelujah! In preparation for an unabridged version of the composer's *Messiah* to be performed Dec. 1, the group is auditioning for additional male singers. 266-6853 for more info.

* * *

Prefer folk to classical? The NM Folk Music Society brings a couple of delights our way. On Jan. 26, Rosalie Sorrels, singer of traditional American music, appears at the Heights Community Center (on Buena Vista a block south of Coal, near TVI) at 8. And on Feb. 7, Brian Bowers, virtuoso autoharp player, gives us some traditional, some bluegrass, and some old timey — great storyteller too. He shares the bill with Trapezoid, presenting folk from the British Isles and Appalachia. It's at 8 at the SUB Ballroom, UNM. Tickets for both concerts from BookStop in Nob Hill and Jack Douthett's (Texas north of Menaul). More info from folk freak David Strip (6415).

* * *

Retiree Hank Baisdon's color photo of a home in T or C took an honorable mention in the *New Mexico Magazine's* farolito photo contest. Winners were published in the December issue. Congrats, Hank. He plans to expose some more film during Sierra County's centennial celebration in April.

* * *

The Marriage Enrichment Encounter people are offering an ecumenical weekend retreat to help you improve communications with your mate. It's Feb. 17-19. Make reservations with Gary or Doris Fox on 296-2370; Salvador Alvarez (DOE) on 821-6817 has information.

* * *

Training for the weekend zoo docents (volunteer teacher-guides) will begin Jan. 28 at 10 a.m. in the zoo barn. For details call the Rio Grande Zoo on 843-7413 or Alice Fienning on 289-0743.

* * *

Retiring this month and not shown in LAB NEWS photos are Ken Harrington (7252), Glen Haines (7473), Bob Henderson (5256), Ruby Rael (7483), Jon Thebert (7556), Jim Kelly (3300), Norman Brisbin (7222), Art Hasenkamp (7551), and Richard Hosley (2631).

Technical Accomplishments 1983 Special Section

LAB NEWS

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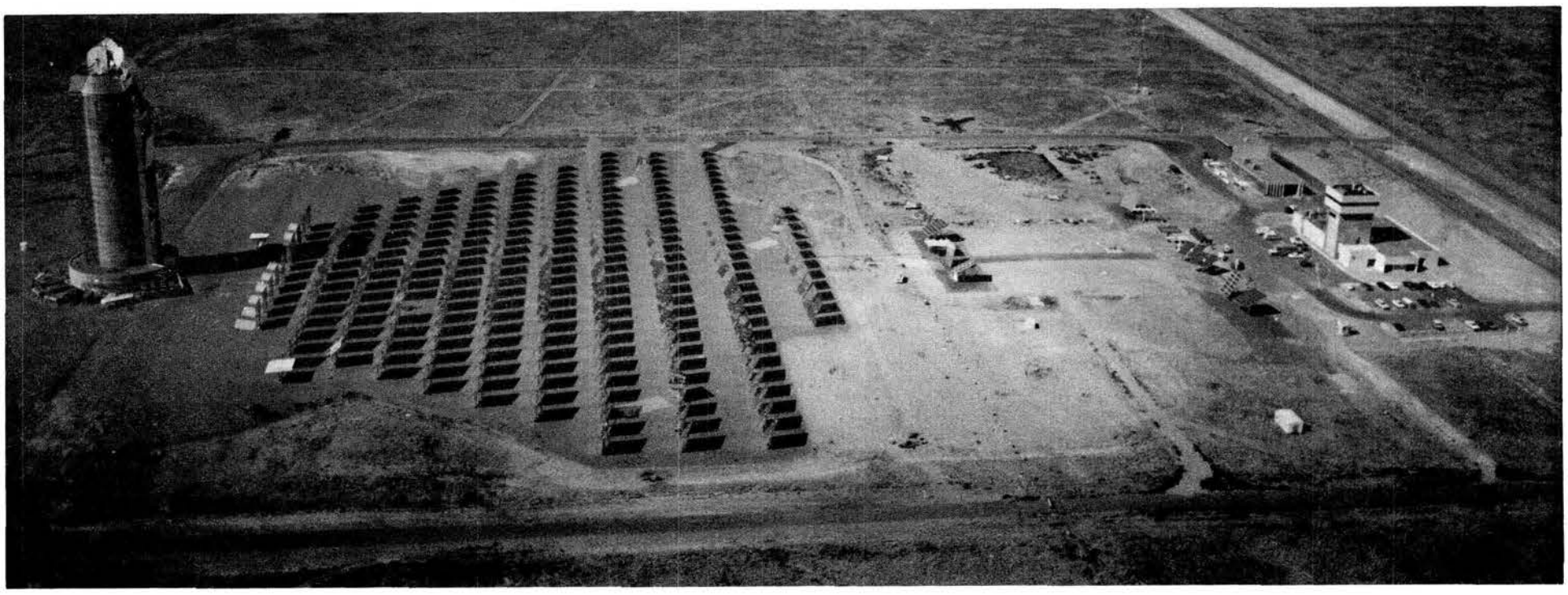


CENTRAL RECEIVER TEST FACILITY was the site of a Molten Salt Electric Experiment, the first US system to use molten salt rather than water to transfer and store heat collected by the field of heliostats. The experiment was funded by DOE, the Electric Power Research Institute, and six private companies.

Technical Accomplishments 1983

Continuing a LAB NEWS feature begun three years ago, *Technical Accomplishments 1983* sums up what we, Sandia National Laboratories, consider our principal technical achievements for the year just past.

The work summarized here has been submitted by technical organizations in Albuquerque, Livermore, and Tonopah. The responsible department is given in parentheses following each item. No attempt has been made to rank items.

Weapon Systems

• All development and preproduction activities for the W84 warhead for the Ground Launched Cruise Missile were successfully completed. The warhead has now entered the production phase. (8160)

• The development of the W85 warhead for the Pershing II Missile System was completed, and the warhead was released for production. The First Production Unit and the 1983 deliveries to the Army were completed as scheduled. (5110)

• We have developed a capability to analyze aircraft/cockpit controller/nuclear weapon electrical interactions to complement field testing programs. The Aircraft Compatibility Analysis Program (ACAP) greatly enhances our ability to evaluate a significant proportion of the 400,000 load configurations that have been approved for use in the field. In addition, ACAP is being used to evaluate Aircraft Monitor and Control (AMAC) systems that are under development. (5120)

• The first production unit of the B83 radar fuze (MC3049) was delivered on schedule in February, concluding a four-year Phase 3 development effort. The B83 radar incorporates many new features and technologies that improve performance and reduce costs. (2340)

• The Continuous Monitor & Control System (CMCS) is a means to provide in-weapon sensing and recording of, and responses to, environmental parameters affecting the weapon's ultimate use and disposition. Prototype CMCS hardware incorporating microprocessor-controlled sensors and bubble memory data storage has been installed in material-compatability-test cannisters at LANL in ongoing tests to determine the feasibility and utility of portions of the concept. (1620)

• The Anti-Submarine Warfare Stand-Off Weapon Nuclear Depth Bomb (ASWSOW NDB) entered phase 2A in April. Los Alamos National Lab and Sandia Albuquerque were selected to design and develop the NDB, which is the prime payload for the Navy's ASWSOW. Boeing is the missile contractor on the program.

Scale model water entry tests demonstrated that the design meets the required hydrodynamic performance criteria for both cavitating and fully wetted flow. These tests also provided shock input data at water entry that have validated theoretical impact loads predictions. Other scale model tests have been performed to obtain parachute performance data and to verify aerodynamic stability of the NDB. (5160)

• Several years of Sandia design and development activities culminated in the first production of the B83 Modern Strategic Bomb. The bomb is now certified for the FB111 and B52 aircraft, and compatability testing with the new B1-B bomber has begun. (8150)

• During the first half of 1983, an intensive analysis of the X-ray laser anti-ballistic missile concept was made. This program definition study examined the feasibility and utility of the concept and potentially related research and development activities for Sandia. The study helped establish Sandia's role with regard to these defensive concepts and provided the guidelines for Sandia's program in this new area of defense technology. (8220)

• The capability of predicting component shock response from computational techniques has been developed and verified on the W87 weapon system. Early in the W87 program, specifications were needed for component design. Detailed analytical models were formulated with the aid of the Cray computer and verified by system level tests. (8120)

• The Mk21 Reentry Vehicle/W87 Program moved into Phase 4 Production Engineering in October. Major warhead testing and telemetry development have qualified the warhead design for 1984 underground effects tests and Peacekeeper (MX) flight tests. (8130)

Components

• The MC3600 is an environmental sensing device (ESD) that senses a two-stage launch acceleration, thus providing abnormal-environment safety for the W87/MX. It contains a unique cylindrical cam and rotary cam-follower mechanism requiring the sensing of two discrete acceleration-time pulses (i.e. first and second boost stages) before actuation occurs. This ESD contrasts with previous launch ESD's that are actuated by a single stage acceleration of sufficient time and magnitudes. (2540)

• A radiation-hardened 2μm CMOS (complementary metal oxide semiconductor) technology has been proven-in on a 16K static RAM (random-access memory) that can tolerate a total ionizing dose of greater than one megarad, is free from latch-up, and is immune to single event upset by cosmic rays. Several versions of this device have

been designed: an asynchronous 16K by 1 organization and a synchronous 16K x 1 organization for memory-intensive applications; and a 2K x 8 organization for smaller systems.

In cooperation with Dept. 1810, the atomic nature of the defects responsible for radiation degradation of MOS devices has been detemined. This information has led to a better understanding of the silicon/silicon dioxide interface for both radiation-hard and radiation-soft oxides. (2140/2110)

• We have developed an instrument employing large-area silicon photodiodes to monitor the neutron generators operated in weapon systems during flight tests. This device, the MC3799, contains two X-ray detectors and two neutron detectors that separate and measure the performance of the two simultaneously operating neutron generators. The technique of separating the data is the subject of a patent application now being processed by the DOE. This signal separation feature is included in six of the seven Joint Test Assembly neutron detectors that we now have under development or in production. (2560)

• The use of the Li/FeS_2 electrochemical system in thermal batteries is relatively new and offers substantial performance advantages and cost savings over the older $Ca/CaCr0_4$ system. Unfortunately, batteries using the new system experience an initial high voltage transient, lasting for 30-90 seconds. We have now defined the mechanisms leading to the transient and developed a technique for mitigating it: adding $CaSi_2$ to the FeS_2 cathode creates many small, localized "short circuits" that keep the battery voltage within acceptable limits for the first minute of battery operation. A patent was issued for the process. This approach is now being employed for most new thermal batteries used in nuclear weapons. (2520)

• We are developing a laser weld capability that involves a plasma formed above the work piece by the interaction of a 5KW carbon dioxide laser beam and the gaseous metal vapors. Single pass autogenous girth welds were made in 6.5 mm thick 304 and 316 stainless steel cylinders at speeds up to 1.25 cm/sec. The quality of the weldment was good; however, it did not meet the stringent production porosity requirements. In later experiments conducted on flat samples, we obtained high quality, porosity free welds by using a helium cross jet to eliminate or minimize the plasma. In addition to reducing the porosity, the cross jet resulted in a 30 percent increase in depth of penetration. (8410)

• As part of an ongoing effort to develop improved radiation resistance in quartz oscillators, we have developed a new method to assess the sensitivity of the quartz material to ionizing radiation. In this method, impurities present that cause the offending radiation response are thermally activated and detected by relatively simple electrical measurements. Because the impurity levels of concern are below those readily detected by standard chemical techniques, the only method to assess radiaiton tolerance previously was to fabricate complete quartz devices and expose them at large pulsed radiation facilities (such as Hermes II), a time-consuming operation. The new measurement technique is important because it allows radiation tolerance assessment before fabrication of devices and because it can be done with readily available equipment. (2530)

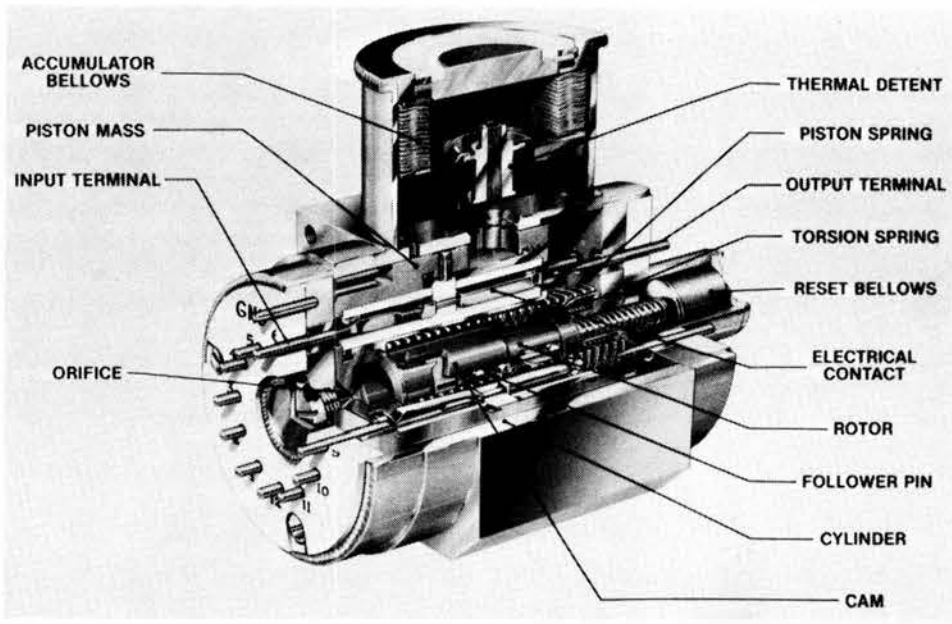
• Sandia's "Fluorinert" capacitor technology has been shown to perform significantly better than those available from the capacitor industry in long life, repetitive discharge service. It appears that an increase in energy density of more than an order of magnitude is possible with this technology in such applications as magnetic and inertial confinement fusion, particle beam technology, radar, communications, and medical electronics.

A hybrid energy storage capacitor has been developed for use in the Peacekeeper warhead. The design consists of a Mylar capacitor and mica paper capacitor connected in parallel. The Mylar capacitor serves as the weak link which fails in case of an accident, and the mica paper is very radiation hard. This is the first time a radiation hard/thermal weak link capacitor has been employed in a warhead. (2150)

• We have completed development and started production of new firing sets for the B83 modern strategic bomb, the W84 Ground-Launched Cruise Missile, and the W85 Pershing II warhead. In addition, we introduced and have begun to develop an entirely new type of firing set that achieves lower production cost and improved performance by integrating the tranformer-coupled strong links with the exclusion region barrier, and by employing advanced hybrid and electro-optical technologies. (2360)

• We have completed development and started production of several major electronic systems this year: an Automated Code Control System for streamlining the management, handling, and verification of weapon release codes; arming after assessing the deployment trajectory; Aircraft Controllers that provide the command and control of weapons on the FB111 and B52 aircraft; Trainers for Cat D, F, and G systems; an interconnect and control assembly for the B83, the SANDAC IV multi-processor computer, and Mini-RIMS inertial navigation system. In addition, several programs attained significant milestones: the W81 combination TSSG/programmer successfully completed compatibility tests; the TSSG for the B61-6, 7, 8 was redesigned and is undergoing flight tests; and the FBIA (Force-Balance Integrating Accelerometer) for Trident II has been redesigned, eliminating about half the components. In addition, a new generation insulin pump has been designed and tested, and our technology transfer partner has started manufacturing activities. (2330)

• Two radiation-hardened 16K-bit MNOS (Metal-Nitride-Oxide-Semiconductor) EAROMS (Electrically-Alterable-Read-Only-Memory) have been designed and fabricated. These devices (the first Sandia silicon gate MNOS circuits), are nonvolatile (retain data in memory without power applied) and can be erased and written electrically. These devices will also retain their data in both a nuclear weapon or space environment for up to 10 years without being rewritten.



ENVIRONMENTAL SENSING DEVICE is the first to be actuated by two acceleration-time pulses. It provides abnormal-environment safety for the W87/MX.

A hardware and software system was developed for parallel testing of MNOS memories in which numerous parts can be tested for endurance in parallel. The data gathered by these tests are essential to the succesful use of MNOS in high reliability systems. (2110)

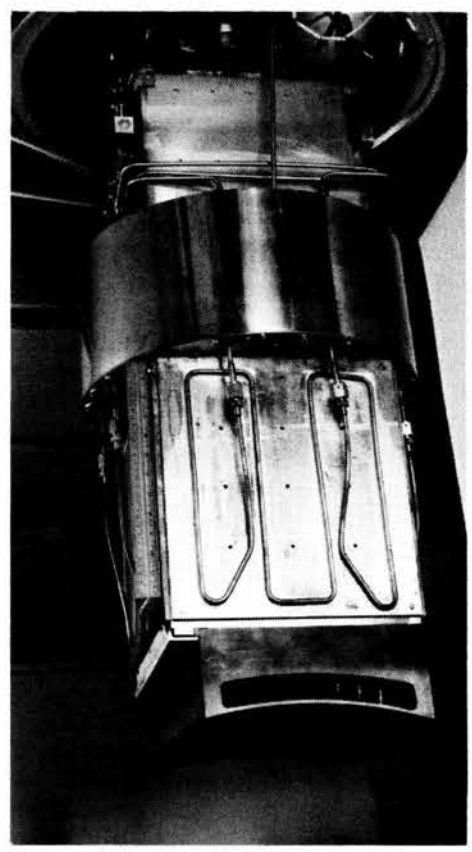
• We have designed a hermetic Aluminum Lightning Arrestor connector (Aℓ-LAC) that will be smaller, lighter, and less expensive to produce than the current LAC. The Aℓ-LAC program passed a major milestone when the first development lot passed environmental and electrical testing. This included a 20kA simulated lightning test. The Aℓ-LAC demonstrates the feasibility of a new line of aluminum hermetic connectors. This new Aℓ-LAC is made possible by a glass that is capable of sealing to alloys with high coefficients of thermal expansion. (2150/1840)

• Hybrid microcircuits (HMCs) are miniature electronic assemblies receiving increased emphasis in systems design. These circuits typically comprise conductor and resistor films deposited on ceramic with additional passive and active components applied to yield the smallest formfactor. In earlier years, such circuits had technology restrictions and were used for only a few applications, such as radars and electronic switches. Over the past year, the logistics and technology for building these miniature electronic assemblies have been significantly improved so that HMCs are attractive for many other systems, such as firing sets, accelerometer controls, programmers, gyro electronics, weapon controllers, and telemetry systems. (2120)

• We demonstrated that electroplating/electroforming techniques can be used to fabricte full-scale components with specific mechanical properties. This technology has been used to produce nickel nose cone fairings that have high strength but are brittle enough to shatter readily upon impact. Typical mechanical properties of the nickel produced by the electroforming operation are: 275,000 psi compressive strength, elongation 1 percent, <1 in-lb impact strength, and a hardness of R_C 60-62. Mechanical properties can be tailored to meet specific requirements. (8310)

Energy

• An Advanced Limiter Test Module (ALT-1) was constructed, tested, and shipped to the TEXTOR at Juelich, West Germany, for use in tokamak experiments. The module allows the study of new ways to remove heat and particles from magnetic fusion devices. It consists of a variable geometry pump duct and a moveable graphite head that is in contact with the plasma. The ALT-1 program includes Sandia Livermore, Sandia Albuquerque, the University of California at Los Angeles, and Kernforschungsanlage Juelich, West Germany. A more ambitious program, ALT-II, involves development of a full-scale limiter and is now in the feasibility study phase. Participants in the ALT-II study include the laboratories mentioned above as well as groups in Japan and Canada. (1830)



NOW ON SITE at the TEXTOR in West Germany, this Advanced Limiter Test Module may lead to new ways to remove heat and particles from magnetic fusion devices.

• We have developed the first repeatable, controlled internal combustion engine experiment for the study of engine knock phenomena. The experiment provided the first time-and-space-resolved measurements of temperature during the auto-ignition of the unburned mixture. (8360)

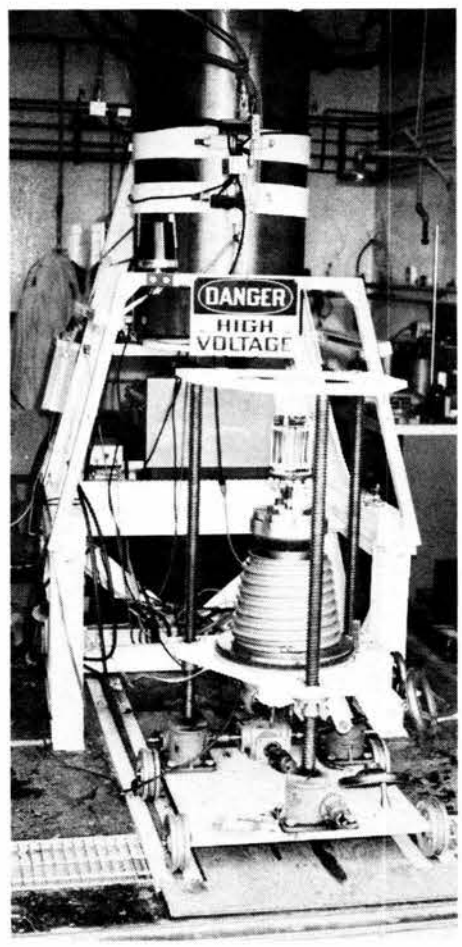
• Using sol gel technology, we developed a process for producing an anti-reflective surface coating on 10-foot long glass solar receiver tubes. This process is the first large-scale application of sol gel coating technology in the U.S. Solar transmittance values of 96 percent have been obtained (compared to 91 percent for uncoated tubes), thus improving performance of the trough collectors. (7470/1840)

• Using the Magma Simulation Facility at Sandia, we obtained the first direct measurements of heat transfer rates in a basaltic magma under typical magma chamber conditions (temperatures >1000°C, pressure≈2 Kb, corresponding to a depth of 8 km). In addition, a finite element model of the experiment provided estimates of the magma viscosity under such conditions. These results are significant for assessing methods of thermal energy extraction from upper crustal magma bodies, as well as for modeling the evolution of these systems. A paper reporting the experiment is scheduled to appear in *Science*. (1540)

• For the first time, we have applied the study of connectedness of irregular shapes, known as percolation theory, to heterogeneous combustion. This synthesis solves the longstanding problem of characterizing flame coalescence in sprays and provides the first quantitative explanation for fragmentation phenomena observed during coal char burnout, heat-shield ablation, and related processes. (8360)

• We completed the construction of a major research experiment in solar central receiver technology at the Sandia Central Receiver Test Facility (CRTF) this year. The Molten Salt Electric Experiment (MSEE) is the first U.S. system to use molten salt rather than water to transfer and store heat collected by a field of sun-tracking mirrors (heliostats). The MSEE, which uses the existing 5 megawatt heliostat field and tower at the CRTF, will generate 750 kilowatts of electricity and will be evaluated in various power production modes over the coming year. The experiment is jointly funded by the Department of Energy, the Electric Power Research Institute, and six private companies. (6220/8450)

• In support of the Subseabed Disposal Program (SDP), the Instrumented Seabed Penetrator (ISP) project completed a test of two free-fall penetrators in the Santa Cruz Basin northwest of Los Angeles, Calif. This test was the first in a series of three that will demonstrate the feasibility of using free-fall penetrators as vehicles for the emplacement of radioactive wastes in seabed sediments. The primary objective of the 1983 test was to verify that the Explosive Acoustic Telemeter (EATM) would function properly in moderately deep water (1700m). The instrumentation on board the penetrator measured deceleration and from these data computed impact velocity and penetration depth. These were then reported by the EATM. (1620)



MAGMA SIMULATION FACILITY allowed the first direct measurements of heat transfer rates in a basaltic magma under typical magma chamber conditions.

• We have completed a series of laboratory experiments that conclusively demonstrate that rubble bed permeability affects yield loss in *in situ* oil shale retorts. Previously, it was thought that yield was controlled solely by particle size and shale grade. The effect of permeability on yield is a significant finding because permeability is more amenable to control through improved design than particle size or shale grade. These laboratory experiments, therefore, indicate that the potential exists for significant improvement in yield from the next generation of modified *in situ* retorts. (6240)

• Doppler broadening spectroscopy was used to characterize the formation of soot in laminar diffusion flames as a function of ambient pressure. Results show that the total soot volume increases rapidly (approximately as the square) with pressure. These results have important implications for energy production at the elevated pressures characteristic of practical combustion. (8350)

• We have designed and fabricated a photovoltaic concentrator module that has the highest solar-to-electric conversion efficiency ever obtained using silicon solar cells. The module uses a point-focus Fresnel lens to focus sunlight, concentrated 200 times, onto specially designed silicon solar cells. Solar cell efficiency is 19.5 percent and lens optical efficiency is 86 percent, resulting in an overall efficiency of 16.8 percent. This design will serve as a vehicle to transfer the technology to several industrial contractors who are developing similar modules. (6220)

• Using novel laser-based experimental techniques, we have investigated a number of chemical reactions involving oxygen atom or hydroxyl radical attack on various hydrocarbons. Such chemical reactions are fundamental to almost all combustion processes, yet the rates and mechanisms of many of them are surprisingly poorly understood. The unstable oxygen atoms or hydroxyl radicals were generated by using pulses of ultraviolet light from excimer lasers to dissociate stable precursor molecules. The rate of the reaction was then measured by observing chemiluminescence or by using a second laser to generate observable fluorescence from the reactant as it was consumed in the reaction. The reactions studied included those important in pollutant formation in flames as well as those governing the knock process in internal combustion engines. (8350)

• Sandia's surface electrical potential (SEP) system was fielded during the chemical stimulation of a geothermal well in the Beowawe Geothermal Field. This system, which measures variations in resistivity resulting from the flow of conductive fluid into the reservoir, has been used in the evaluation of hydraulic stimulation treatments in oil and gas reservoirs, but it has never before been applied in a geothermal well or during an acid stimulation. The Beowawe test showed that the SEP system is highly sensitive to chemical stimulation, and the test data indicate that it should be possible to map the acid flow paths as well as the *in situ* conductive zones. (6250)

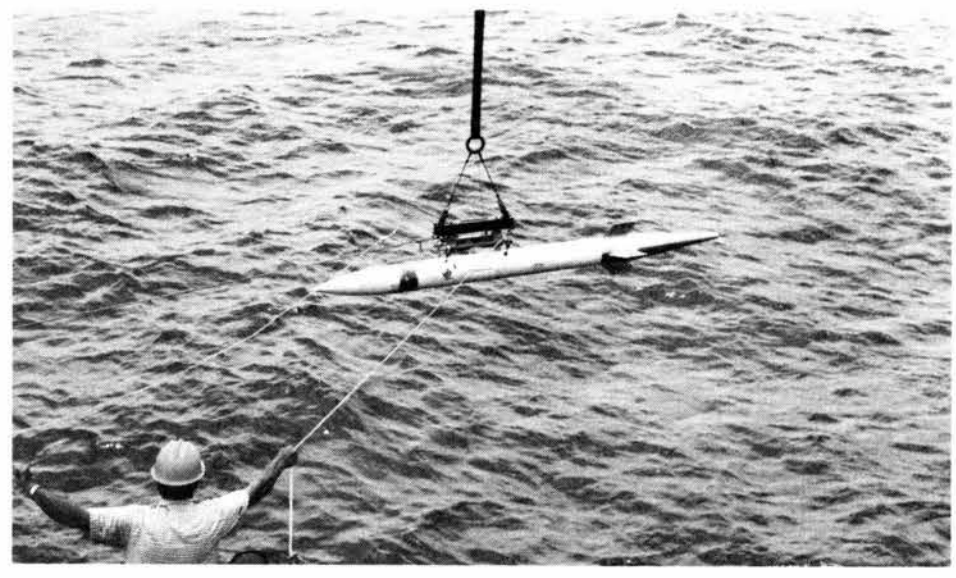
• We characterized the geology and hydrology of the Waste Isolation Pilot Plant (WIPP) site in southeast New Mexico to a level of detail sufficient to justify full construction of the facility. Topical reports covering such concerns as structural deformation, salt dissolution, and site hydrology (coupled with detailed geologic studies in about two miles of underground drift) concluded that natural conditions and processes at the WIPP site will assure adequate isolation for defense transuranic wastes. Studies continue, especially in hydrology, to increase the level of confidence and to provide a more detailed understanding of the hydrologic model to be used in conducting isotope transport calculations. (6330)

• Since 1979, Sandia has managed the oceanographic field program in support of DOE's program for disposing of decommissioned nuclear submarines at sea. This field program has identified two potential sites, one in the Pacific Ocean and one in the Atlantic. We have conducted a complete environmental assessment according to a set of site selection guidelines developed early in the program. The Navy used this work to support the draft environmental impact statement that was recently opened to public comment. The final statement is expected to be published in February 1984. (6330)

• We have developed and analyzed a theoretical model that predicts a wide range of pulsating and cellular flame instabilities. The nonlinear differential equations that are the basis for the model can have multiple solutions, only some of which are mathematically stable, i.e., physically realizable. Employing a nonlinear stability analysis, we have derived, for the first time, flame speed formulas for pulsating cellular flames. Flames often propagate in a steady fashion, but under some circumstances they can pulsate and develop wrinkled or cellular structures. These pulsating cellular flames bifurcate, or branch, from the steady flames at certain critical values of some physical parameter, such as the activation energy of the chemical reaction. We have also shown how quasi-periodic flames can arise as a secondary bifurcation from a time-periodic primary bifurcation state, and we have predicted "mode-jumping," in which there is an exchange of stability between two time-periodic primary states. Some of these phenomena have now been observed in both condensed and gas-phase flame propagation at Sandia, LLNL, and elsewhere. (8230)

• The Geotechnically Instrumented Seafloor Probe (GISP) was used in two 5-month tests to measure pore-water pressures in soft marine sediments on the Mississippi delta. Test results in undisturbed sediments support the conclusions of conventional geological and geotechnical investigations regarding changes in the depositional environment during the growth of the delta. Pore pressures measured in an unstable collapse depression were so high that the soils appear to be fully suspended in the water. These tests with GISP and the related Seafloor Earthquake Measurement System have successfully demonstrated the technology for long-term data gathering on the seafloor at remote sites. (6250)

• We used model solvents to disclose the role of hydrogen bonding in subbituminous coals and to under-



READY FOR FREE-FALL into the seabed off the California coast, this Instumented Seabed Penetrator carried an Explosive Acoustic Telemeter that allowed computation of the impact velocity and penetration depth after a fall through 1700 meters (more than a mile) of ocean.

stand the mechanism for coal dissolution reactions. Results for the liquefaction of Wyodak coal (375°C, 100 psig nitrogen) suggest that this coal is composed of sub-units ("molecules") in the molecular weight range of 250 that are held together by hydrogen bonds. This work suggests novel process concepts in which coal may be liquefied under extremely mild conditions of temperature and pressure. (6240)

• We used the DIFFUSE computer code to predict the expected tritium permeation and inventory in the Tokamak Fusion Test Reactor at Princeton; the predictions help to determine the operating procedure for the introduction of tritium into the machine. It appears that, for the expected material properties and operating scenario, there will be no tritium permeation through the stainless steel walls and less than 1k Ci of tritium inventory in the walls. (8230)

• We composed preconceptual design studies for the development of a nuclear waste repository at the Yucca Mountain Site in Nevada. These studies used site characterization data and material property information of the volcanic tuff host rock to develop preliminary underground and surface facility configurations capable of receiving up to 70,000 metric tonnes of initially loaded heavy metal in the form of spent fuel or reprocessed high level waste. An architect engineer is beginning to develop conceptual design allowing the DOE to decide whether to characterize the site with an exploratory shaft. If Yucca Mountain is ultimately chosen as the first repository site, these design studies would be the basis for construction of a facility to safely dispose of approximately one half of the waste from the commercial nuclear power plants projected for the U.S. through the year 2000. (6310)

CITY'S WINTER "HAZE" includes wood smoke and vehicular exhaust components, says a Sandia study based on both surface and aerial sampling techniques. The results will aid in Albuquerque's battle against air pollution.

Research Sciences

• Dramatic progress continued in the newly discovered field of Strained Layer Superlattices (SLS's). These new semiconductors may be tailored to optimize their performance for a variety of applications. Electronic transport studies, photoluminescence studies, and ion channeling research have increased our understanding of SLS's and confirmed the excellent quality and tailorablility of the properties of these multi-layered semiconductors. One of the exciting results is that SLS materials make more efficient light emitters in the green wavelength range than do bulk materials. This suggests the possibility of efficient green LED (light emitting diodes) and solid state lasers emitting in the green. Other experiments have produced very high mobility materials through the modulation doping process; these SLS materials are interesting for applications like very fast transistors for microwave and computer applications. SLS research will continue on new optoelectronic and high speed devices. This research has already resulted in six patent disclosures and 25 scientific publications. (1140/1110/1130/1150)

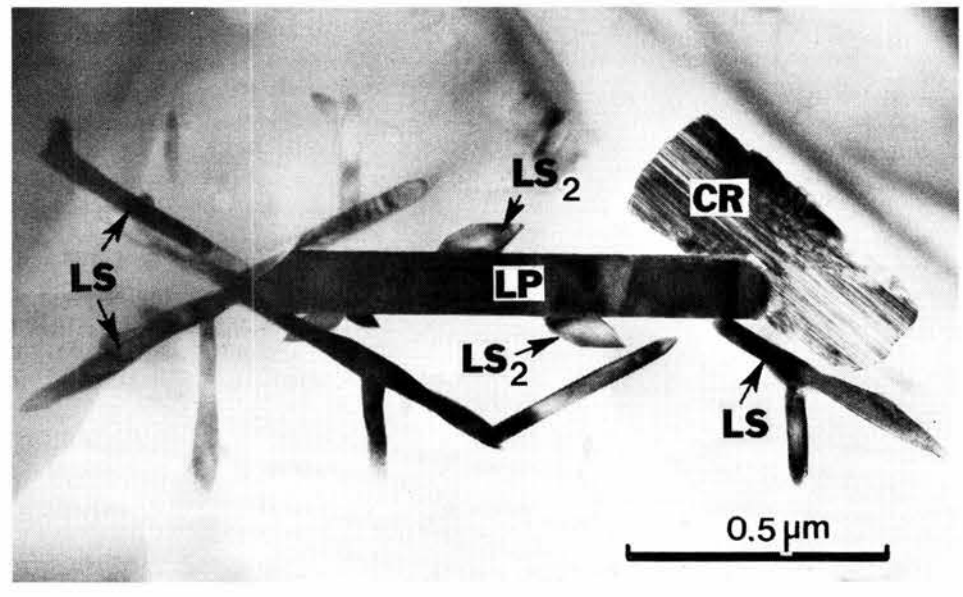
• The RSA two-key crypto-algorithm, used in several Sandia programs and currently the main contender for a national two-key crypto standard, is only as secure as the factoring of a large number is difficult. In 1982, 50-digit numbers were the limit of what could be factored in practical amounts of time on even the largest computers. Exploiting the architecture of the Cray computer, we have advanced the state-of-the-art in factoring to the point that 67-digit numbers can now be factored in less than 14 hours. The significance of this accomplishment is that the smallest acceptable size of the keys — a pair of numbers — needed in the RSA crypto-algorithm for the system to be cryptosecure is much better defined than before. (1640)

• We have designed a series of field sampling techniques to quantitatively convert high temperature fumarole and volcanic gases (SO_2, H_2S, HCl, HF) into known stable compounds. Analytical chemistry methods have been developed to analyze the compounds and to allow quantitative inference of the on-site gases. These procedures have been successfully applied at active sites on Kilauea Volcano and at Mammoth Lakes, Calif., during the past year. These sampling and analytical techniques are potentially important in the monitoring of gases released from magma moving into shallow crustal depths under volcanic regions. (1540/1820/6320)

• Future weapons systems will require structural components manufactured of alloys that have high strength and significant resistance to fracture (high fracture toughness). A theory that relates fracture toughness to the size, spacing and number density of second phase particles has been used to guide the development of tough, high strength steels. An alloy has been produced that has the highest toughness ever measured in a low alloy steel at the strength level. This material will provide new design capabilities and significant cost savings in future systems. (8310)

• We have developed new experimental techniques that permit real-time measurements of the melt and resolidification dynamics of solids subjected to pulsed laser irradiation. These techniques are being used to study the fundamental processes that govern crystal growth at extremely high velocities (meter/sec) and to examine the thermodynamic parameters of metastable solids. Results include the demonstration that amorphous silicon melts by a first-order process at a temperature about 200 degrees C below the melting temperature of crystalline silicon and can be transformed extremely rapidly to crystalline silicon in a process mediated by a 20 nm molten layer. We have also made the first measurements of impurity-induced reduction in crystallization velocity under rapid solidification conditions in order to understand the mechanisms that control formation of supersaturated solid solutions and metastable phases. (1110)

• We have made significant advances in the science of glass-ceramics. We have used transmission electron microscopy to understand the role of nucleating agents that are added to glass-ceramics to promote formation of desired crystalline species. For the first time, we have direct evidence that confirms the widely accepted mechanism of nucleation and epitaxial growth on precipitates that incorporate an oxide



ELECTRON MICROGRAPH confirms long-suspected epitaxial growth on precipitates with an oxide nucleating agent; here, cristobalite (CR), lithium metasilicate (LS), and lithium disilicate (LS_2) grow on the exposed faces of a lithium phosphate (LP) crystal in Sandia-developed S-glass, a glass-ceramic containing P_2O_5 nucleating agent.

nucleating agent. Electron diffraction has demonstrated the epitaxial relationships between host and nucleating crystals. Understanding these structural relations between nucleants and the crystal species they generate may lead to novel techniques for tailoring the properties of glass-ceramics. (1820/1840)

• We have observed spontaneous helium bubble formation in tritiated metals for the first time. The transmission electron microscopy and small angle neutron scattering techniques employed in these experiments corroborated our theoretical predictions. (8340)

• Our research on laser-surface interactions has led to techniques with important consequences in microelectronic circuit processing. One technique is a laser-based process for direct etching of semiconductor materials composed of elements from Groups III and V in the periodic table. This process has high anisotropy in the sense of depth-to-width etching ratios and high selectivity between p- and n-doped material. A second technique resulted from the discovery of a method for silicon deposition that uses both lasers and plasmas. Very rapid epitaxial growth rates are achieved because the plasma strongly increases the chemical activity of the silane (a gas used in semiconductor circuit processing) before it reaches the surface. The laser stimulates the epitaxial growth of the deposited silicon. (1120)

• A multiphase reactive flow model based on the theory of mixtures has been developed to describe the thermal, mechanical, and transport processes of flame spread in granular explosives. Using available thermophysical and chemical kinetic data, we have made predictive calculations for the granular explosive CP. These calculations successfully matched experimental streak camera observations of the transition from deflagration to detonation in a confined column of the explosive. This numerical modeling tool has been developed to aid in design of low-voltage detonator components. (1510)

• We have developed the Embedded Atom Method as a means to add to the understanding of the fracture of a transition metal in the presence of hydrogen. Dynamic calculations on room-temperature nickel with hydrogen impurities reveal the process by which hydrogen affects crack growth and propagation. In brittle fracture, hydrogen is bound to the weakened ligaments formed during fracture, and causes decohesion between the metal atoms in the ligaments. New calculations also show the production of dislocations by the crack and their interaction with hydrogen. (8340/8230)

• We have developed a new high-spectral-resolution Raman spectroscopy technique, ionization detected stimulated Raman spectroscopy (IDSRS), that has thus far demonstrated more than a thousand-fold increase in detection sensitivity over any other Raman spectroscopic method. Preliminary experiments have been performed on the nitric oxide molecule, but the IDSRS method promises to allow the study of several other weak Raman scatterers. Furthermore, these studies may eventually lead to the use of Raman methods in measuring and studying transient species in chemical reactions where the low sensitivity of present-day methods renders such applications impossible. (1120)

• We have developed weighted multivariate least-squares statistical methods to improve the accuracy, sensitivity, and applicability of quantitative analysis by infrared spectroscopy. These methods have been successfully applied to the analysis of gases, organic liquids, and glasses. Rapid quantitative analysis of PCB's (polychlorinated biphenyls), a compound of great environmental concern, has been demonstrated. The computer codes implementing these routines have been requested by and delivered to most of the infrared spectrometer manufacturers for adaptation to their system software. (7220/1820)

• We have developed a microwave interferometer technique that permits continuous direct observation of the position of a combustion or detonation wave front in a granular solid explosive. This nonintrusive technique has been used to observe shock growth-to-detonation and deflagration-to-detonation transition in explosives. These phenomena are difficult to observe by other conventional methods, but their observation is important to component development. (2510)

• To solve some production difficulties with a uranium-niobium alloy at DOE's Y-12 facility at Oak Ridge, Tenn., a Sandia vacuum arc melt experimental/numerical effort on a melting/solidification process has shown that macrosegregation upon resolidification can be minimized when a melting current is selected such that the Lorentz-driven flows are dominant over the buoyancy-driven flows. Our experiments have characterized the metal transfer process for this alloy and have also shown that a quality problem in the Y-12 electrode process stream is caused by the presence of contaminants that create a refractory film on the molten pool atop the ingot. This technology is currently being transferred to Y-12. (1830/2640)

GASES FROM FISSURES along the East Rift Zone of the Kilauea volcano in Hawaii were collected by Terry Gerlach (1543) and Ed Graeber (6324) during the eruption of January 1983. The collection and analytical techniques being developed (with the aid of Div. 1821) are likely to be important in monitoring gases released from magma moving into shallow levels under volcanic regions.

CROSS-SECTIONAL VIEWS of a nickel slab with defects, showing the effects of hydrogen and stress. Crystallographic directions are indicated. Open circles represent nickel atoms. Three unit cells in the vertical direction are shown, and three in the direction perpendicular to the page. (a) Four nickel atoms in each cell have been removed from the midplane and an artificial stress of 0.11 eVÅ^3 applied to the outer surfaces. No fracture occurs. (b) Same slab with the addition of one hydrogen atom (solid circles) per unit cell. The energy in (b) is not converged, and further iterations show the halves to be completely separated.

Testing

• A joint flight test telemetry (TM) system has been designed and built for the Navy Standard Missile-2 Development program. The TM is configured to replace the high explosive in the test assembly. The electronic design incorporates much of the latest in Sandia flight telemetry concepts, but this design has a unique packaging concept that allows the W81 to be one of the most war reserve (WR)-like JTA (joint test assembly) designs to date. Also, because the TM package is quite representative of the WR high explosive parts, the Pantex assembly will also be more representative of WR procedures. (5330)

• A facility modernization program designed to reduce the radiation exposure of operators has resulted in new methods of operation at the Sandia Pulse Reactor (SPR) Facility. By making improvements in many areas — the facility, facility support systems, the reactor stand, and administrative policies — the overall radiation dose to operators has been significantly (33 percent) reduced. A movable, 2-inch thick, lead shadow shield usable in many maintenance operations, for instance, attentuates the radiation field by factors of 10 or higher at normal positions occupied by operators performing the tasks. (6450)

• We have developed and put into service the TC894 Delayed Fireset. This component is a synthesis of a high-voltage power supply, a digital time delay and a fireset. It is capable of firing up to four exploding bridgewire (EBW) detonators. It can also be used as a trigger source for the delayed firing of standard EBW firesets. The delay can be adjusted with digital switches over a range of one microsecond to 999,999 microseconds.

The TC894 was originally conceived for special explosive firing applications, but it was quickly applied to the underground test program where it has been used for the delayed firing of the detonators on LLNL nuclear devices and is being included in a delayed firing system for LANL nuclear events. (7130)

• Long period (10-40 sec) surface seismic waves have been measured to determine nuclear seismic yields to complement the short period (1 sec) waves traditionally employed. These long period waves, while of lower amplitude, are less influenced by inhomogeneities in the propagation path. The results from a small set of events give standard deviations in the range of 1.1 to 1.3 regardless of source location. This compares favorably with the Sandia Seismic Net value of 1.16, which requires some knowledge of the source location. (7110)

• We have developed a non-explosive method of simulating pyrotechnic shock for component testing. (Pyrotechnic shock refers to any oscillatory high-frequency acceleration pulse, typically caused by exploding charges such as stage separation hardware.) The component to be tested is mounted on a thick aluminum plate which is then struck with a steel hammer or projectile. Plate response can be varied by changing the plate dimensions, hammer size, or impact speed. This method is superior to the usual drop test for simulating pyrotechnic shock. (7540)

• We have designed and developed an ultrasonic phased-array transducer that allows better sizing of flaws in engineering materials. This annual transducer permits electronic focusing of ultrasonic energy at known depths in the material. The transducer provides better information because focusing produces larger echos from flaws at the focal depth than those produced by conventional spherical-wave transducers. In use (in the Nondestructive Test Lab), the transducer is automatically scanned over the test specimen and pulsed to send energy to a number of depths at each step of the scan. The echos from any flaws are recorded on a computerized digital data acquisition system. The final result is a three-dimensional image of flaws in the material. (7550)

• A Global Positioning System (GPS) satellite, with Sandia instrumentation aboard, was launched July 14, 1983. It is the first GPS satellite capable of nuclear detonation detection (to verify compliance with the Limited Test Ban Treaty) and is performing flawlessly. The detection system includes a Sandia-designed optical fireball sensor and a processor that collects, time-tags, and formats data for relay to ground receiving stations. The satellite is in a circular orbit 10,900 nautical miles above the earth's surface and is exposed to a radiation environment that necessitates radiation-hardened parts. Some of these parts are supplied by Sandia's Center for Radiation-hardened Microelectronics. An eventual constellation of 18 GPS satellites will provide a full-time worldwide detection and navigation capability. (5310)

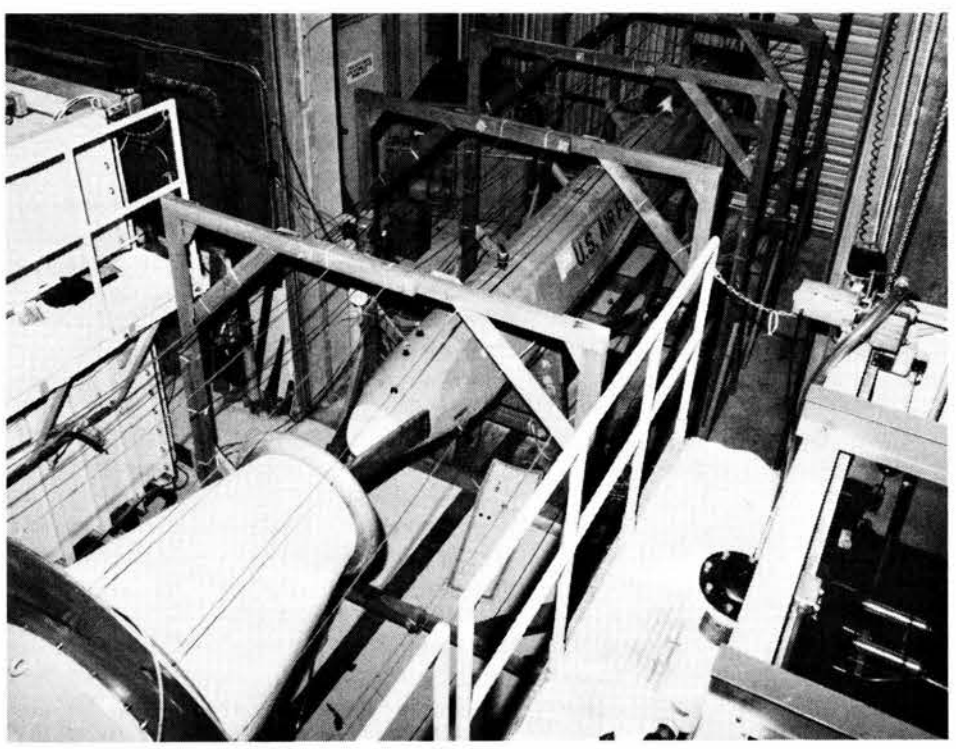
• The Tonopah Test Range developed the capability to support off-range test activities by mobilizing three prime instrumentation systems. A NIKE-Hercules tracking radar was reworked into a highly mobile instrumentation configuration, the new mobile optical tracker was completed, and an S and L-band self-tracking telemetry antenna system was integrated into the TTR control network. All three systems can be transported aboard military cargo aircraft; the radar and TM systems will be used to support Sandia operations in the Pacific during FY84. (7170)

• Our new remote radiant heat test facility permits the controlled high-temperature testing of devices that contain sizable quantities of high explosive (HE). This facility consists of a 12-ft-square test cell with communication links with the main radiant heat facility where the test is controlled. All data from thermocouples and other transducers are recorded by the computer-controlled data acquisition system.

The new facility (located near the main radiant heat facility in Area III) has been used to simulate backface heatshield temperatures of a W87/MX warhead with live HE; it will be used in future development testing of components or assemblies containing sizable quantities of HE or similar hazardous materials. (7530)

• We used the Lightning Simulator to subject an Air-Launched Cruise Missile (ALCM), both with and without an inert W80-1 nuclear warhead, to simulated lightning tests. These tests were part of the Atmospheric Electricity Hazards Protection (AEHP) program, which is a joint undertaking of USAF, USA, USN, DNA, FAA, and NASA, and coordinated by the Air Force's Wright Aeronautical Laboratories. Lightning protection concepts developed by the AEHP program are expected to minimize cost, weight, and power reliability/maintainability requirements for advanced airframes and systems. The direct stroke of severe natural lightning was simulated in 33 tests. (7550)

• With the completion of the High Pressure Station, the Tritium Research Laboratory can now safely generate and handle tritium at pressures up to 25,000 psi. This capability opens an extensive range of experiments involving the effects of tritium and its decay product, helium-3, on materials and components of interest to Sandia. Already underway or scheduled are investigations into the long and short term behavior of tritium-containing systems, the super-conductivity of PdT_x (palladium tritide of variable stoichiometry) at high pressures and cryogenic temperatures, and the growth and mechanical properties effects of tritium-induced helium bubbles in Cu, Ni, A-286, steel, and various stainless steels. (8440)



IN SANDIA'S LIGHTNING SIMULATOR, an Air-Launched Cruise Missile was subjected to direct strokes of severe lightning, part of a joint Atmospheric Electricity Hazards Protection program.

Safeguards

• We have developed two computer programs that generate a two-dimensional graphic perspective of the video output produced by a CCTV (Closed Circuit Television) camera. After various input parameters (such as camera lens and orientation) are entered, the programs automatically calculate and graphically plot the locations of various items, e.g., fences, an assessment zone, running men, and intrusion detection sensors. With this type of simulated perspective, proposed camera locations can be rapidly evaluated without the costly time delays and expenditures associated with field evaluation. (5260)

• The demonstration of a 1 megabit/sec Loop Multiplexed Communications System for data transfer from sensors to host computers at security sites was successfully completed by the incorporation of dual loop controllers and multiple slave processors. The system solves the problem that occurs when several widely separated intrusion alarms need continuous supervision and fast access to central computers. Sandia will provide technical support for the installation of this system at multiple DOE facilities. (5260)

• A Miniature Surveillance Television and Recording system (MINISTAR) has been developed for use by the International Atomic Energy Agency (IAEA) in unattended surveillance. It can be used in either installed or portable applications and can replace film camera systems now in use. The advantages of this system over film cameras include increased scene recording capacity and on-site review. The system incorporates unmodified commercially available video equipment into a Sandia-designed tamper-resistant control system. Six development systems are being fabricated for evaluation by the IAEA in FY84. (5250)

• We have developed and demonstrated an Automatic Position Location System for land vehicles. The system utilizes a dead-reckoning computer that employs compass and odometer inputs to determine the location of a vehicle. Drift is removed from the system by obtaining fixes from a TRANSIT satellite receiver at about 90-minute intervals. The system operates in an unattended mode and provides an accuracy of about 1 to 2 miles. (5210)

• We have completed Phase I of a state-of-the-art small arms training range. Called the Live Fire Range, it is for use by DOE Albuquerque Operations, Sandia Security, and Nuclear Security Systems personnel. In addition to conventional capabilities, this range safely accommodates stressful tactical scenarios with radio-controlled pop-up and moving targets. Also included are nighttime firing capabilities and other advanced target systems that instantaneously record and display the shooters' scores. (5210)

• We performed a human factors evaluation at Nellis AFB to determine the alarm assessment and communications capabilities of security police certified in operation of a closed circuit television system with three rows of five television monitors. Multiple live intrusion scenarios under daytime and nighttime conditions and false alarms were displayed on the monitors. Specific attention was given to operator capabilities in performing immediate visual assessment (IVA) of multiple simultaneous live intrusions at random perimeter locations followed by immediate radio transmissions of target descriptions and locations to interior response forces. Both time and accuracy of assessment and transmission were examined. No performance standards exist for this type of IVA. (7220)

• We have designed and installed a new operator's console in the SECOM (SEcure COMmunications) Control Center that incorporates an interactive map display showing the locations of all DOE convoys. A touch-sensitive face plate on a high-resolution color display allows the operator to rapidly call up a variety of map display options. Additional displays assist the operators in emergency situations by providing a law enforcement contact list for the state involved, and an interactive checklist of procedures to be followed in an emergency.

• In conjunction with the Savannah River Plant (SRP) in Aiken, SC, we have completed the design of the safeguards upgrade system for the four SRP production reactors. Sandia developed the computer-based alarm display and assessment system and also developed an automated entry control system to meet SRP requirements. We have completed the site-specific design details, and we are now transferring the Sandia-developed technology to the du Pont Engineering staff. Sandia will provide technical guidance and field support as this system is installed. (5260)

Pulsed Power Development

• We completed design and construction of the structure of the Particle Beam Fusion Accelerator II (PBFA II) and the design, development and testing of a prototype 6 MV Marx generator. The structure for PBFA II, a 100 TW ion accelerator to be used for ignition scaling studies, was designed using analytical and finite element calculational models. It is extremely unusual in that massive (>5 million kg) loads from structure, insulating fluids, and other dielectrics must be supported over a large experimental access area beneath the accelerator. The 108-foot-diameter, 20-foot-high tank and the support structure have been extensively analyzed for response to various assumed static and dynamic loads. The $2.5 million cost reflects both the size and complexity of the structure. The 36 Marx generators form the prime energy storage for PBFA II and will be the world's largest high-voltage, low-inductance generator of its kind. In addition to demonstrated operation at high voltage and low inductance (<15 μh), the prototype unit has demonstrated long life (>1000 shots so far), low jitter in firing time (<10 nanoseconds), and low cost (<$100,000 for 400,000 Joules). (1250)

• We are developing a radiation pump source usable for laboratory X-ray laser experiments and simulations. Initial experiments on the Proto II accelerator in Area V use imploding noble-gas z-pinches as sources of intense X-ray line radiation. We have produced 2.0 kilojoules of Krypton L-line radiation in a 10-nanosecond pulse, which surpasses by a factor of two the milestone set for 1983. This L-line radiation represents 5 percent of the total kinetic energy in the plasma implosion, which is comparable to the conversion efficiencies observed on longer pulse-length drivers at other laboratories. So far, the experimental data agree well with theoretical predictions. At these energy levels, we have a system capable of studying X-ray laser atom physics. The demonstrated conversion efficiency provides the experimental and theoretical basis for scaling our systems to pulsed-power machine energies necessary for X-ray laser experiments. (1260)

• In the light ion beam fusion program, vacuum diodes convert high power electrical pulses into proton beams. An applied magnetic field ion diode was studied on the Particle Beam Fusion Accelerator I (PBFA I) at the six terawatt level from January until September. The instantaneous ion production efficiency was as high as 90 percent with an average efficiency of 80 percent (±10 percent), and the proton beam divergence was reduced to 1.2°. The efficiency and beam quality are similar to those obtained by sub-terawatt experiments, providing confidence that this technology will scale to the 100 TW level required for inertial confinement fusion with light ion beams. Proton beam efficiency was limited by the anode plasma purity; about 50 percent of the ion current was carried by doubly and triply charged carbon ions. (1260)

• We have developed and demonstrated fixturing and processing techniques to fabricate thin film bolometers for the Proto II Facility. Metal strips approximately 1500Å thick of nickel or chrome/gold composite are deposited by sputtering or evaporation onto smooth fused-silica substrates that are then epoxy-bonded to a machinable glass-ceramic base of complex geometry. By measuring the electrical resistance of the metallic strip during exposure to radiation from a plasma source, these devices allow monitoring the power level of the plasma in true time. (7470)

• To develop high peak power and short duration pulses, pulsed power accelerators use several switching stages. Conventional switches are based on high voltage dielectric breakdown of gasses or liquids. Such devices are inherently single-shot machines and are usually cumbersome. We have developed a new switching mechanism, which holds promise of being more efficient and of being capable of repetitive operation, and tested it at full operating power on the Supermite accelerator. This magnetic switch uses a saturable core inductor to provide rapid switching of a 2 MV, 2 TW pulse into a 2.2 ohm load with a rise time of 70 ns. A second magnetic switch reduces the pulse rise time to 30 ns.

Previous small-scale experiments had shown the feasibility of such switches, but major improvements in insulation and power flow design were required to scale from the 100 kV to the 2 MV level. This experiment represents a major advance in switching technology in that it demonstrates that magnetic switching can be used at the MV, TW power level and promises more efficient pulse forming sections for high power, repetitively operating pulsed power devices. (1250)

Reimbursables

• We completed final development of a laser beam-director system for calibrating satellite radiometric sensors for the DoD. Operation of the computer-driven acquisiton, pointing, and tracking telescope coupled to a high-power pulsed ruby laser was successfully demonstrated for satellite payloads in a number of different orbital configurations. (5320)

• We have designed a system of thermal flashblindness protective windows, based on the electrooptic ceramic PLZT (lead/lanthanum/zirconate/titanate), for the Air Force's B-1B aircraft. The system consists of six modular portholes approximately 6 inches in diameter. When in use, the modules are mounted in the semi-rigid thermal shields of the aircraft — one in front of each of the two pilots and two on each side. All six modules are independently powered and are interchangeable. In event of a very rapid increase in the intensity of light outside the aircraft, the windows will darken much faster than the human blink to exclude more than 99.9 percent of the light and thermal energy. The use of windows rather than goggles extends the thermal protection to all equipment in the crew compartment. (2530)

• We completed the development and installation of the first node of DoD-funded real-time acquisition, analysis, and display network for satellite sensor monitoring. Unique from a Sandia perspective was the in-house development of a complex multi-tasking, real-time operating system that includes a device-independent graphics package, a high level "C" language compiler, a hierarchical file system, and modification of the machine instruction set to support real-time system features. A further achievement was the creation and maintenance of the nearly 800,000 lines of "C" language code on a Bell Labs UNIX software development system. (5320)

• We completed the first major series of experiments for the internationally sponsored program on the energetics of fast reactor accidents on the ACRR (annular core research reactor). A series of tests on the disruption of irradiated fuel under severe accident conditions provided the first visual data indicating the energetic potential of a hypothetical core disruptive accident. A second series of experiments utilizing this technology will investigate later stages of the accident. (6420)

• For the past five years, Sandia has been involved in the advanced development of arming and fusing systems for strategic reentry bodies. This program has involved numerous flight tests of fuzing hardware, component development, and characterization and analysis activities to optimize fuze performance for particular weapon applications. The results from this development activity have now been applied in the engineering development of an integrated Arming, Fuzing, and Firing (AF&F) system for the Navy's Mk 5 reentry body, which is currently being developed by Lockheed Missile and Space Corporation as a payload for the next generation Trident II missile. The Mk 5 AF&F takes advantage of advances in semiconductor technology, radar design, thermal battery chemistry, accelerometer technology, and fire set design to provide an AF&F with significantly enhanced capabilities in comparison to current generation weapon systems. (5150)

• We developed several computer codes for the Nuclear Regulatory Commission (NRC) to use in their regulatory and licensing activities involving geologic disposal of high-level radioactive wastes. These codes can simulate a variety of physical processes: ground-water flow; transport of radionuclides dissolved in ground water; heat transport; geochemical and thermomechanical processes; movement of radionuclides through the surface environment; and human uptake of contaminated food, water, and air. The codes can also determine dose and the resulting risk of adverse health effects from ingestion, inhalation, and external exposure pathways. These codes have been used by NRC in developing regulatory standards for disposal of high-level radioactive wastes, and by the Environmental Protection Agency (EPA) in developing environmental standards for management and disposal of spent fuel and high-level and transuranic radioactive wastes. (6430)

• We investigated the potential interaction between the electromagnetic pulse (EMP) from a high-altitude nuclear burst and commercial nuclear power plant systems required for safe shutdown to identify and remedy any vulnerabilities. EMP signal coupling, induced-plant responses, and equipment damage thresholds were established. A limited test program verified the coupling analysis techniques. Based upon the analysis, it was concluded that: EMP-induced signals are less than nominal operating levels, but they are affected by plant topology; and the likelihood that individual components examined will fail is small. Therefore, it is unlikely that an EMP event would prevent safe shutdown. The results of this study resolved questions on potential nuclear power plant vulnerability raised by several Nuclear Regulatory Commission (NRC) commissioners and staff members and closed out NRC activities in this area. (6410)

• As the culmination of about seven years of effort, the final version of the *Handbook Of Human Reliability Analysis With Emphasis On Nuclear Power Plant Applications* by A. D. Swain and H. E. Guttmann was published by and for the Nuclear Regulatory Commission. An earlier draft version received considerable peer review and worldwide use in applying probabilistic risk assessments (PRAs) to the risk to the public of nuclear power plants. The handbook includes descriptive and probabilistic models of human performance, a data bank, and analytical techniques that enable an analyst to obtain estimates of human error probabilities and uncertainty bounds in the performance of routine and nonroutine tasks in both normal and abnormal situations. (7220)

• At the request of the City of Albuquerque, we planned and carried out a study to define the composition of the cloud that hangs over the city in winter, and to determine the relative contribution of various pollutant sources to that cloud. The two-month study involved routine monitoring of pollutant concentrations at two sites, routine aerosol sampling at three sites, and occasional meteorological measurements and aerosol sampling aloft. It was found that organic aerosol and soot were the dominant species responsible for visibility degradation in the cloud. At the sites in the Northeast Heights, wood combustion contributed most to the cloud from early evening through early morning. During the day, however, vehicular effluents dominated. At the sampling site in the Valley, it appears the vehicular effluents dominated both day and night. Other sources of pollutants made only minor contributions. (6320)

• We have successfully demonstrated a new multiple fracturing technique in Devonian shale gas wells for the Gas Research Institute. The most recent test, in Ohio, increased gas production from 5000 to 22,000 cu ft/day. Previous tests in Kentucky verified that the technology developed in ash fall tuff at Nevada Test Site works equally well in Devonian shale. This High Energy Gas Fracture technique is a propellant-based technology designed to create four to eight radial fractures from the

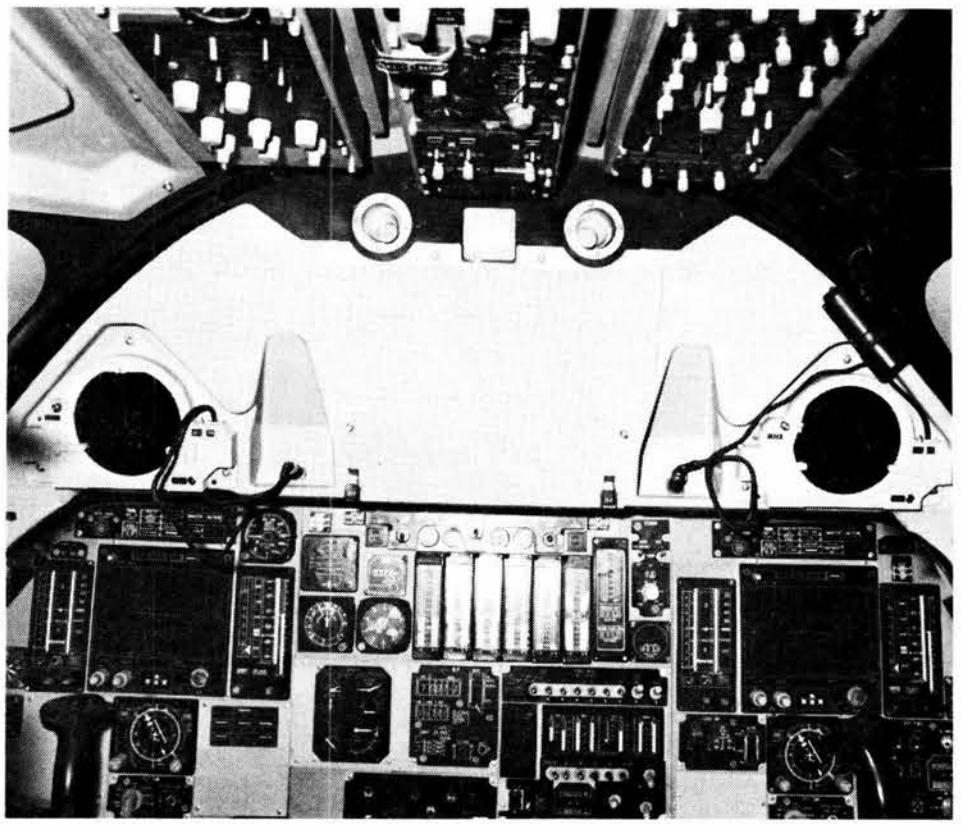
wellbore. The objective is to use the radial, multiple fractures to connect existing natural fractures to the wellbore and improve gas production. (6250)

• Spin-stabilized liquid-filled (phosphorous) artillery projectiles have exhibited rapid despin and nutational instability in flight. Numerical solution of the Navier-Stokes (NS) equations (utilizing the total capabilities of the CRAY 1) for a highly-viscous-liquid cylindrical payload in a spinning nutating coordinate system demonstrated the internal motion of the fluid. The roll, pitch and yaw moments that act on the projectile and that result from the internal fluid motion explain the abnormal flight characteristics of the phosphorous shell. This is the first numerical solution of the NS equations for liquid-filled shells. (1630)

• Based on an on-site sensor survey, a complete intrusion detection system was designed and installed at the Ground-Launched Cruise Missile (GLCM) Site at a Royal Air Force base in the United Kingdom. We defined the perimeter sensor system from components that are expected to make up next generation U.S. Air Force intrusion detection system. Political considerations made it mandatory that the system be operational on time. Sandia completed the installation, testing, and turnover as scheduled to support the initial deployment of the GLCM. The performance of the system has been outstanding: the excellent detection capability is complemented by a low nuisance alarm rate. (5230)

• The first degraded core coolability experiment (DCC-1) was successful. DCC-1 is part of an experiment series examining the coolability of damaged light water reactor (LWR) cores such as the one at Three Mile Island. The series is part of the Nuclear Regulatory Commission's research program to examine severe fuel damage in LWRs. The experiment spanned the temperature and pressure ranges expected in such reactor accident scenarios and produced 49 dryouts (loss of liquid with attendant heat transfer) under various experimental conditions. (6420)

• We completed a procedures guide that defines acceptable methods for performing probabilistic risk assessment (PRA) on nuclear power plants. The guide, prepared under the auspices of the American Nuclear Society and the Institute of Electrical and Electronic Engineers and under the technical direction of Sandia, was written by approximately 30 authors, many of them Sandians, eminent in the field. The 2-year effort provided the first complete documentation of PRA methods for nuclear power plants and will be used by the Nuclear Regulatory Commission when reviewing PRAs submitted for regulatory purposes. (6410)



BLACK CIRCLES are thermal flashblindness protective windows mounted in the cockpit of the Air Force's B-1B aircraft. The Sandia-invented electrooptic ceramic PLZT darkens the windows much faster than a human blink to exclude 99.9 percent of any sudden light or thermal energy.

Computing

• The first phase of the development of a Central Computing Network (CCN) was completed when a very large common mass storage subsystem called the Integrated File Store (IFS) was brought into production. A hierarchy of disk and magnetic cartridge stores (amounting to more than 100 billion bytes of auxiliary storage) is now available to computers connected to the CCN. Plans are underway to add an Automated Tape Library (ATL) to the system, which will make the total storage available more than 1600 billion bytes. (2640)

• The scientific open timesharing environment at Sandia was significantly improved in March when the workhorse CDC 6600 was replaced by a new CDC CYBER 170/855 running on the NOS (new operating system) 2. Some of the highlights of the enhancements: significantly decreased response time, the ability to detach a terminal from one job and work on a second while the computer runs the first, a doubling of permanent file space, a full-screen text editor that supports VT100 terminals, increased memory for individual users, and a throughput three to four times that of the 6600. (2630)

• We have implemented a computer-aided design (CAD) system incorporating both drafting automation and artificial intelligence. As this development continues, more of Sandia's cables will be designed and connectors selected by a computer. The knowledge centers for material selection and connector geometry library are being developed. The basic cable design software should be operational by the end of FY84. Engineers will then routinely (interactively or by a datafile) specify requirements to this expert system, and the system will deliver a cable design to the engineer and/or the production facility. (2150)

• After eight months of testing and preparation, the Sperry 1100/82 dual processor computer was split into two logically separate machines in May. While combined, the system was overburdened and could not consistently meet the demands of production users and application developers. In the split, one system was configured to serve users of corporate data bases. The other system was configured for application programmers. Both systems have been more stable than the former dual configuration. (2630)

• We have developed a data storage system that utilizes a CMOS (Complimentary Metal Oxide Semiconductor) memory to meet a need for improved resolution of acceleration and strain gauge data obtained by rock and earth penetrators during their penetration. This data system has been shock tested in all axes to 10,000g's. The system can digitize and store in memory eight simultaneous inputs, with each input providing 10 kHz data response. The memory capacity within the system is user adjustable. The systems in use at this time contain 640,000 bits of memory and provide a data window of 200 ms. Idle current for the memory system is only 40 μamps; thus a small battery allows data to be retained in memory for many months. (5330)

• The Computing Directorate has planned and implemented a Small Computer Support Center (SCSC). Fast growing technology has made the small desktop computer a valuable office tool that fulfills an important need at the Labs. The SCSC purchases these personal computers, including peripheral hardware and software in economic quantities, then issues them to various users at the Labs. The first of these were placed in use in October. (2610)

• We expanded the Sandia network of distributed VAX computers to 15 nodes to be connected to two gateways to the Central Computing Facility. Currently 83 percent of the jobs run on the large CRAY computer come through the distributed VAX network. The VAX operating system was enhanced to include mixed classified and unclassified operation. These enhancements were requested by more than a dozen government facilities, including many DOE sites. (2640)

• The NWC CAD/CAM (Nuclear Weapons Complex Computer-Aided Design/Computer-Aided Manufacturing) Integration project led to the successful exchange of computer-generated design data among the several different CAD/CAM systems within the NWC. CAD/CAM graphics data have been communicated from the graphics CAD/CAM system at Sandia Albuquerque to four other graphics CAD/CAM systems: those at Pantex, General Electric Pinellas, Sandia Livermore, and Bendix Kansas City. The data communication format used was the Initial Graphics Exchange Specification (IGES) of the U.S. Bureau of Standards. Five different mechanical parts from current weapon programs have been fabricated using CAD definitions from Sandia and Los Alamos. Ninety-nine percent of the geometry and over 85 percent of the textual data were translated automatically. (7610)

• We developed a Machining Verification Program built around an interactive display program (MULTAX-PLOT), to allow machinists to visualize a numerically controlled machine tool's action before cutting the part. The machinists use the program to quickly verify that a tool will not interfere with the fixture. Perspective color graphics plotting techniques display the cutter's actions. Program options permit scaling and rotating the image to change the viewing point, and slow-motion techniques allow the user to inspect individual commands or auxiliary parameters. (7480)

• We have demonstrated that very large scale integrated circuits (VLSIs) can perform complex encryption algorithms. Design and delivery of both classic and newly developed schemes have been completed. These designs represent a capability useful in the increasingly complex military information environment for command and control as well as for security and survivability.

To verify the design of these and other VLSI circuit designs, we have developed a computer code to analyze devices for single-level and multiple-level design rule errors. Support programs allow graphic analysis of the results for an entire VLSI chip. This program eliminates the manual checking of mask plots and aids in quickly detecting layout errors. (2110)

INTERACTION between a laser beam and gaseous metal vapors forms a plasma that permits laser welding, a new capability. Here, 304 stainless steel is being laser welded.

Fun & Games

Kathie Hiebert-Dodd (315) will be carrying a torch for all Sandians soon. She was picked (in fierce competition) to be a member of AT&T Technology's (was Western Electric) Olympic Torch Relay Team. Husband Henry (6252) is an alternate. Collectively, the team will escort the Olympic torch through all 50 states and into Los Angeles in July. Congratulations!

* * *

Like to swim? Competitively? Are you 25 or older? The Kirtland Aquatic Club holds its annual masters swim meet at the Olympic pool on Jan. 28. Warm up at 7:30 a.m. Meet begins at 8:15. Any 1984-registered master swimmer may enter; registration forms are available at the pool. Entry is $5, U.S. Masters registration is also $5. More info from Chuck McClenahan (1232) at 292-3119.

* * *

Thanks to Dennis Huffman (2121), it's a first for Albuquerque — a square dance event with clogging between tips! It's tomorrow at 7:30 at E.G. Ross Elementary School (6700 Palomas NE), it's $2 each, and, yes, you can clog while you're square dancing.

* * *

The Walkers & Striders Association has announced a series of events for January, February, and March. Drop by the LAB NEWS office for a copy. The group is making great strides toward fitness; join and enjoy.

* * *

The KAFB Arts & Crafts Center has announced another spate of classes — auto body repair and spray painting, a sew-sew class for beginners, basic woodworking, intermediate tole painting, drybrush on ceramics — most of which began earlier this week (but call if you're interested). Starting tomorrow are classes in pottery and oil painting tole on canvas. Info on 4-0222.

SO STOP PICKING ON *LAB NEWS*

It appears that scientific reporting, although more prone to error than any other news stories, is more accurate than scientists generally believe. Moreover, errors that do occur tend to be omissions and misemphases rather than errors of facts. It is possible that scientists selectively remember the disasters and forget the successful articles, consider minor errors to be a greater threat to accurate communication than is the case, and are more concerned about how their scientific colleagues perceive them than whether the lay reader has been well-served.

— Robert B. McCall & S. Holly Stocking
in *American Psychologist*

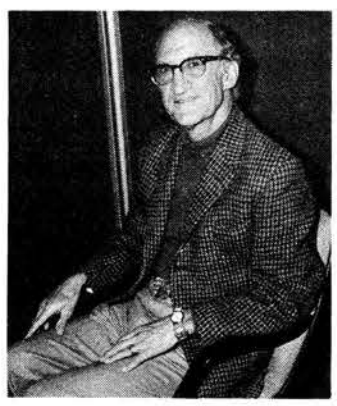
BIOLOGICAL INFERIORITY OF WOMEN?

It is now thought likely that the subjugation of women did not start until some 12,000 years ago when hunting and gathering were replaced with domesticated plants and animals. Current hunter-gatherer societies (for example, the !Kung and the Mbuti) give us some idea of how we may have lived in much of our human history; and in these societies, women are most fully equal to men and often supply the major portion of food. [These societies] tell us that male dominance is not in our genes. It is not something we inherited in becoming human, along with the big brain and the small canines. It emerged afterward. It is a specific *cultural legacy*.

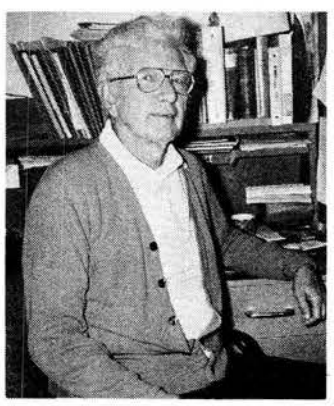
— Naomi Weisstein in *Ms.*

Retiring

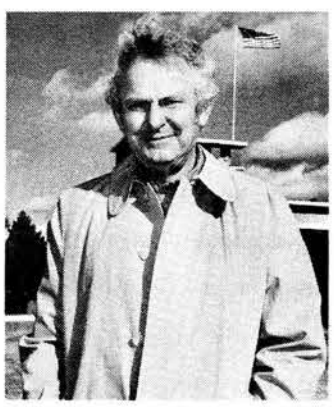
Mattie Williams (3154)



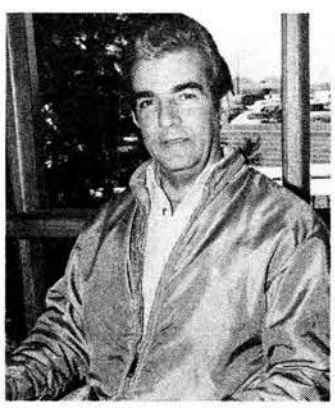
Tex Vandi (7633)



Bill Poole (5234)

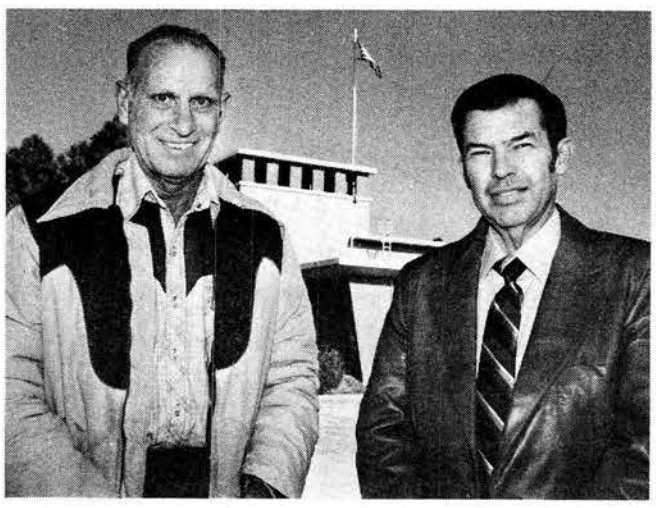


Ira Honeycutt (7485)

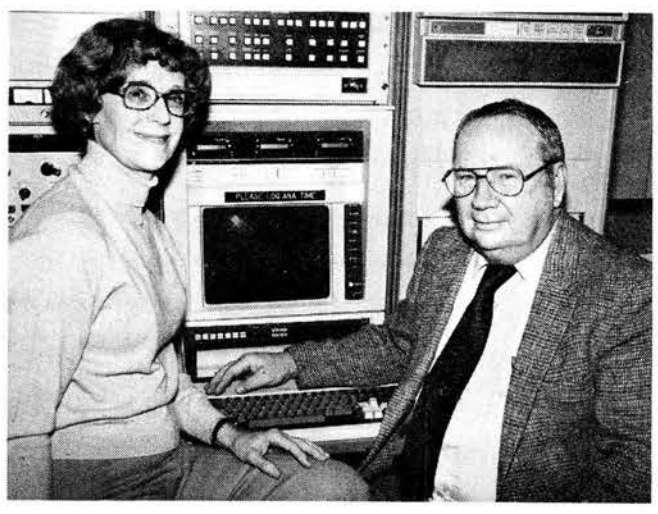


Martin Vigil (7658)

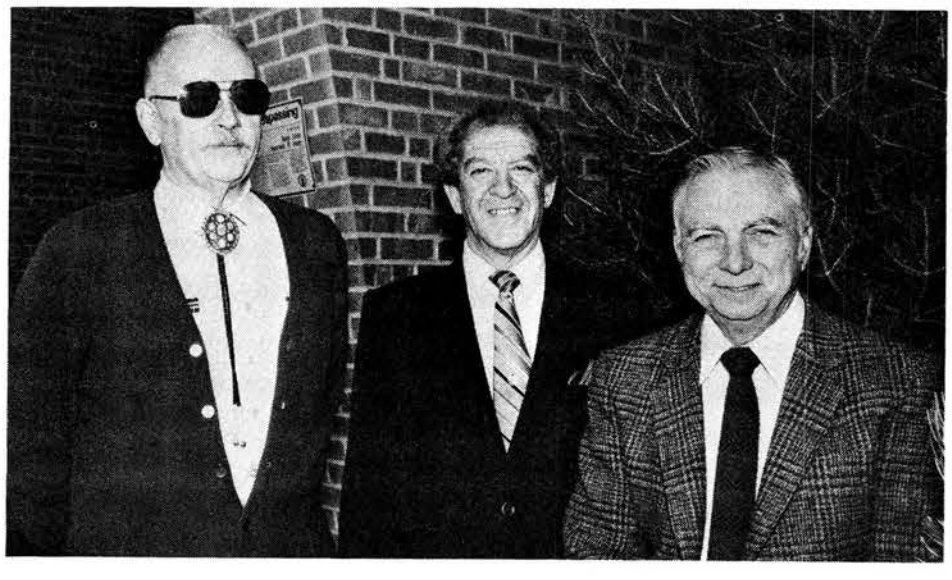
Mildred Hill (6414), Adelina Littleton (132)



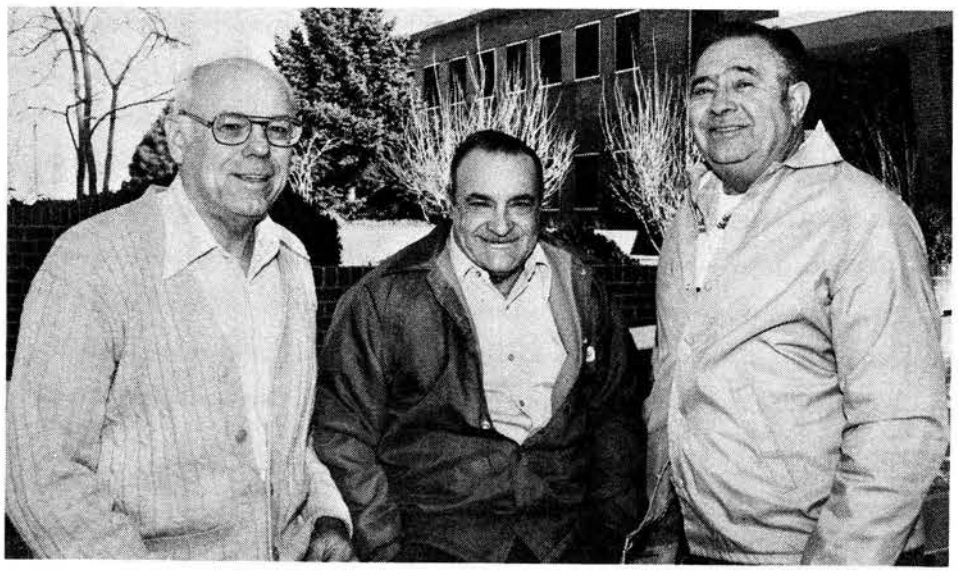
Troy Bewley (7483), Ray Fry (7633)



Dorothy Troy (2552), Bob Erickson (2552)



Bob Harnar (7254), Charles Balistrere (7625), Bob Clay (5115)

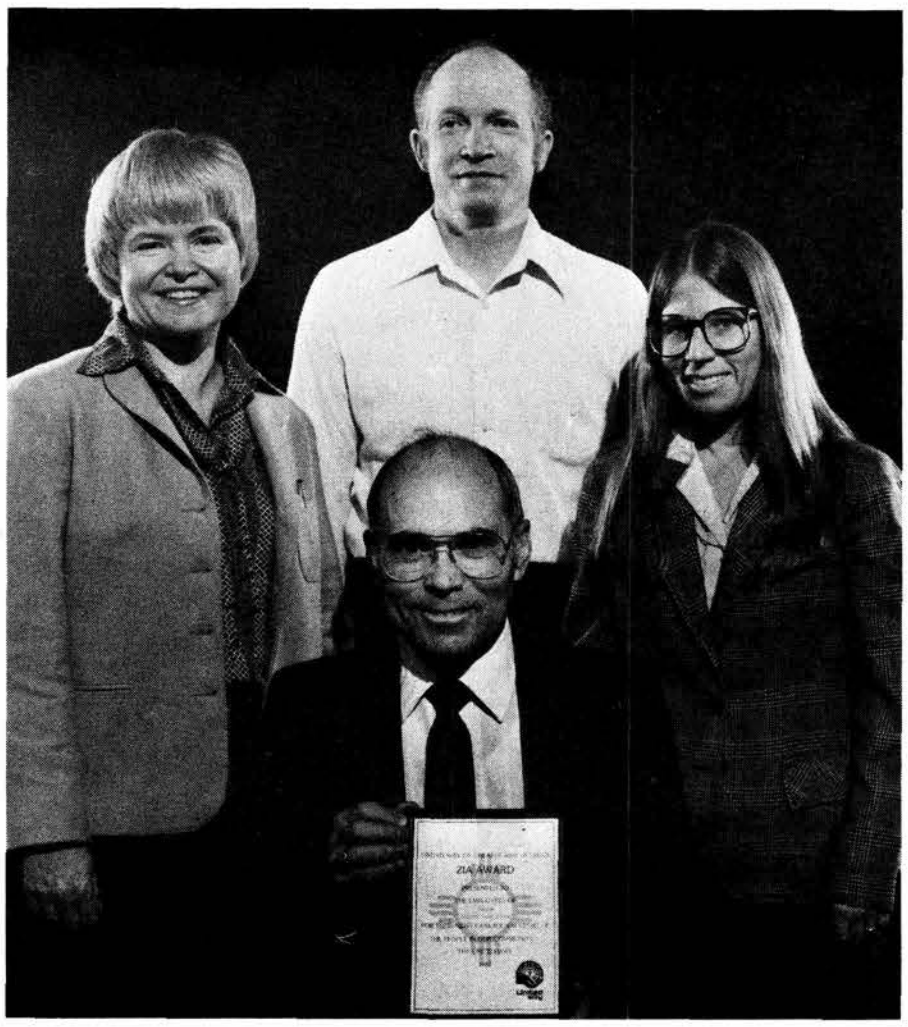


John Irwin (1652), Jake Sandoval (3434), Gene Medina (7531)

volunteers in action

Here are a couple of current volunteer opportunities for employees, retirees, and their families. If you are interested, call Karen Shane (4-3268). **Bernalillo County Mental Health/Mental Retardation Center** needs staff persons for its auxiliary thrift shop, open Thursday from 10:30 until 2.

Albuquerque Civic Light Opera needs a person with electrical skills to repair wiring and convert a table saw to 220 AC. Help in set painting and construction is also needed.



ZIA AWARD from the United Way for Sandia employees' "most generous support" in the recent ECP campaign is displayed by four Sandians who played key roles in the effort: (clockwise from top) Larry Pope (1833), who conducted the directorate training program and served on several other committees; Lynn Peters (3155), the artist who produced all the publicity materials; Waylon Ferguson (3710), the ECP chairman; and Ellen Cronin (6330), who coordinated the Employee Concert Party/variety show.

Better Bus Service

Sun-Tran Specials Seek Sandians

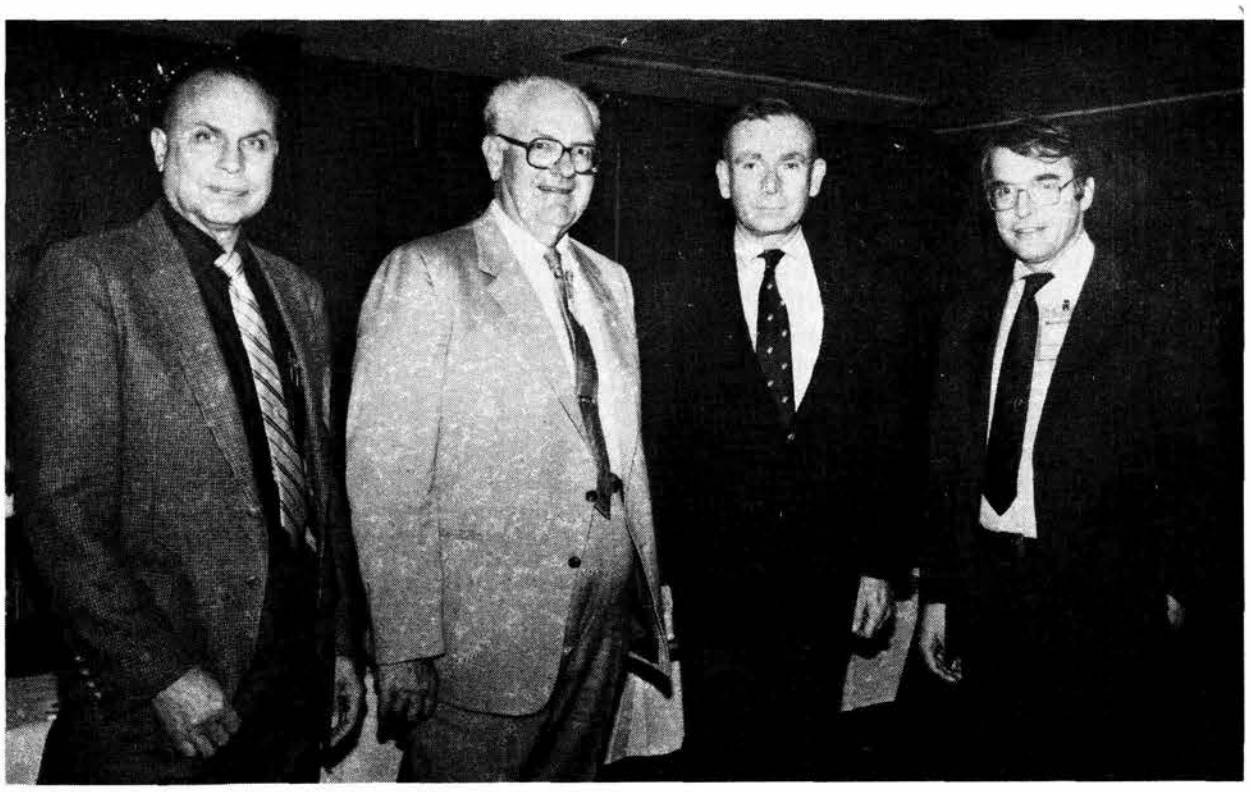
It's not often that doing what you really ought to do gets easier. But that's what's happening on the commuter-bus-service-to-Sandia front on Jan. 30.

As delineated in fine detail — and finer print — on the page opposite, Sun-Tran is improving the service on three Sandia Specials. These serve the Carlisle-Gibson, Wyoming, and Downtown areas. In addition, West Mesa residents can use the new North Coors Express (Route 90) from Corrales Center to I-40 to downtown. The Route 90 bus then continues to KAFB as Route 55.

Connections from other bus routes to the routes serving the Base have also been improved. With 15-minute service along Wyoming during peak commuting hours, connections from all east-west arterials are easier to make. In addition, many routes serving the downtown area from west of I-25 connect to Routes 9 or 55 (see opposite page). And the San Mateo (Route 4) and the San Pedro (Route 34) buses connect with Route 55 buses within five minutes.

"We have made a significant effort to improve service to the Base," says Sun-Tran Director Gary Garlick. "We hope that the service changes encourage Sandia employees to use mass transit and ease traffic congestion."

It's likely that fares will rise soon; get the bus habit while it's cheap — so you won't mind the fare increase.



MARINE CORPS COMMANDANT Paul Kelley came to Sandia last month and was briefed on a wide variety of Sandia programs. Here he's flanked by President Dacey and George Keyworth, President Reagan's Scientific Advisor; on the left is Brig. Gen. Eugene Russell, Deputy Chief of Staff for R&D and Studies, Marine Headquarters.

ECP News

The Albuquerque Hearing and Speech Center, a United Way Agency, will conduct "hearing screening" on Jan. 25 from 11:15 a.m. to 1 p.m. in the agency's mobile van. The van will be parked in front of the Sandia cafeteria.

1984 Holidays

Memorial Day ..... Mon., May 28
Independence Day .... Wed., July 4
Labor Day ..... Mon., Sept. 3
Thanksgiving .....Thurs., Nov. 22
Christmas and New Year Shutdown
..... Tues., Dec. 25 through
Tues., Jan. 1
Energy Conservation Day will be announced later.

Retiree Deaths (Oct. through Dec.)

Brad Sanders (64)	Oct. 3
Lucile Marcrum (66)	Oct. 14
Carlton Whitcomb (77)	Oct. 20
Edwin Berquist (71)	Oct. 20
Samuel Hurst (99)	Oct. 20
Leslie Cox (69)	Oct. 21
Jack Miller (61)	Oct. 21
Albert Gower (67)	Oct. 22
Lawrence Gustafson (86)	Nov. 3
Charles Glaese (89)	Nov. 6
Calvin Thompson (79)	Nov. 17
Elliott Dopking (73)	Nov. 25
Frances Fidler (69)	Nov. 25
Audrey Burns (68)	Nov. 27
George Dixon (77)	Nov. 30
Raleigh Middleton (67)	Dec. 4
Donald Deherder (68)	Dec. 10
Cecil Tolbert (64)	Dec. 19
Jerome Jones (63)	Dec. 19
Antonio Jinzo (79)	Dec. 24
Hilman Frock (70)	Dec. 25
Carl Northam (59)	Dec. 25
Charles Eisenhour (53)	Dec. 30

New Improved Service To K.A.F.B.

These new bus schedules will go into effect January 30, 1984 . Connections from other bus routes to these routes have been improved .

For additional bus schedules check the Journal or Tribune, January 21, 22, 23 . The peak hour specials will remain the same .

Fares

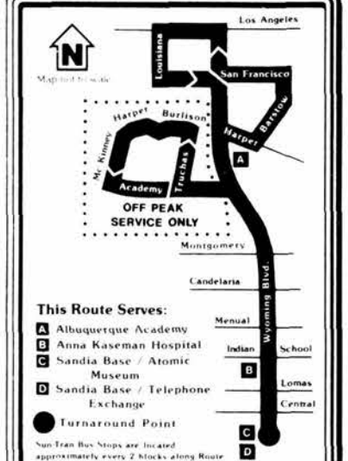
All cash fares, passes and tokens will remain the same until further notice.

Info.
766-7830

31 Wyoming

* Effective January 30, 1984

Bus Schedule



For information call
*766-7830
City of Albuquerque
Sun Tran

*TTY System in use for the hearing impaired.

Monday - Friday Service

Times indicated may vary according to traffic conditions.

Route 31 to Kirtland East

	A.M.												P.M.											
Wyoming & Krim	6:08	6:23	6:38	6:53	7:08	7:38	8:08	8:38	9:38	10:38	11:38	12:38	1:38	2:38	3:38	4:38	5:08	5:38	6:08	6:38				
Wyoming & San Francisco	6:22	6:37	6:52	7:07	7:22	7:52	8:22	8:52	9:52	10:52	11:52	12:52	1:52	2:52	3:52	4:52	5:22	5:52	6:22	6:52				
McKinney & Harper								9:16	10:16	11:16	12:16	1:16	2:16	3:16	4:16									
Wyoming & Montgomery	6:26	6:41	6:56	7:11	7:26	7:56	8:26	8:56	9:26	9:56	10:26	10:56	11:26	11:56	12:26	12:56	1:26	1:56	2:26	2:56	3:26	3:56	4:26	4:56	5:26	5:56	6:26	6:56
Wyoming & Menaul	6:33	6:48	7:03	7:18	7:33	8:03	8:33	9:03	9:33	10:03	10:33	11:03	11:33	12:03	12:33	1:03	1:33	2:03	2:33	3:03	3:33	4:03	4:33	5:03	5:33	6:03	6:33	7:03
Wyoming & Ind. Schl. Rd.	6:35	6:50	7:05	7:20	7:35	8:05	8:35	9:05	9:35	10:05	10:35	11:05	11:35	12:05	12:35	1:05	1:35	2:05	2:35	3:05	3:35	4:05	4:35	5:05	5:35	6:05	6:35	7:05
Wyoming & Central	6:43	6:58	7:13	7:28	7:43	8:13	8:43	9:13	9:43	10:13	10:43	11:13	11:43	12:13	12:43	1:13	1:43	2:13	2:43	3:13	3:43	4:13	4:43	5:13	5:43	6:13	6:43	7:13
Kirtland East	6:50	7:05			8:20	8:50	9:20	9:50	10:20	10:50	11:20	11:50		12:20	12:50	1:20	1:50	2:20	2:50	3:20	3:50	4:20	4:50	5:20	5:50	6:20	6:50	7:20
Gate #1			7:20	7:35	7:50																							
Gate #10			7:34	7:49	8:04																							

Route 31 from Kirtland East

	A.M.												P.M.											
Gate #1															4:20	4:35	4:51							
Gate #10															4:34	4:49	5:04							
Kirtland East	7:04	7:19	7:34	7:49	8:04	8:34	9:04	9:34	10:04	10:34	11:04	11:34	12:04	12:34	1:04	1:34	2:04	2:34	3:04	3:34	4:04	4:19	5:34	6:04	6:34	
Wyoming & Central	7:11	7:26	7:41	7:56	8:11	8:41	9:11	9:41	10:11	10:41	11:11	11:41	12:11	12:41	1:11	1:41	2:11	2:41	3:11	3:41	4:11	4:26	4:41	4:56	5:11	5:41	6:11	6:41
Wyoming & Ind. Schl. Rd.	7:19	7:34	7:49	8:04	8:19	8:49	9:19	9:49	10:19	10:49	11:19	11:49	12:19	12:49	1:19	1:49	2:19	2:49	3:19	3:49	4:19	4:34	4:49	5:04	5:19	5:49	6:19	6:49
Wyoming & Menaul	7:21	7:36	7:51	8:06	8:21	8:51	9:21	9:51	10:21	10:51	11:21	11:51	12:21	12:51	1:21	1:51	2:21	2:51	3:21	3:51	4:21	4:36	4:51	5:06	5:21	5:51	6:21	6:51
Wyoming & Montgomery	7:28	7:43	7:58	8:13	8:28	8:58	9:28	9:58	10:28	10:58	11:28	11:58	12:28	12:58	1:28	1:58	2:28	2:58	3:28	3:58	4:28	4:43	4:58	5:13	5:28	5:58	6:28	6:58
McKinney & Harper						9:12		10:12		11:12		12:12		1:12		2:12		3:12		4:12								
Wyoming & Krim	7:38		8:08		8:38		9:38		10:38		11:38		12:38		1:38		2:38		3:38		4:38	4:53	5:08	5:23	5:38	6:08	6:38	
Wyoming & San Francisco	7:48		8:18		8:48		9:48		10:48		11:48		12:48		1:48		2:48		3:48		4:48	5:03	5:18	5:33	5:48	6:18	6:48	

Saturday Service

Times indicated may vary according to traffic conditions.

No Sunday Service.

Route 31 to Kirtland East

	A.M.						P.M.						
Wyoming & Montgomery	7:26	8:26	9:26	10:26	11:26		12:26	1:26	2:26	3:26	4:26	5:26	6:26
Wyoming & Ind. Schl. Rd.	7:35	8:35	9:35	10:35	11:35		12:35	1:35	2:35	3:35	4:35	5:35	6:35
Wyoming & Central	7:43	8:43	9:43	10:43	11:43		12:43	1:43	2:43	3:43	4:43	5:43	6:43
Kirtland East	7:50	8:50	9:50	10:50	11:50		12:50	1:50	2:50	3:50	4:50	5:50	

Route 31 from Kirtland East

	A.M.						P.M.						
Kirtland East	7:02	8:02	9:02	10:02	11:02		12:02	1:02	2:02	3:02	4:02	5:02	6:02
Wyoming & Central	7:09	8:09	9:09	10:09	11:09		12:09	1:09	2:09	3:09	4:09	5:09	6:09
Wyoming & Ind. Schl. Rd.	7:17	8:17	9:17	10:17	11:17		12:17	1:17	2:17	3:17	4:17	5:17	6:17
Wyoming & Montgomery	7:26	8:26	9:26	10:26	11:26		12:26	1:26	2:26	3:26	4:26	5:26	6:26

TIPS FOR TRANSFERS From Route 31

Monday-Friday

To Downtown

Transfer from Route 31 to any Central Avenue bus at Wyoming and Central. Buses on Central run every 8 minutes all day.

To UNM

Transfer from Route 31 to any Central Avenue bus at Wyoming and Central. Buses on Central run every 8 minutes all day.

To Winrock Shopping Center

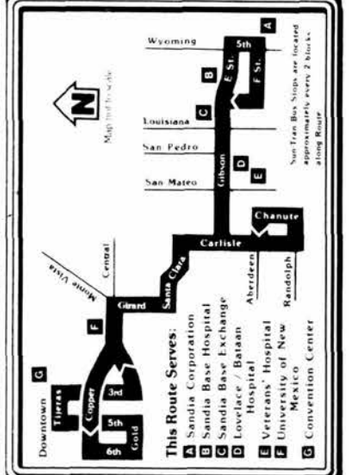
Transfer from Route 31 to Route 6 at Wyoming and Indian School. Certain Route 31 buses connect with Route 6 buses within 5 minutes. Check the schedules.

Note:
Many connections can be made in under 10 minutes. Check your bus schedules to find the quickest routes and transfer times to and from your destination. In some cases you can save time by using a return route that is different from your original route.

9 Carlisle - Gibson

* Effective January 30, 1984

Bus Schedule



For information call:
*766-7830
City of Albuquerque
Sun Tran

*TTY System in use for the hearing impaired.

Monday - Friday Service

Times indicated may vary according to traffic conditions.

Route 9 to Downtown

	A.M.											P.M.										
Kirtland East	6:51	7:21	7:51	8:21	8:51							3:51	4:21	4:51	5:21							
Gibson & Louisiana	6:59	7:29	7:59	8:29	8:59	9:29	10:29	11:29	12:29	1:29	2:29	3:29	3:59	4:29	4:59	5:29	5:59	6:29	6:59			
Gibson & San Mateo	7:03	7:33	8:03	8:33	9:03	9:33	10:33	11:33	12:33	1:33	2:33	3:33	4:03	4:33	5:03	5:33	6:03	6:33	7:03			
Gibson & Carlisle	7:11	7:41	8:11	8:41	9:11	9:41	10:41	11:41	12:41	1:41	2:41	3:41	4:11	4:41	5:11	5:41	6:11	6:41	7:11			
Girard & Central	7:21	7:51	8:21	8:51	9:21	9:51	10:51	11:51	12:51	1:51	2:51	3:51	4:21	4:51	5:21	5:51	6:21	6:51	7:21			
University & Central	7:25	7:55	8:25	8:55	9:25	9:55	10:55	11:55	12:55	1:55	2:55	3:55	4:25	4:55	5:25	5:55	6:25	6:55	7:25			
5th & Gold	7:35	8:05	8:35	9:05	9:35	10:05	11:05	12:05	1:05	2:05	3:05	4:05	4:35	5:05	5:35	6:05	6:35	7:05				

Route 9 from Downtown

	A.M.											P.M.										
5th & Gold	6:07	6:37	7:07	7:37	8:07	8:37	9:47	10:47	11:47	12:47	1:47	2:37	3:07	3:37	4:07	4:37	5:07	5:37	6:07			
University & Central	6:17	6:47	7:17	7:47	8:17	8:47	9:57	10:57	11:57	12:57	1:57	2:47	3:17	3:47	4:17	4:47	5:17	5:47	6:17			
Girard & Central	6:21	6:51	7:21	7:51	8:21	8:51	10:01	11:01	12:01	1:01	2:01	2:51	3:21	3:51	4:21	4:51	5:21	5:51	6:21			
Gibson & Carlisle	6:31	7:01	7:31	8:01	8:31	9:01	10:11	11:11	12:11	1:11	2:11	3:01	3:31	4:01	4:31	5:01	5:31	6:01	6:31			
Gibson & San Mateo	6:39	7:09	7:39	8:09	8:39	9:09	10:19	11:19	12:19	1:19	2:19	3:09	3:39	4:09	4:39	5:09	5:39	6:09	6:39			
Gibson & Louisiana	6:43	7:13	7:43	8:13	8:43	9:13	10:23	11:23	12:23	1:23	2:23	3:13	3:43	4:13	4:43	5:13	5:43	6:13	6:43			
Kirtland East	6:51	7:21	7:51	8:21	8:51							3:51	4:21	4:51	5:21							

Saturday Service

Times indicated may vary according to traffic conditions.

No Sunday Service.

Route 9 to Girard and Central

	A.M.						P.M.						
Gibson & Carlisle	7:52	8:52	9:52	10:52	11:52		12:52	1:52	2:52	3:52	4:52		
Girard & Central	8:02	9:02	10:02	11:02	12:02		1:02	2:02	3:02	4:02	5:02		

Route 9 from Girard and Central

	A.M.						P.M.						
Girard & Central	7:42	8:42	9:42	10:42	11:42	12:42	1:42	2:42	3:42	4:42			
Gibson & Carlisle	7:52	8:52	9:52	10:52	11:52	12:52	1:52	2:52	3:52	4:52			

TIPS FOR TRANSFERS From Route 9

To Winrock / Coronado Shopping Center

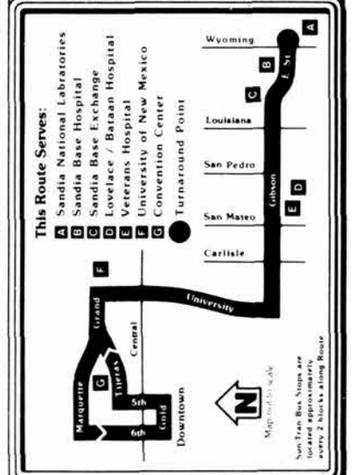
Transfer from Route 9 to Route 3 at Girard and Central.

Note:
Many connections can be made in under 10 minutes. Check your bus schedules to find the quickest routes and transfer times to and from your destination. In some cases you can save time by using a return route that is different from your original route.

55 Downtown - University - KAFB East

* Effective January 30, 1984

Bus Schedule



For information call:
*766-7830
City of Albuquerque
Sun Tran

*TTY System in use for the hearing impaired.

Monday - Friday Service

Times indicated may vary according to traffic conditions.

No Saturday or Sunday Service.

Route 55 from Downtown

	A.M.			
5th & Gold	6:22	6:52	7:22	7:37
University & Grand	6:30	7:00	7:30	7:45
San Mateo & Gibson	6:41	7:11	7:41	
Wyoming & O St.	6:51			
Gate # 1		7:21	7:51	
Gate # 10		7:35	8:05	

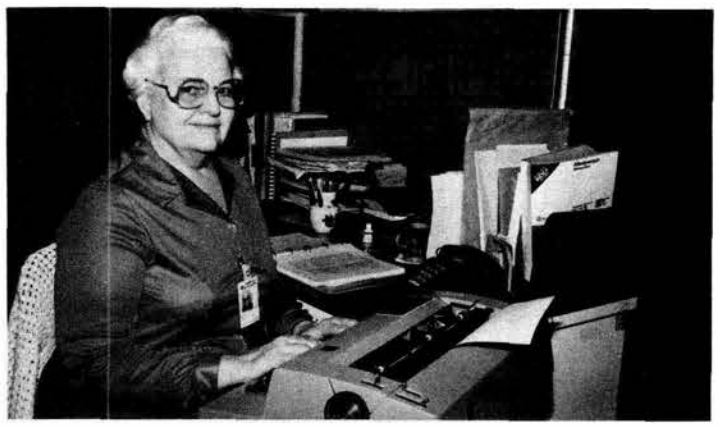
Route 55 to Downtown

	P.M.		
Gate # 10	4:00	4:30	
Gate # 1	4:14	4:44	
Wyoming & O St.	3:42		5:14
San Mateo & Gibson	3:52	4:24	4:54	5:24
University & Grand	4:03	4:35	5:05	5:33
5th & Gold	4:11	4:41	5:11	5:41

MILEPOSTS
LAB NEWS

JANUARY 1984

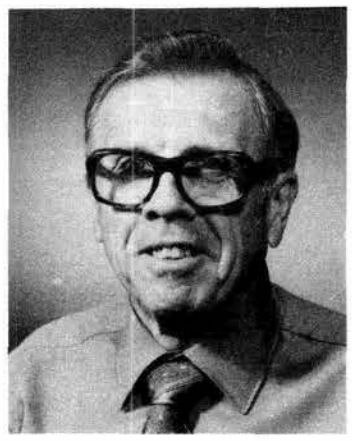
Doris Ramel (3321) 15



Myrtle Patterson (3152) 30

Tom Cordova (3416) 20

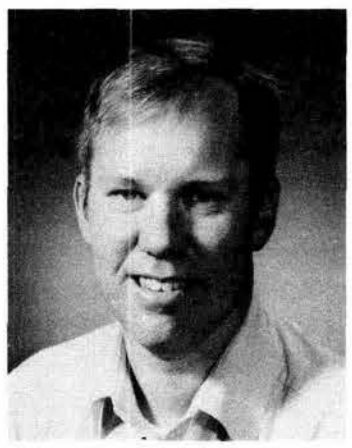
Hannibal Madden (1134) 10



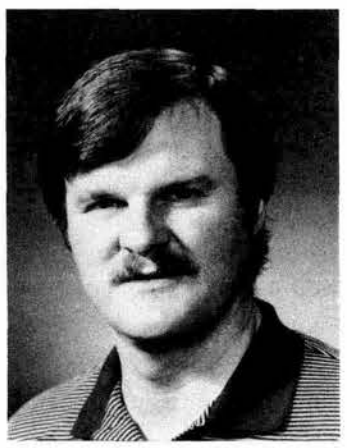
Frank Graham (121) 25

Mary Bailey (3418) 10

Morton Lieberman (2515) 15



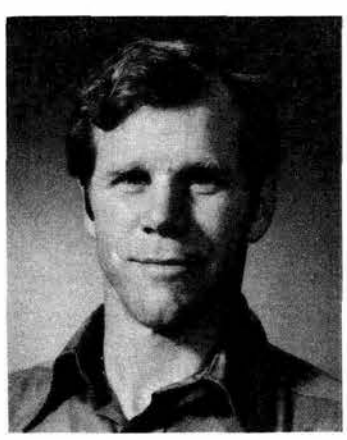
Jimmie McDonald (1837) 15



Gary Schuster (2123) 15

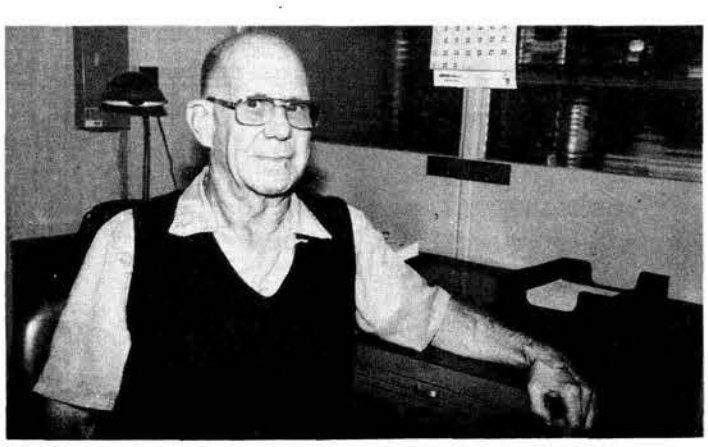
Tom Morgan (3543) 20

Garland Tilley (3462) 10



Parke Davis (1234) 10

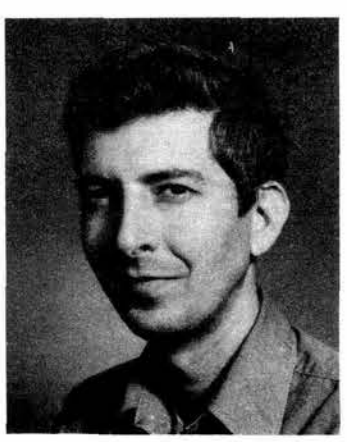
Jesus Luna (2123) 35



Bill Walker (7251) 35

Frank Fuentes (7471) 20

Keith Gawith (7481) 20



Jim Hamilton (5323) 15

'True Spirit of Equal Opportunity' Reaffirmed

"Not only will we comply with the letter of the laws and regulations of federal and state governments, but we will practice the true spirit of equal opportunity as a matter of Laboratories' policy."

That was President Dacey, reaffirming the Labs' commitment to the principles of Equal Opportunity and Affirmative Action (LAB NEWS, Nov. 11, 1983). Since then, Equal Opportunity and Affirmative Action Department 3510 has distributed copies of the '84 Affirmative Action Program to all supervisors.

"Talents and abilities are distributed evenly throughout the human race, and to ignore those talents and abilities possessed by persons who happen to be minority or female or handicapped is simply wrong," says President Dacey. "Both outside Sandia and within our own house we will continue to seek out and develop the talents of all persons, at all levels of our organization."

All supervisors will be discussing the program with their employees. Questions about the program should be directed to Maureen Baca (3511) on 4-6281. Copies of the program will be distributed in Livermore before Feb. 1; questions should be directed to Don Charlesworth (8426), on 2-2301.

In a videotape available to employees (through Div. 3511), President Dacey asks all employees to participate in the organizational affirmative action meetings. "I hope that all of you will take to heart the spirit of affirmative action, which is to recognize and affirm the best within each person. By treating each person with dignity and respect, we will enjoy a workplace that is free from bias and filled with a spirit of cooperation and collegiality."

UNCLASSIFIED ADVERTISEMENTS • UNCLASSIFIED ADVERTISEMENTS • UNCLASSIFIED ADVERTISEMENTS • UNCLASSIFIED ADVERTISEMENTS

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

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 and organization.
9. Housing listed here for sale is available for occupancy without regard to race, creed, color, or national origin.

MISCELLANEOUS

COMPUTER, IBM PC, expanded memory, monitor, printer, color/graphics board, many extras, including software pkgs., $3700. Williams, 299-8986.

BLACK mesh fp screen w/brass trim, 35" wide by 25" high, $10. Smith, 299-6873.

AM-FM stereo, speakers, turntable, play-record tape deck, $50. Dieter, 255-8056.

CARPET, rust, sculptured, 27 sq. yds., pad, $125; Kerosene heater, $50; upholstered swivel barrel chairs, $100; twin studio-bed, $20. Sharp, 293-1824.

BROILER/rotisserie, Farberware, Model/455N, no smoke & spatter, $30; coffee maker, Norelco Express, 1-4 cups, $8. Rauch, 821-6992.

46" ROUND table, pecan finish w/one 18" extension leaf, complete w/pads, $200. Batchelor, 299-4831.

COMPUTER: NEC PC-8001A Z80, 64k(CP/M version 2.2), dual disc drive, 12" color monitor, w/software (word processor, spreadsheet program, data base management), $1500. Vinson, 255-6562.

UNUSED chimney tiles, firebricks, damper, chimney bricks & interior bricks; make offer. Shane, 294-4920.

LIGHTING fixtures, modern; dining room chandelier, $100; kitchen, $20; bdr or hall, $15; French Provincial entrance hall, $30. Crowther, 821-0172.

USED appliances: washer, dryer, freezer, drop-in range, free-standing range, range hood. Hansen, 898-3544.

TEKTRONIX 1A1 late model [serial 028467) dual trace plug-in preamp for series 500 oscilloscopes, $125. Simmons, 281-3590.

STEERING wheel, walnut woodgrain, 16" diameter, $40; record cabinet, lt. maple, $45; tea cart, roll-around, lt. maple, $150. Clements, 293-5618.

NEW Motorcycle tire: Dunlop 5.10 x 16 touring elite, $60; Brooks motorcycle jacket, brown leather w/removable liner, $90. Barnard, 831-4114.

SKIS, boots, poles & bindings; size 10 boots, 180 cm skis (Spalding) & Spademan bindings mounted, $60. Norwood, 292-0072.

CAMPER shell for lwb pickup, $275; solid-ox welding torch kit; car stereo; booster/graphic equalizer; lg. chainsaw. Falacy, 293-2517.

RUNNING boards; dining/pasenger seats; cabinets w/sink, ice box & closet for van or pickup. Garcia, 293-3937.

FULL size portable GE dishwasher, $60. Robinson, 822-0180.

LARGE capacity water softener, semi-auto., $50; small GE refrigerator, $40. Finley, 292-0366 after 5:30.

DINETTE set, solid pine, w/2 leaves & 6 chairs, 42" x 65" top, $200 OBO. Barnard, 256-7772.

1976 Silver Streak "Supreme" 33½', $12,500 or trade for motorhome. Romine, 281-5682.

CLASSICAL guitar, Takamine model C-132S w/hard shell case, $250. Goggans, 344-6528.

EARLY American maple 4-poster bed & dbl. dresser w/full mirror, $200; recliner chair, $50. Gorney, 821-9623.

RECLINER chair, rust color w/dark brown fleck, $95. Newton, 296-2335.

CHANDELIER, modern wood, glass & brass, for DR, offer. Rabinowitz, 266-2957.

SMITH & WESSON model 28 w/6" barrel, 357, w/box. Georg, 266-3203.

BABY items: crib mattress, $35; mechanical infant swing, $15. Drotning, 294-4807.

SKI package for Juniors: Hart Gremlin skis w/Tyrolia 60 bindings & brakes, size 2 Garmont boots, $75; Munari women's ski boot, size 7, $25. Benson, 296-4282.

BLACK Chow puppies, $150. 12 weeks old, AKC reg. Forsythe, 298-9326.

TIRE chains, Allstate, reinforced, E/E78/15 & G 78/15, $55 ea. or will trade for set of H78/15. Barnaby, 265-4353.

SOLID wood French provencial double bed, mattress & springs, 60" dresser, dust proof drawers, lg. mirror, 2 matching bedside tables, $800. Palmer, 883-9090 or 291-3316.

DINETTE SET, wood grain w/leaf, 6 chairs, $120; exercise trampoline, $30; table lamp, $25. Meyer, 292-8431.

GAS FURNACE, Bryant, 116,000 BTU, updraft w/controls, $50; Hondo 13" rims w/tires, 4 for $18. Stamm, 255-2640.

BELL bicycle helmet, "Biker" model, size 7½ (60cm), $20. Gerwin, 881-0028.

TRAILER, made from Ford long-bed pickup, can be seen at 11035 Central, $75. Harstad, 298-6551 after 5.

CAMERA: Canonet G III, 35mm rangefinder, used twice, orig. box & registration papers, $75. Smith, 242-9576.

REMINGTON rifle, M788, scope, 308 cal., some ammo, $225. Rangematic Mark V rangefinder, 50 yd. to 2 miles, never used, $75 OBO. Ma, 883-4438.

YASHICA Electro 35, GSN, camera including Vivitar electronic flash unit, telephoto & wide angle lenses w/carrying case, $250. Mason, 281-3052.

TAPPAN Range top, one piece, overhead oven, stainless; overhead exhaust fan; Hardwick microwave w/touch control. Freshour, 266-1662.

12 LARGE Brandy glasses, small brandies, wine, 10 water goblets, $10 set, $35 for all; port. dishwasher, $95. Blackledge, 294-6030.

MAPLE bureau, 4-drawer, youth size, $70; new 40-gal. natural gas water heater, $100. Keizur, 884-8357.

TWO 10 pt diamonds (20 pts. TW) full cut, $175 for both. Burstein, 821-6688 after 5.

SOLID walnut dining table, 38" x 56", expands to 68" or 80", w/pads, & 6 chairs, 2 captain, $450. White, 293-2219.

SPORTSMAN overhead camper, 10', sleeps 4, heater, stove, potty, carpet, drapes, jacks, $995; ¾ ton Chev. pickup available. Daniel, 268-8335.

TWO-BURNER gas grill w/electric rotisserie; crib w/mattress & sheets; car seat; chest. Black, 296-8414.

PIONEER cassette tape deck, $50; ski rack, $10; backpack baby carrier, $10; window air conditioner, $25. Graham, 293-7302.

VIOLA music, all half price; leather full length green coat, new lining, ladies size approx. 6-8, $55. Gregory, 268-2022.

ELECTRIC typewriter, $95; overhead bicycle rack, $25; TV stand, $15; fp grate, $10; intermediate sized tire chains, $25. Owyoung, 294-1884.

MINIATURE Poodle, silver male, purebred, housebroken, 5-months, $75 OBO. Sunberg, 299-2134.

BEDROOM suite, all wood, blonde finish, full size bed, lg. dresser w/mirror, night stand, $125. Johnson, 898-4591.

GALVANIZED Pipe, ½", ¾", 1", mostly full lengths, some short pieces. Mozley, 884-3453, 884-5225.

TIMEX Sinclair 1000PC, 16K RAM, 3 programs — Backgammon, Organizer, Super Math — never used, $45. Korbin, 821-9658.

COMPLETE stereo system, $350; teak stereo stand; elec. typewriter; TV stand; down ski jacket; brown luggage. With, 298-4864.

TRANSPORTATION

'73 OLDS, AT, PS, AC, 4-dr., $500. Barnaby, 265-4353.

'82 CHRYSLER Le Baron, 2-dr. HT, silver w/red interior, 16K miles, fully loaded, $8750. Sutherland, 345-1183.

ROYAL Enfield 750cc interceptor, fast, near original, $2500 firm; '65 Cadillac, restorable cond., $400 OBO. Koetter, 266-5317.

'66 CHEVROLET convertible, AM/FM stereo radio, AT, PS, 327 cu. in. engine, new top. Rex, 344-6552.

'78 FORD Fiesta, 3-dr. hatchback, 4-spd., gas efficient, book $2050, make offer. Shire, 821-8460.

'78 CHEV ¾T full size van, V8, PS, PB, AT, carpeted, paneled, new tires, brakes & carb, $4500. Ahr, 293-1113.

YAMAHA DT400 Enduro, street legal, $500 OBO; Attex GWD ATV w/dump bed, $500 OBO. Hanshce, 281-5623.

'72 450 HONDA, dual overhead cam, windshield, 2 helmets, all $550. Greer, 296-7310.

'81 CONCORD DL, 4-dr., AT, AC, tilt steering, 29K miles, $4900. Falacy, 293-2517.

'67 FORD truck, 6-cyl., 3-spd., shell, SB radials, $1000. Beattie, 898-2706.

'69 HONDA TRAIL 90 motorbike, 2-spd. rear axle, $200. Yingst, 884-3812.

'72 GRAN TORINO, new tires, AC, PS, PB, 351c, reg. gas, $1500 OBO. Millington, 294-5808.

'76 DODGE Aspen R/T coupe, make offer. Barton, 268-7349.

'80 DATSUN 210, AC, 5-spd., low miles, one owner. Sinclair, 884-7096.

'83 FORD Escort GL, 4-cyl., front-wheel drive, AT, AC, PB, PS, cruise, AM/FM/cass., 9200 miles. Bobbe, 298-5663 after 5.

'68 PLYMOUTH Fury, 2-dr. sedan, AT, $375. Esterly, 883-1477.

'69 MERCEDES diesel 220D, new paint, tires, battery & clutch, needs work, $1975; '71 Honda 175 motorcycle, low miles, $350. Kane, 881-7672.

'72 FORD truck, AT 302 V8 engine, camper w/boat rack & ball hitch. Harris, 344-6640.

'69 MERCURY Montego, 4-dr., AT, AC, white, extra wheels, snow tires. Spray, 884-8453.

'73 CHRYSLER New Yorker, AC, PB, PS, AT, AM/FM stereo radio, $600 OBO. Gibanica, 298-6321.

'62 CHEVY II Nova, $200. Guidotti, 294-6535.

'68 CUTLASS Supreme, 2 dr., 350 4-barrel, AT, AC, rebuilt car, new trans., best offer. Eldredge, 881-4528.

'77 KAWASAKI KZ750, custom seat, low miles, $1400 OBO. Rich, 344-2354 between 8-5.

'79 RABBIT, one owner, 4-dr., deluxe, AC, 4-spd., stereo, brown, 66K miles. Whalen, 822-0413.

'69 PONTIAC Firebird, blue/white interior, overhead cam, 6-cyl., 3-spd., $1500 firm. Jankey, 344-9641.

'37 CHRYSLER Roadster, 75% restored, $7K. Perryman, 281-3020.

'76 CHEVY Chevette, 4-spd., AC, deluxe interior plus other extras, 45K miles, $1500 OBO. Fuller, 294-3089.

2 SCHWINN bicycles, 26," 1 ladies 3-spd., 1 man's 1-spd., $125 ea. Thompson, 299-6615 after 5.

'83 HONDA 1100 motorcycle (V65, Magna), 5100 miles, $3595. Ulibarri, 881-3551.

'81 DATSUN kingcab w/shell, 24K miles, loaded; '77 Honda Civic, AC, AM/FM, low miles, Shephard, 298-4879.

'71 VOLKSWAGEN 411, AT, 4-dr., $700. Robles, 298-2456.

'78 DODGE Diplomat, AT, AC, PS, PW,AM-FM, vinyl roof, $2500 OBO. Miranda, 255-3342.

'76 FORD Pinto stn. wgn., AC, PS, 4-spd., roof racks, 52K miles, $995. Dellin, 293-8318.

REAL ESTATE

NE, 3-bdr., 1½ bath, atrium, sunken den, 1-car garage, good financing, low down, 11½% assumable loan. Sorroche, 299-3075 after 5:30.

HOUSE in Dietz Farms, 3-bdr., 2 full baths, LR, DR, open balcony, 2 fp, fully fenced, on ½ acre, mid 90s. Rex, 344-6552.

1.3 ACRES El Pinar Estates, 14 miles east off frontage road, wooded, electricity, phone, $8K. Perryman, 281-3020.

'79 WAYSIDE MH, 14 x 60, 2-bdr., front kitchen, set up in family park, NE, payments $207/mo., w/low down. Brown, 822-0701.

TOWNHOUSE, Ladera golf course area, Candlelight, 3 yrs. old, 3-bdr., fp, 2-car, landscaped, covered patio, low equity, $65K. Potter, 831-0155 or 892-1734.

20 ACRES Juan Tomas area between S Hy 14 and Hy 217, southern exposure, trees, $2300/acre, terms. Baack, 296-2312.

WANTED

NATIONAL GEOGRAPHIC, Nov. 1982 issue. Baxter, 344-7601.

ROOMMATE to share 4-bdr. house near Juan Tabo, Copper & Chelwood NE, $250 includes utilities. Shaw, 299-8524.

TRADE W.E. Touchtone desk phone for wall phone of same type. Hereford, 822-8111.

ONE WHEEL rim for Toyota Celica, 4-bolt pattern, 14". Barnard, 831-4114.

KNITTING needles, plastic or bone, size 10½. Arnold, 898-1467.

UNIV. prof. & spouse need accommodations from Feb. 27 to March 23; if you need a house sitter or have a rental home available for any part of this period, contact Costin, 846-0488.

ROTOTILLER, 16" to 20" wide cut, 3 or 4 hp gas motor. Parker, 877-8525.

ROTOTILLER in reasonably good condition to buy or for short term rental. Bott, 298-4903.

WOULD like to buy a lot in Sandia Heights South. Iman, 299-6500.

SUBARU 4-wd stn. wg. w/low miles. Zanner, 281-1789.

HAWAII? People to join small group for low budget hiking / sightseeing trip March 25-31, approx. $700; call immediately. Plein, 884-3749.

PLANT lovers: free philodendron cuttings; Christmas light bulbs: trade you blue & yellow twinkle light bulbs for red and green. Miyoshi, 821-9118.

SHARE-A-RIDE

TWO or three persons to car pool from vicinity of Griegos NW, Candelaria NW, & Rio Grande NW. Gallegos, 4-4078.

FOURTH member for car pool from La Cueva & Turner or Paseo del Mar & Copper to Area I. Bickes, 293-4037.

Coronado Club Activities

Isleta Poor Boys Play Weekend

WESTERN WEEKEND is the name of what's happening tonight and tomorrow with the Isleta Poor Boys, one of the more popular country and western groups around the city, booked at the Club both nights. Happy Hour prices are in effect tonight from 4:30 until the music starts at 8:30. Dining room hours (either buffet or regular menu service) are from 6 until 8:30. Karen Edwards instructs free western dance lessons from 7:30 until 8:30.

Tomorrow, the buffet is a western favorite — barbequed beef ribs with baked beans and coleslaw. For reservations, call 265-6791.

ON SUPERBOWL SUNDAY, Jan. 22, friends will start gathering at the Club around 11 a.m. to watch the action on a special giant screen rented for the occasion. The $1 admission ($2 guests) covers a bowl of green chili or posole. Special bar prices, such as bloody Marys for 75 cents and draft beer for 50 cents, will be in effect. Every quarter, a drawing will be held and winners will receive T-shirts.

DON'T MISS the Club's already-famous Thursday night fresh seafood buffet. Inaugurated since the first of the year, the spread features the best and freshest seafood available and it's flown in especially for the occasion. Manager Mitch Giffin is making points with this activity. The New England Kid knows about seafood — ask someone who was there last night. The buffet includes soup and salad bar, and the tab is only $7.25 for adults, $4.25 for children under 12. In the background, the Sandia Jazz Corporation (formerly Arlen Asher Trio) plays very quiet but very exciting jazz. The fresh seafood buffet is served every Thursday starting at 6 p.m.

NEXT FRIDAY, Jan. 27, features an all-girl group called "9 to 1" on the bandstand playing a swinging variety of danceable music. Dining is either buffet or standard menu.

FREE SLIDE SHOW and program on Alaska is scheduled Monday, Jan. 30, in the ballroom. The schedule includes slide and film presentations of spectacular Alaskan scenery plus a live performance by Larry Beck, a favorite Alaskan entertainment personality. The show, sponsored by Westours Alaska Travel, is on a national promotional tour. Refreshments will be available from the lounge bar.

* * *

MARK YOUR CALENDAR now for Saturday, Feb. 4, and a Variety Night special. Walt Disney's classic animated film *Dumbo* about an elephant with oversized ears and the ability to fly is the movie of the evening. In addition, Don Marchi (2512) brings his magic show back to the Club for a mystifying performance. Food service is available at 5 p.m.; entertainment starts at 6. Admission is free to members and families.

RETIREE DICK STROME displays one of his recent paintings called "Zuni Ceremonial Finery." His work is currently on exhibit at Aldridge Fine Arts Gallery in First Plaza and in the permanent collection at the State Fairgrounds.

Retiree Roundup

Strome's Insights Aren't All Artistic

Retiree Dick Strome smiles a lot. He was enjoying a hamburger and French fries as we had lunch in a restaurant in First Plaza downtown. We had just spent a pleasant half hour admiring his paintings on display at Aldridge Fine Arts Gallery there.

But the smile wasn't in appreciation of the hamburger. "My painting has improved," Dick says. "I work at it."

He paints realistically, working in oil or opaque watercolor. His subjects are Southwestern — people, horses, or landscapes. Usually he includes a technical challenge such as white on white, silver in the bright sun, moonlight, the shadow shape of trees.

Dick was a technical artist and supervisor at Sandia for 30 years. He retired four years ago this month. Dick was active in the local fine arts scene throughout those years at Sandia. His work was annually selected for exhibit at the State Fair, and in 1971 he won the purchase award. (The Fine Arts Gallery at the State Fair is currently displaying its permanent collection, including Dick's large landscape in opaque watercolor.)

"The thing about retirement," Dick says, "is that you have time to fill your life with interesting things to do. My wife and I take care of the everyday chores, and I usually work in my studio from mid-morning until mid-afternoon. We travel some. We went to Spain last summer — a tour of castles and cathedrals — and we've visited the beaches in Mexico."

Dick smiles again. "There's time with friends," he says, "and some socializing.

"But it's not enough. There are still empty spaces." Very serious now, Dick continues, "I was lucky. Through my church I found out about the volunteers who help at Ann Pickard Convalescent Hospital. I now spend several hours a week visiting with the patients there — mostly older people. They need someone to talk to. It helps them feel better. And, you know, I feel better too. I highly recommend some kind of meaningful volunteer activity. It makes the business of living a little more worthwhile."

Dick smiles again. He's entitled.

SPEAKING OF TRAVEL, Club members may still make reservations for the Louisiana Exposition in New Orleans May 25-29, 1984. The package includes airfare, four nights lodging at the New Orleans Marriott, two days admission to the exposition, a sightseeing tour of New Orleans, dinner at the Andrew Jackson restaurant, and a breakfast with jazz on the riverboat SS Natchez while cruising on the Mississippi River on the way to the Fair. Price is $562 per person (double occupancy). The Club's new travel director is Charlie Clendenin (2611), who is usually at a travel table in the Club lobby early on Thursday and Friday evenings. More info available anytime from the Club office, 265-6791.

KIDDIE KARNIVAL, an annual event at the Club, is scheduled this year on Saturday, Feb. 18. Ronald McDonald will present a clown show, door prizes will be awarded, and the ballroom will be set up with game booths offering fun and challenges. A book of game tickets sells for $1.25 (and a portion is donated to the Ronald McDonald House). The book includes tickets for a coke and popcorn. Doors open at 10 a.m., the magic show is set for 1:30, and super sandwiches will be available throughout the event.