ERB: Converting Bombs Into Missiles

ERB—Chris Dalton and technician Harold Smith (both 1321) work on prototype of extended range bomb being set up for flight test at Tonopah Test Range. ERB incorporates a propulsion unit, canard wings and guidance; it permits stand off delivery of weapon to target.

A technology development program in Chris Dalton's Exploratory Systems Division 1321 would offer an additional tactical capability to military planners. Called the Extended Range Bomb, the ERB concept calls for the addition to a stockpiled nuclear weapon of three elements—a rocket propulsion unit, canards and wings, and a guidance package. In use, the pilot approaching a tactical target would release ERB at some distance from the target (on the order of ten miles), the rocket would ignite, and the weapon would proceed to the target while the delivery aircraft made its escape.

The development of ERB is prompted by studies concluding that Soviet anti-aircraft defenses are now truly formidable and that the survivability of aircraft, including high performance jets, flying above a few hundred feet in the vicinity of heavily defended targets is severely limited. These conclusions were buttressed by the experience of the Israel-Egypt war of 1972, in which Soviet-supplied anti-aircraft systems were extremely effective against Israeli jets.

Dalton outlines the weapon delivery problem bluntly. "If you can't fly to the target on the deck—100 to 200 feet—the probability of completing the mission is fairly low. ERB would greatly increase the probability of a successful mission by allowing the aircraft to release the weapon some distance from the target and at very low altitude."

The ERB has a second delivery mode which the pilot can select. This mode

[*continued on page four*]

LAB NEWS

VOL. 29, NO. 12 JUNE 17, 1977

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

A First— Fusion Neutrons Produced

Scientists at Sandia Laboratories have obtained experimental evidence for the country's first fusion neutrons using electron beams, an important preliminary step in eventual production of energy by controlled thermonuclear fusion.

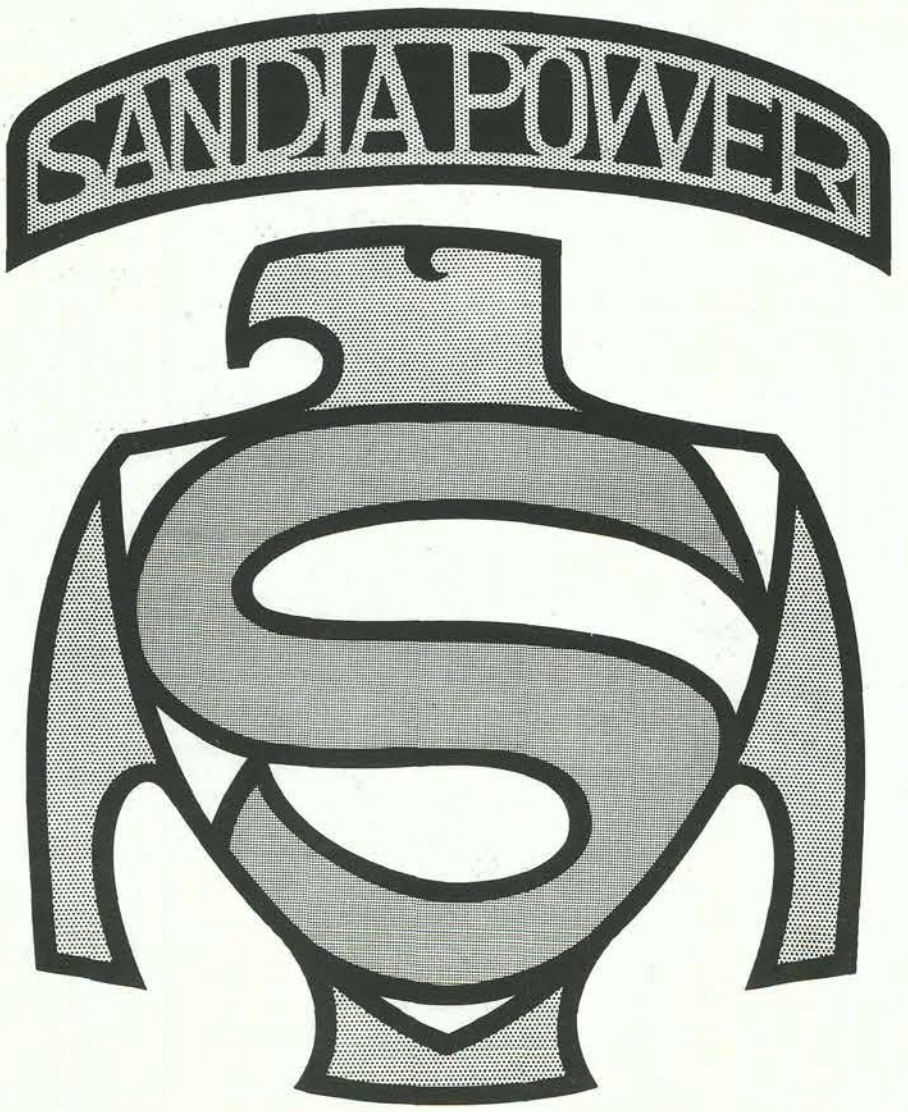
The neutrons were produced by irradiating BB-size, deuterium-filled fuel pellets with intense electron beam pulses. About a million neutrons were produced per pulse, indicating that fusion reactions had occurred in the deuterium.

Thermonuclear neutrons are produced when atomic nuclei in the deuterium fuse together under extreme heat and pressure, emitting neutrons.

A full-fledged fusion reactor, needed for the economical production of energy by controlled thermonuclear fusion, would have to produce millions of trillions of such neutrons, an event not expected to occur for many years.

The electron-beam induced reactions at Sandia were the first produced in the U.S.;

[*continued on page four*]



THE WINNER in the LAB NEWS T-Shirt Contest is this design submitted by Bob Helgesen (9473). And Richard Cernosek (1354). Turns out we adopted elements from both their entries and came up with this (so both get a Savings Bond). A future issue of LAB NEWS will publish the design life-size and in color (red and blue) using a special ink that makes it possible for you and your household iron to create your own Sandia Labs T-shirt. More than 20 entries were received in the contest.

Afterthoughts

We've been following the nuclear power issue with interest and herewith present our file on it--a collection of pronouncements, insights, and observations that (it seems to us) apply the rational process to a subject beset by much that is irrational.

* * *

"Nuclear energy is in trouble. I don't believe that a primary energy system that is feared or rejected by 33 percent of the public can survive in the long run (a reference to the voters' two-to-one rejection of nuclear moratoria in seven states last fall). Nuclear energy has three possible futures. It could disappear gradually; the public's fears could subside as we acquire more experience with reactors and familiarity with radiation; or we could draft the terms of a peace treaty between those who oppose nuclear energy and those who support it." -- Alvin Weinberg, Institute for Energy Analysis, Oak Ridge

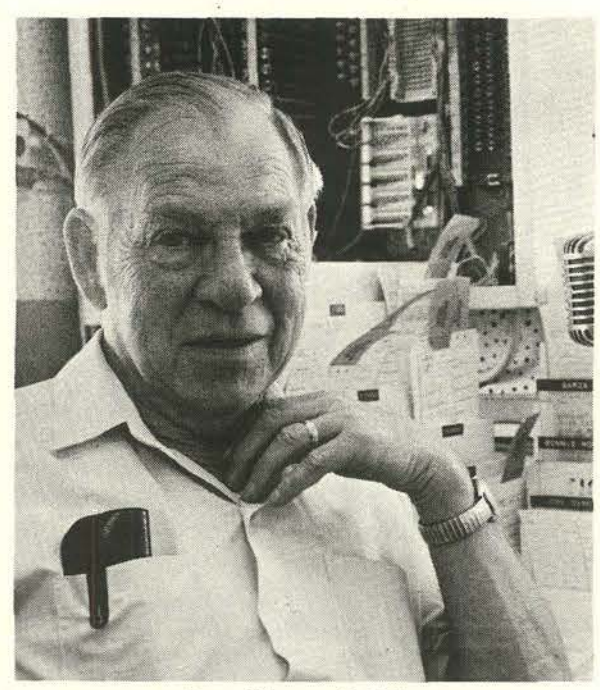
"Our immediate prognosis is for extension rather than dimunition of the opposition to nuclear technology. Public opinion, which has consistently supported nuclear power, is nonetheless deeply divided, much as it was during the war in Vietnam... Our own bias is to keep the nuclear option open, but to proceed cautiously; to press vigorously for solutions to immediate problems; but to forego at this time the implementation of plutonium recycle and the breeder..." -- Science Magazine

"In such a nuclear conscious community of East Idaho and Idaho Falls it's mystifying why he (Pres. Carter) should rule out the fast breeder reactor and use of plutonium. This is probably the cleanest and best source of energy but President Carter's proposal would tie the hands of this emerging industry... It's rather mystifying that President Carter, trained as a health physicist and even a frequent visitor to the Idaho National Engineering Laboratory when he was a young naval lieutenant just out of the U.S. Naval Academy at Annapolis should take such a hard stance." -- The Post-Register, Idaho Falls, Idaho

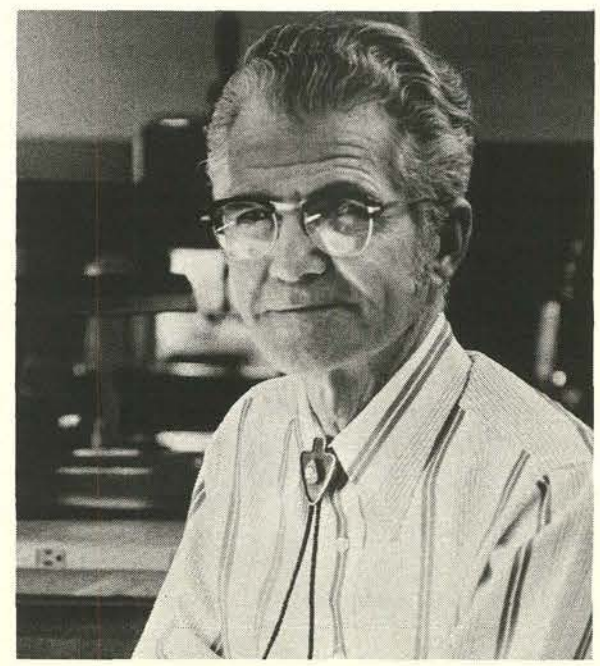
"It is the public perception of the magnitude of risk associated with nuclear power generation in the context of the alternative--the risk of not using nuclear power--which most likely will have the strongest influence on the relative importance of the nuclear power option... The traditional U.S. approach of trying to educate the public on portions of the technical issues seems to have been repeatedly ineffective in achieving public acceptance... Regardless of whether the U.S. decides to accept nuclear power generation, we must still deal with our own existing nuclear wastes from continuing military applications..." -- James Liverman, ERDA AA for Environment & Safety

"A decision to bypass the breeder represents a gamble of high risk." -- Ralph Lapp in Energy Daily *js

Retiring



Pete Klemm (3421)



Raleigh Pickering (9561)

Deaths

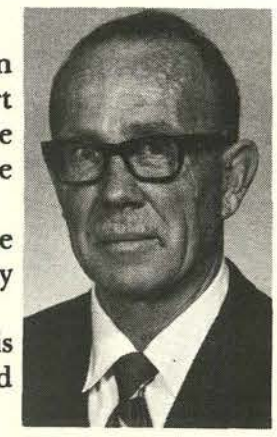
Tom Mead, a security inspector in Security Standards and Operations Department 3430, died suddenly in a local hospital May 31. He was 60.

Tom had been injured in a boating accident at Elephant Butte Lake in early May while working as a member of the Coast Guard Auxiliary.

He joined Sandia in March 1951.

Survivors include his widow and a daughter.

* * *



Malcom Hamm, an artist in Technical Art Division 3155, died June 4 after a long illness. He was 54.

He had worked at the Labs since February 1951.

Survivors include his widow, a daughter and a son.

LAB NEWS

Published every other Friday

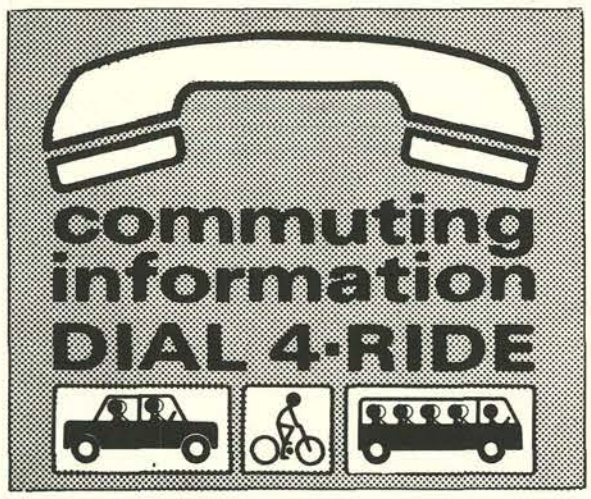
SANDIA LABORATORIES

An Equal Opportunity Employer

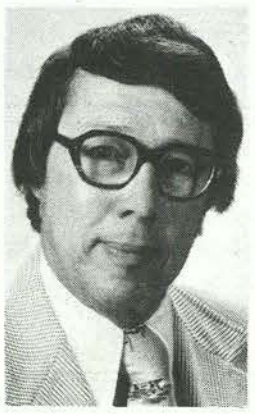
ALBUQUERQUE, NEW MEXICO
LIVERMORE, CALIFORNIA
TONOPAH, NEVADA
Editorial offices in Albuquerque, N.M.
Area 505 264-1053
FTS 475-1053
ZIP 87115
In Livermore Area 415 455-2952
FTS-469-2952

john shunny is editor
&
don graham ass't. editor

bruce hawkinson & norma taylor write
bill laskar does picture work
so does russ smith
&
lorena schneider reports on livermore



Supervisory Appointment



Gordon Ross to supervisor of Material Management Division 8256, effective June 1.

Joining Sandia/Albuquerque in 1955, Gordon worked in Personnel, Employment, Business Methods and Job Evaluation organizations. In 1968, he transferred to Livermore where he has been personnel representative and PhD recruiting coordinator in the Personnel Division. Previously, he was with El Paso Natural Gas Company. For six years, during WWII and the Korean conflict, Gordon served as a pilot in the Air Force.

A graduate of New Mexico State University, Gordon has done graduate work at the University of New Mexico. He is a member of the Western College Placement Association.

Gordon has held various offices in the Rotary Club over the past 14 years, both in California and New Mexico. He also enjoys boating, camping and photography.

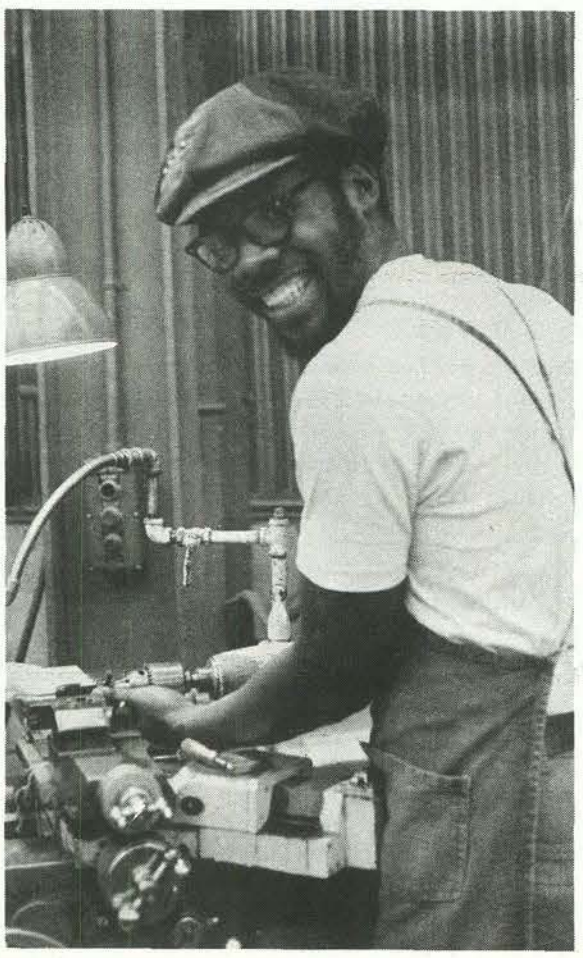
The Ross's have five grown children and live on Mirador Drive in Pleasanton.

Congratulations

Mel LaGasca (8411) and Gail Timberlake, married in Stockton, Calif., May 21.

Mr. and Mrs. Leo Mara (8116), a son, Abraham Frederick, May 28.

Mr. and Mrs. Dave Geene (8313), a daughter, Donna Marie, Apr. 30.



APPRENTICE GRADUATE—Now a journeyman machinist, Fred Johnson (8423) recently completed SLL's apprenticeship program which included four years of on-the-job training and related academic courses.

LIVERMORE NEWS

VOL. 29, NO. 12 LIVERMORE LABORATORIES JUNE 17, 1977

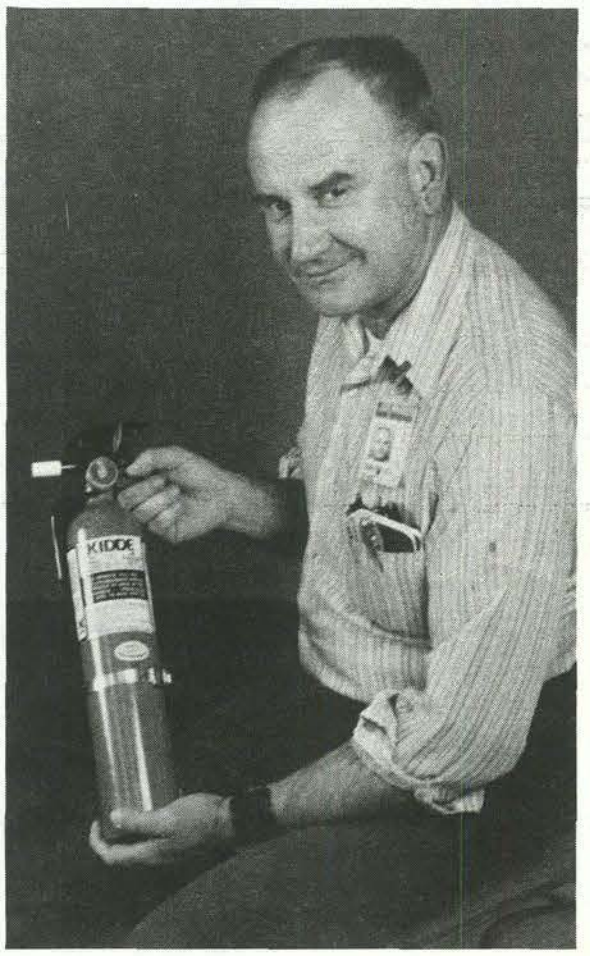
Sandian Firm Believer In Home Fire Extinguishers

For whatever benefit it may serve fellow Sandians, Gordon Bennett (8413) passes on details of a recent incident that occurred in his home.

Gordon relates that his wife had put a pot of cooking grease on the stove to heat for french fries, then went off to another part of the house. Gone longer than she had expected, the grease caught on fire. "Our two boys, ages 12 and 18, who were in the front yard, happened to see the flames through the window," says Gordon. "A fire extinguisher I'd purchased only two months previously through our Safety organization was in the garage just outside the kitchen door and both boys headed for it at the same time. With it they managed to put out the fire."

"I have no doubts," comments Gordon, "but that their action saved us a good bit, perhaps the whole house because the flames certainly were off to a good start. Luckily, I had instructed the whole family in operating the extinguisher at the time I brought it home."

A selection of extinguishers is available for purchase in Safety. Call Verne McNabney, ext. 3086, for further information.



FIRE EXTINGUISHER purchased by Gordon Bennet (8413) through SLL Safety organization prevented extensive damage to his home.

Livermore Labs Reports Bond Drive Results

Fred Eichert (8432), chairman of this year's SLL Savings Bond Drive, reports that final results of the campaign show overall participation at an impressive 96%. When the drive began, 87% of employees were purchasing bonds.

Out of the four directorates at SLL, two achieved 100% participation—8200 and 8400—and out of the remaining 100 organization units, 75 also achieved 100%. Certificates recognizing these accomplishments are being presented for individual organizations.

Fred thanks all who made the drive such a success. "I'm pleased with the numbers," he says, "but, more than that, the spirit of the drive was great!"

Blood Bank Drive Big Success

One hundred thirty-nine Sandians donated blood during the recent annual Blood Bank Drive at Sandia/Livermore. This resulted in 53 pints going to the Sandia Blood Bank and 86 to Kaiser Health Care Plan.

Jim Henderson of Training and Benefits Division 8214 says this is the highest number of participants since the first drive in 1959.

Take Note

The "Happy Hookers" team took first place in the Sandia Mixed Handicap Bowling League's winter competition. Team members are captain Dick Silva (8257), Gil Esquibel (8183), Ray Gott (8424), Chris Imler (8265) and Jim Rego (8424). Finishing second was the "So Happy It's Thursday Swingers" team.

Individual awards went to: high scratch game—Paul Dominguez (8433), 247, and Eva Leong (8212), 215; high scratch series—Ray Gott, 628, and Mary O'Shea (8266), 582; high handicap game—Dave Ross (8256), 272, and Debbie Cosgrove (8344), 256; and high handicap series—Ollie Rohrback (8413) and Roger Baroody (8410), both 698, and Cheri Rego, 687.

* * *

Jim Henderson (8214) was recently picked by Livermore Valley's radio station KKIQ as "Millionaire for a Day." As the lucky winner, Jim received a check for $138.90, representing one day's interest on one million dollars, along with dinner and theatre tickets for two.

Continued from Page One

A First—Fusion Neutrons Produced

Russian experimenters at the Kurchatov Institute having obtained evidence of similar reactions in early 1976 using a different fuel pellet.

The electron beam fusion concept is similar in many respects to the better-known laser fusion approach, now being investigated at several laboratories. Both forms of fusion require the symmetrical irradiation of small fuel pellets with high energy beams lasting only a few tens of billionths of a second or less.

The laser beams consist of light particles—photons—while the electron beams consist of electrons.

In both approaches, however, the beams heat and compress the fuel pellet, by implosion, fusing atomic nuclei—normally both deuterium and tritium—and causing a micro-explosion whose heat would be used to drive a conventional power generator.

These micro-explosions—equivalent to the detonation of several pounds of TNT—would be produced many times a second, thereby releasing more energy than would be required to generate the beams used to trigger the explosions.

Sandia experimenters became interested in electron beam fusion because e-beam accelerators are relatively simple machines and are highly efficient, converting in principle up to one-half of their input energy into beam energy, compared to only a few percent efficiency for present gas lasers.

Much of the Sandia research in the past five years has been devoted to shortening beam pulses, focusing electron beams to the diameters needed to irradiate fuel pellets and developing means of transporting beams from emitters to fuel targets.

In the neutron-producing experiments at the Labs, the e-beam accelerator (named REHYD) was used to produce a beam by applying about one million volts between the two electrodes of the machine's vacuum diode.

Electrons emitted from the negatively charged electrode streamed across the vacuum gap to the positively charged electrode, or anode, where the fuel pellet was located. The beam current of about 250,000 amps created strong magnetic forces which caused the beam to focus down to the diameter of the one-tenth-inch diameter pellet.

The electron pulse lasted approximately one ten-millionth of a second, with the electrons depositing their energy in the outer shell of the pellet. This caused the shell to explode, compressing and heating the deuterium fuel.

Measurements indicate that the pellet absorbed about 40 billion watts of power, was compressed about 1000-fold with a pressure of approximately five million atmospheres, and reached temperatures ranging from 10 to 20 million degrees F.

The temperature and pressure were sufficient to cause some of the deuterium nuclei to fuse. The fusion of two such nuclei—each containing one proton and one neutron—forms a helium-three atom containing one neutron and two protons. The extra neutron is emitted during the reaction and can be detected because of its unique energy—2.45 million electron volts.

Sandia experimenters are continuing their fusion research, using increasingly powerful electron beam accelerators. Now being tested is an accelerator capable of producing eight trillion watts of power in a pulse lasting about 24 billionths of a second. Another accelerator which will produce 40 trillion watts is scheduled for completion late in 1979.

It is expected that a commercial electron beam fusion power plant would require at least 100 trillion watts of beam power in a pulse lasting 10 billionths of a second or more. Accelerators for such plants, not projected to be in operation for several decades, would have to fire from one to 10 times a second, and many technological problems in their design and construction remain to be solved.

Sandia e-beam experiments are conducted by Fusion Research Department 5240 headed by Gerry Yonas. Key people for the neutron experiments were James Chang, A. V. Farnsworth, Melvin Widner, and Ramon Leeper, all of that department.

Continued from Page One

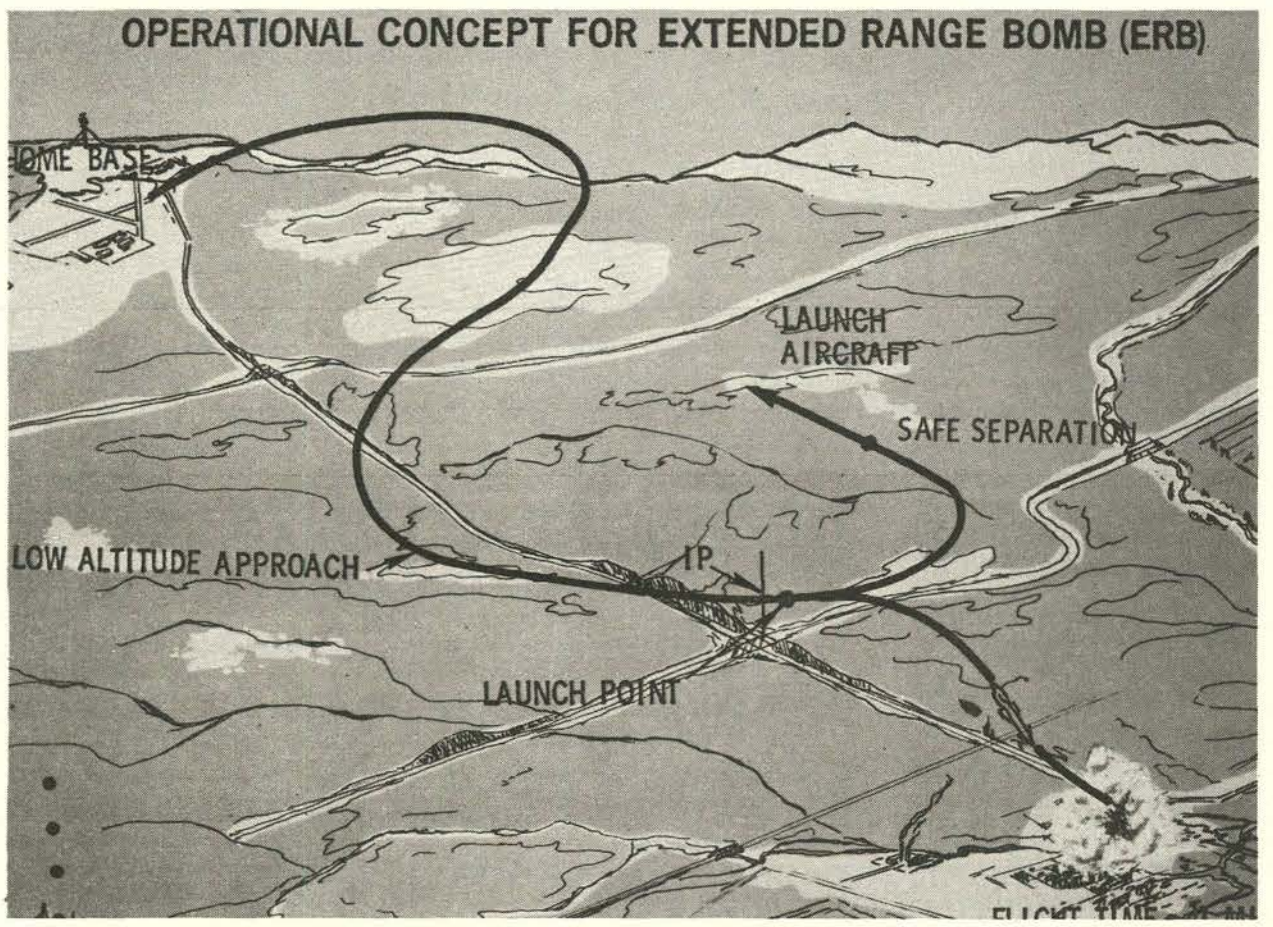
ERB: Converting Bombs Into Missiles

would allow the aircraft to overfly the target, at which point the pilot initiates the inertial guidance system, proceeds for a pre-determined length of time beyond the target and releases the ERB unit, which promptly turns around and flies back to detonate over the target.

Work on ERB technology over the past three years has progressed to the early hardware stages and, currently, test flights of ERB units are being made at Tonopah Test Range. The first such flight, last February, was a checkout of the guidance and control, auto-pilot, and aerodynamics. It was successful.

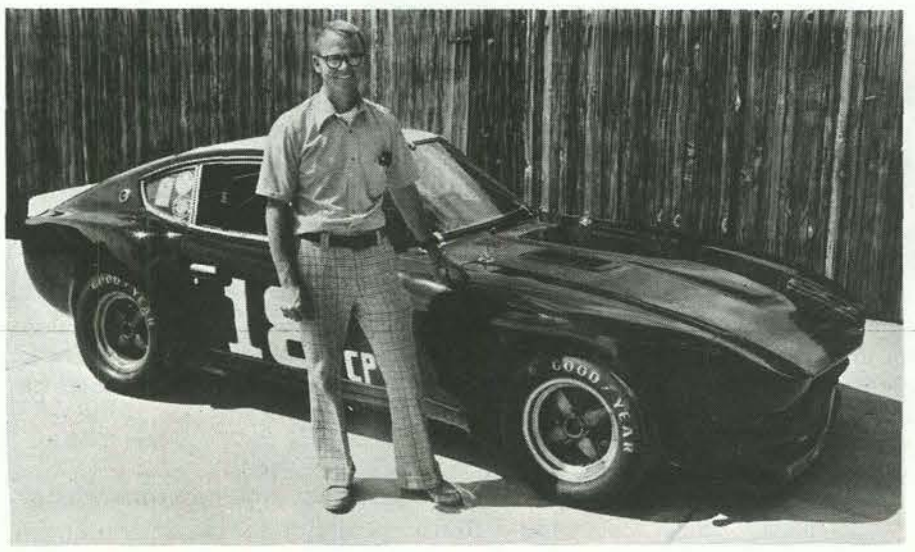
The ERB program involves the efforts of many Sandians and many organizations. The guidance and control activities have centered in various divisions in departments 1320, 2120, 2130 and 2320. Many of the divisions in department 1330 have contributed their talents in the development of the aerodynamics, simulation activities and recovery systems. The instrumentation systems, key items in assessing system operations, have been developed by various divisions in department 9480. The shop, drafting and test organizations have also played major parts in support of the ERB program.

The potential application of ERB technology to existing weapons is being pursued by 4310 under the TIGER Program, standing for Tactical Inertial Guidance and Extended Range. Additional ERB flight tests are planned to evaluate changes in guidance systems and aerodynamic configurations.



HOW ERB WOULD WORK is shown in this drawing. As launch aircraft flies over IP (identification point), extended range bomb is released to continue on to target under rocket power. Inertial guidance system directs ERB to target, which may be up to ten miles distant.

TUNE 'EM UP—That's the word from and job of Ernie Marquez (8718) who recently performed that chore on the 100 vehicles assigned to Area III. He adjusted carburetors and timing and replaced air filters and points to ensure lowest possible gasoline consumption and harmful emissions.



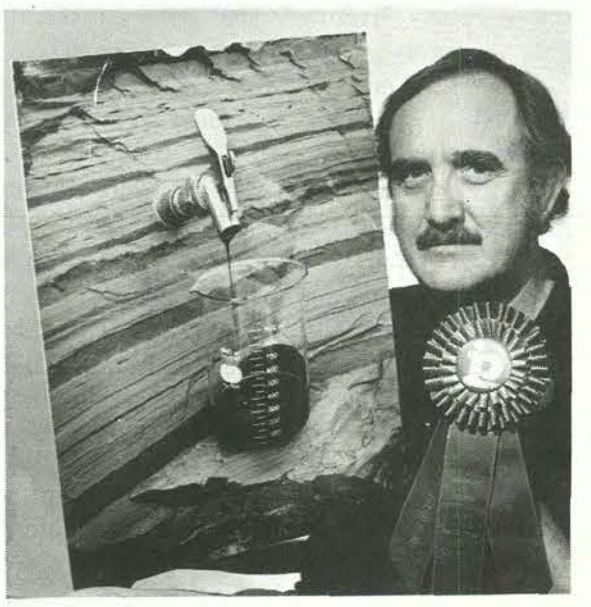
AFTER 10 YEARS of racing Formula Vee VW's in Sports Car Club of America competition, Bill Kampfe (9335) moved into the big time (C-Production category) by buying this 280Z racer. Bill modified the fenders (note flare), painted it, tuned it to perfection, and drove it to wins in recent races in Pueblo, Colo., and Hutchinson, Kans. He took first in two regionals, 2nd and 3rd in national races. He hopes to collect enough points to compete in the natonal championship runoffs in Atlanta, Ga., next October.

FREE TENNIS CLINIC for women (Sandia and ERDA employees, spouses or dependents) is scheduled tomorrow from 8 to 9 a.m. on the courts near the Base Gym. Instruction will cover basic strokes for beginners or intermediate level players. Participating will be Kathy Pitts (3512), Kathy Ward (1712) and Kate Young (3141). Other instructors include Paige Shunny and Joe Tillerson (5162). No registration is necessary. Show up for the instruction, stay for another two hours of play on the courts.

sandia PEOPLE Report

JACK REX (3413) was honored recently with a plaque from the Governor's Committee on Employment of the Handicapped in Albuquerque. Jack was recognized "for an outstanding job." He headed Sandia's Recruiting Division from 1969 through 1975 and was a member of the Governor's Committee for two years.

NEW TELECON OPERATOR is La Rue Wildgoose (9753). She handles some 80 phone calls daily taking requests for plant maintenance, getting details of the work to be done and writing work orders.



ESSENCE of Sandia's oil shale project is captured by photographer Louis Erne (3171) in this prize-winning color print. The photo garnered second place in recent competition of Industrial Photographers of the Southwest in Santa Fe. Louis is a past president of the organization.

First Time Ever

Post-Meltdown Conditions Simulated

A team of Sandia engineers and technicians led by Joe Rivard (5422) has succeeded in simulating the conditions inside a Liquid Metal Fast Breeder Reactor (LMFBR) vessel after a hypothetical core meltdown and refreeze. The first of a series of three experiments sponsored by the Nuclear Regulatory Commission, the simulation marked the first time: 1) that oxide fuel material, in the particle form it would have after a core meltdown, has been internally heated (by nuclear fission) while submerged in liquid sodium coolant; and 2) that "post-accident heat removal" conditions (temperature, pressure, materials) expected in the event of an extremely improbable large scale core-disruptive accident in an LMFBR have been essentially duplicated. The test confirmed that the heat generated by fuel particles after meltdown is, as calculations have predicted, satisfactorily dissipated by the liquid sodium coolant.

A core meltdown, while extremely improbable, is theoretically possible. What is hypothesized as happening is that the temperature of the fuel core (mixed oxides, a combination of uranium oxide and plutonium oxide) rises suddenly. This could result either from a loss of coolant flow, caused by circulating pump failures, or from a reactivity excursion, caused by failure of the control devices to keep the fuel at normal operating temperature. Assuming such an incident, the fuel at a temperature of 3000°C would melt the steel cladding around the fuel rods, exposing the molten fuel to the 500°C liquid sodium coolant. The sodium would briefly be transformed into a bubble of sodium vapor and would then collapse around the fuel material. The sudden exposure of the fuel to the comparatively cold sodium "freezes" the core material and shatters it into a fine gravel-like powder. This powder ends up as a "debris bed" lying on horizontal surfaces of the reactor vessel.

It's at this point that the Reactor R&D Department 5420 experiments in post-meltdown begin. "Our goal," says Joe, "was to determine whether the fuel material in this condition, that is, as a debris bed, would be cooled sufficiently by the surrounding sodium, or whether the fuel material would fail to be cooled and would heat up and eventually melt and erode the reactor vessel's structural materials, resulting in a release of radioactive materials from the vessel.

"What we have learned," says Joe, "is that, for the shallow beds simulated in this first experiment, the liquid sodium penetrates into them and 'wets' them. This allows the bed to conduct their heat away, thanks to the high thermal conductivity of the metal (sodium) coolant. This cooling is entirely a natural process—it doesn't require pumps or other devices to be in operation. The heat ends up raising the temperature of the sodium coolant only slightly, since a typical LMFBR contains more than a thousand tons of sodium.

"Initially, we expect thicker debris beds, such as those in the two later experiments in this series, to behave similarly, particularly at low power levels. However, at high power, when the sodium at the bottom of the bed may boil, we may see different effects predominate."

A TEST ASSEMBLY similar to this was used to simulate post-meltdown conditions in an LMFBR. The oxide fuel particles were in a can like the one in Joe Rivard's right hand. The rest of the capsule assembly is above the can. At left is the coolant assembly with ports for helium inlet and exhaust. At right are some of the thermocouples and pressure transducers used to instrument the experiment.

The successful experiment is a milestone in the effort to investigate the safety of the LMFBR. So why hadn't it been done before? Says Joe, "Many labs, including Sandia, have heated core materials and materials simulating fuel with external resistance heating and induction methods, for example. But our experiment is the first one that actually simulates the heating condition in the LMFBR: the fuel is being heated internally as it would be by radioactive decay.

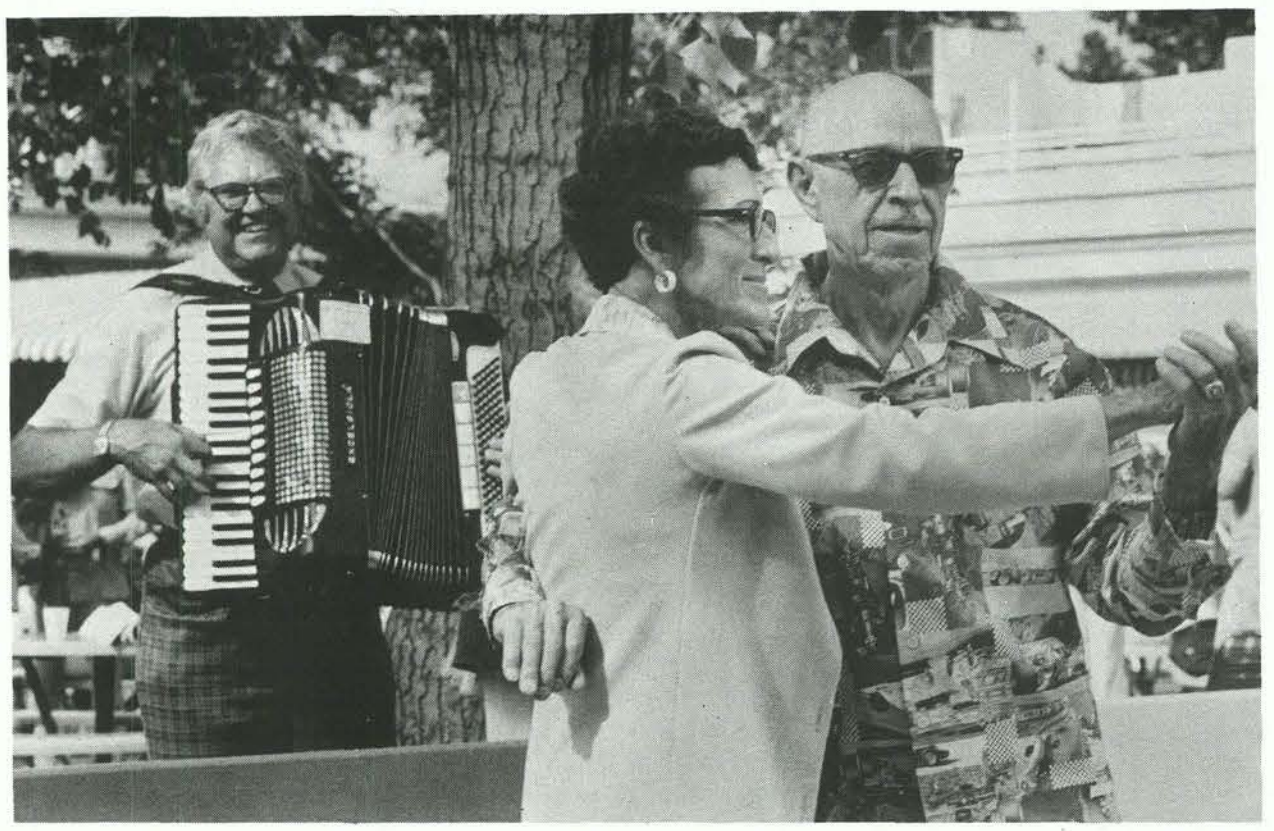
"One reason it hasn't been done before is simply that it's difficult to ensure the safety levels necessary. What we had to do was to design an innovative test cell to contain the fuel and the sodium, provide a complex helium loop cooling system (developed by John Brammer, 1136) so that we could cope with the heat generated, and instrument the entire experiment so fully that we knew exactly what was happening at the bottom of our test reactor, the Annular Core Pulsed Reactor (ACPR). We worked closely with Sandia's Internal Reactor Safety Review committees and with the Health Physics Division 3312 on all the safety planning."

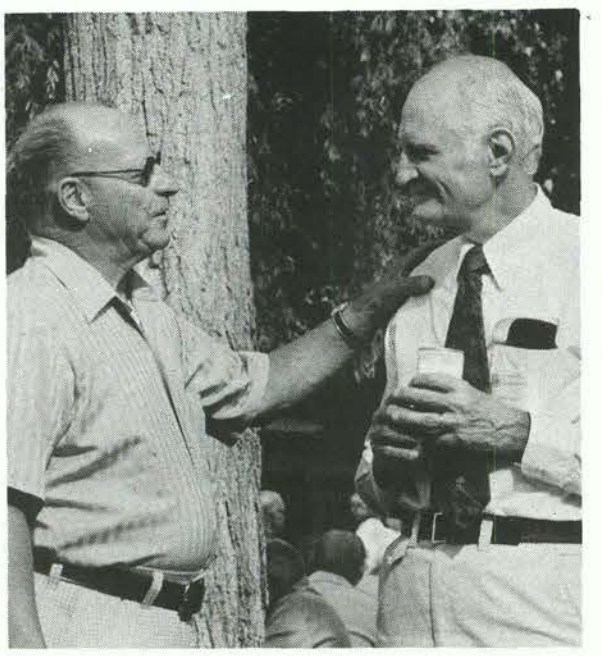
Other reasons that such an experiment hasn't been done are the cost—reactor experiments are expensive—and the time—three years of preparation versus the few months associated with non-reactor experiments.

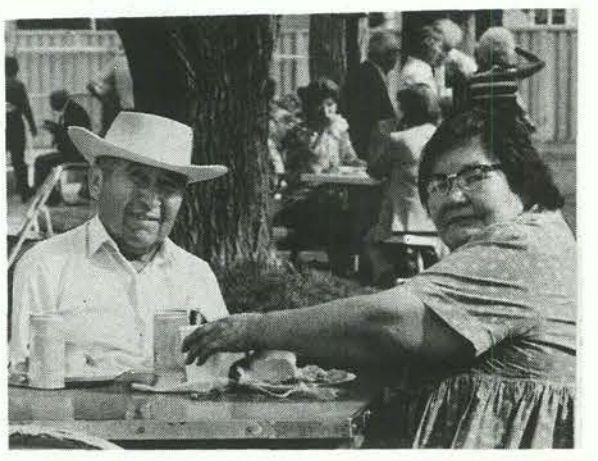
"The results were pretty much as expected for this experiment," says Joe, "although we did observe, after 11 hours of the 24-hour operation, one location within the bed that experienced a transition from the predominant mode of heat transfer—conduction—to a convection mode. We're currently evaluating this occurrence. The important point is that temperatures at the bottom of the bed were steady; they did not exhibit the rapid rising characteristic that would signal an uncooled bed condition."

An experiment of this magnitude demands a large and skilled team. Many people in the Reactor Studies Division 5422 and the Radiation Physics Division 5423 were involved as were the reactor personnel in 5451 under reactor supervisors J. C. Conant and Max Morris (5452). The technical team also included people from the Systems Engineering Division II 1136 and from Simulation Instrumentation Division 1126. A data analysis team composed of people from Fluid Mechanics and Heat Transfer Division II 1262 and Reactor Safety Studies Division 5411 performed initial calculations and is now analyzing the data from the experiment. Steve Burchett (1281) did all of the stress analyses for the fuel capsule design.

This activity is part of Sandia's Advanced Reactor Safety Research Program conducted on behalf of the Division of Reactor Safety Research, of the Nuclear Regulatory Commission for the purpose of assuring the safety of the LMFBR.

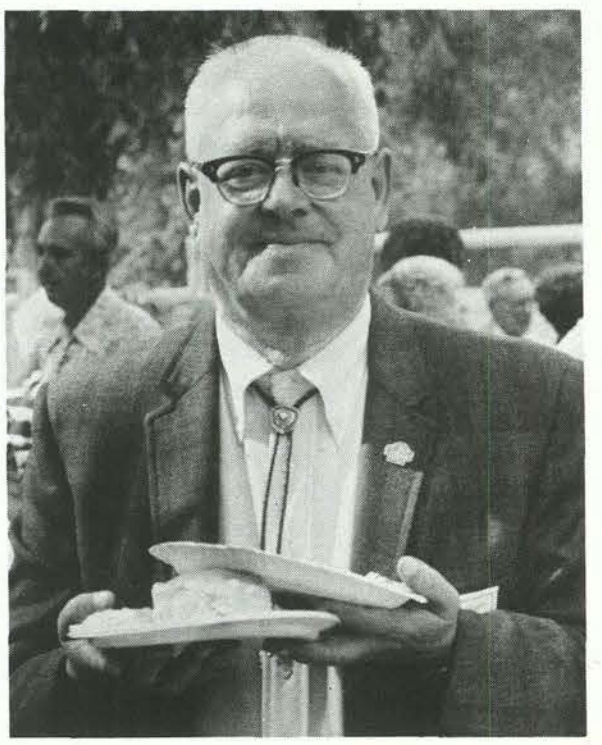






Retirees' Picnic '77

The weather was balmy, more than 800 people showed up, the food & drinks were great, and everyone had a super time. Mike Michnovicz (9632) squeezes out a tune for Margaret and Bud Foster, as Les Lamkin appears to be bestowing a word of advice upon a familiar figure. Warren and Amelia Nilchee were part of the crowd, and Einar Moterud decided that two plates were better than one.



Events Calendar

June 17-19—10th Annual Tribal Powwow, Albuquerque Indian School football field.

June 17-26—"Celebration," Corrales Adobe Theater, 898-3323.

June 17—June Music Festival, Fine Arts Quartet, Woodward Hall, 8:15 p.m.

June 17-19, 24-26, July 1-3—"Oliver," Albuquerque Civic Light Opera, 344-2317.

June 17—New Mexico Ballet Company, benefit concerts with Soili Arvola and Leo Ahonen, Rodey Theater, 8:30 p.m., 821-2453.

June 18—N.M. Mt. Club, Penasco Springs hike, 873-2430.

June 19—Opanci Folkdancers sponsored by the Albuquerque Parks and Recreation Dept., Holiday Park, 3 p.m.

June 23, 24—San Juan Fiesta, San Juan Pueblo.

June 24—San Juan Fiesta, Taos Pueblo.

June 24-26—New Mexico Arts and Crafts Fair, State Fairgrounds.

June 25-Sept. 1—Mimbreno Art Iconography, Maxwell Museum of Anthropology.

June 30—Albuquerque Childrens Theater, free plays and comedies, Prospect Park Library, 7 p.m.

thru July 10—"My Daughter, Rated X," Ole Henry's Dinner Theater, 293-5060.

thru July 10—"Stuffed Shirt," Barn Dinner Theater, 281-3338.

Safeguards Exercise

One element of Safeguards is to devise barriers—the kind that might be used to protect, say, a reactor site or a storage facility for nuclear material. The purpose of these barriers is not necessarily to stop a group of adversaries but to delay them long enough for the response force to arrive. A corollary of this effort is to subject the barriers to the acid test and, to this end, the Labs has been assembling teams of "adversaries" from among physically fit employee volunteers. Their mission: breach the barrier. This team is shown in a recent exercise involving barbed tape entanglements. The barbed tape isn't the relatively innocuous wire you see on the range (note inset). In fact, it's just plain frightful.

Above, Bill Ingram (9654) scrambles across a perimeter barrier on a ladder. The two team members in leather are Jim Linn (5742) and Mac Weaver (9743) (in hood). Below, Jim Linn proceeds nimbly through a 28-foot entanglement of concertina wire. The extension ladder is steadied by Gabe Romero (9655) and Mac Weaver. Other attack team members are Gail Barton (5833) and Vern Marsh (9633). The designer of the barriers and test director was Marty Kodlick (1752). We won't reveal the times taken by the team to accomplish its mission—only that their performance gives one a new and not very respectful perspective of the traditional chain link fence (the kind around the Tech Area).

Plant Engineering—Building and More Building

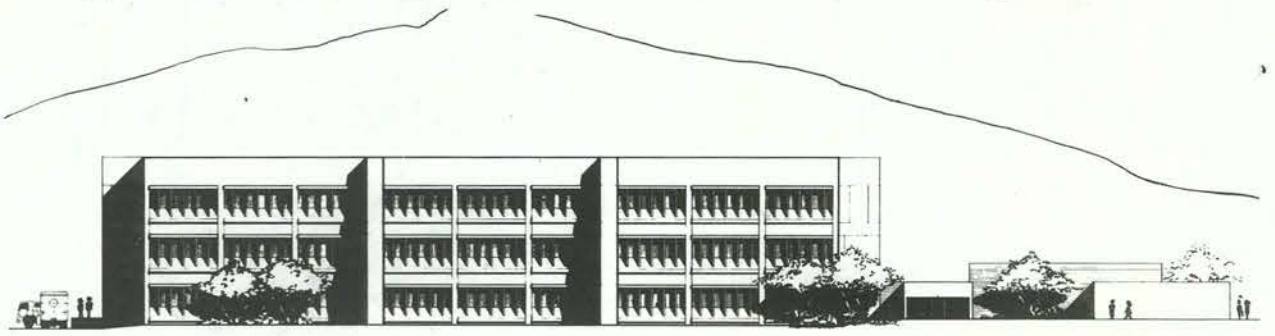
We dropped in to see Harry Pastorius the other day. He's manager of the Plant Engineering Design Department 9740, and he subjected us to some gentle scolding. "Your LAB NEWS stories about new facilities never mention the plant engineering role. But no matter—we're in the middle of the biggest construction year we've ever had. Let's talk about that."

We began with facilities now being constructed—the 5 megawatt solar tower in Area III is probably best known. "It's going to be over 60 metres high with a boiler-receiver mounted near the top. Eventually, several acres of heliostats will focus the sun on the boiler to create steam. When it's finished, perhaps by next February, it will be the largest such facility in the world. The total cost? Over $21 million."

The other major facility under construction at Albuquerque is the electron beam fusion facility (EBFF). "Again, when completed in the fall of 1978, it will accommodate a unique, state-of-the-art tool that will, according to Gerry Yonas (5240), give Sandia an excellent chance to determine whether practical fusion reactors can be developed using intense particle beams." The EBFF will total $14.2 million.

We asked about Livermore construction. "Ken Finders (8254) has a $404,000 contract to install a new optics and physical properties lab in Bldg. 916 underway," replied Harry. "It's due to be finished in July.

"And back here in Albuquerque, we're in the middle of a complete $275,000 renovation of the mezzanine area in Bldg. 894. When it's completed in September, it will house the new word processing operation. Modifications to create a hot cell in the basement of Bldg. 6580 by August will total about $320,000."



ARTIST'S CONCEPTION of new Safeguards 'light' lab and offices with classroom-lecture hall on right. View looks north from point south of Gate 10.

Then we asked about construction still on the drawing boards but due to go out for bids this fiscal year. Harry called in his division supervisors Don Knott (9742) and Ken Harper (9743).

Don talked about the project that most of us are likely to use at one time or another, the new cafeteria. "It will be located outside the Tech Area, north of Gate 6. It will seat 240 and, with each seat turning over (so to speak) about three times, will feed about 750 people during the lunch period. Food will be prepared on the premises, and we'll eat on real, not paper, plates. The new cafeteria will replace the current cafeterias in Bldg. 839 and in the Coronado Club. Costs will total $450,000."

"Then there's the new safeguards facility," said Ken. "Really it's two, no, three buildings. One is the 'heavy lab' with a high-bay area to accommodate tractor-trailer rigs and railroad cars to be used to transport special nuclear material. It will be located southwest of Gate 10. Southeast of the gate will be the safeguards 'light lab' for smaller projects and offices. Next to it and connected by a portal will be a classroom-lecture hall. The total will run to $8.3 million."

Smaller projects going to bid this year include: a rock mechanics lab in a renovated Bldg. 849 ($215,000); a diode assembly addition to Bldg. 6596 ($175,000); an addition to the Bldg. 867 warehouse ($200,000); new physics laboratories and offices in Libermore's Bldg. 916—the third of four phases involved in converting part of 916 from a warehouse-heavy lab into an 880-like complex ($475,000).

Smaller (less than $100,000) projects now total 79 and $2,245,000. The staff is reviewing designs for the waste isolation pilot project, monitoring five contracts in the Solar Total Energy Program area, administering the solar irrigation program construction at Willard, and more.

The grand total—major and minor, Albuquerque and Livermore, under construction or in design—is over $40 million. Says Harry, "If you like work, this is a great place."

Fun & Games

For the fit and not-so-fit—Ralph LaForge is a noted exercise physiologist at the Lovelace-Bataan Medical Center whose work with heart patients has achieved impressive results. He'll be the featured speaker at the Sandia colloquim on June 29 at 10:15 a.m., Bldg. 815. Title of his talk: "The Role of Exercise Training in Adult Cardiovascular Fitness." Ralph will discuss effects of aerobic exercise, how best to enhance cardiovascular performance, training regimens, and misconceptions about adult exercise.

* * *

Tennis—A mixed doubles fun day is scheduled by the SLA Tennis Assn. for Saturday, June 25, from 9 to 12 noon. Mixed doubles teams are urged to contact Kate Young (4-5461) or Lloyd Melick (4-1917) to sign up or for additional information. The round robin matches will be held on the courts near the East Side Gym.

Thirty players took part in the Association's recent men's singles tournament. In the championship match, Joe Tillerson (5162) defeated Jose Gonzales (9581), while Fred Hartman (4312) was runner-up defeating Art Hardeman (2623). The Association is currently sponsoring a men's doubles tournament.

* * *

Biking—A number of Sandians participated in last weekend's race to Sandia Crest from San Antonito. Tom Mayer (1247) was first to complete the 13-mile climb in one hour and 13 minutes. Others completing the course: Mac Weaver (9743), Irv Hall (1223), Ron Malpass (9412), Bob Roginski (9621), Pete Richards (5132), and John Shunny (3162).

The Sandia Bicycle Association continues to grow, with present membership at 455. A recent gate count indicates that some 300 cyclists were commuting to work on the day of the count, probably more than at any other industrial plant in the country. Purpose of SBA is to improve cycling conditions in Albuquerque and on Base, a purpose that has seen realization over the years. To join SBA send your name, E-number and organization to LAB NEWS; include a dollar if you wish. The money buys bike tools for use by members.

Schedules—Here are hours of operation of various Base facilities to which Sandians have access:

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Bowling Lanes 4-4327	1-10	9-11	9-11	9-11	9-11	9-11	9-11
Golf Course 4-4427	8-sunset	closed	8-sunset	8-sunset	8-sunset	8-sunset	8-sunset
Gym Nov-Apr 4-1818 May-Oct	1-5	11-8 11-6	11-8 8-6	11-8 11-6	11-8 8-6	11-8 11-6	9-5
Library 4-0795	closed	9-9	9-9	9-9	9-9	9-5	9-5
Oly. Pool Sept.-May 4-4008 June-Aug	1-5 11-7	closed	Tuesday-Friday 11-1 & 4-7 closed	11-7	11-7	11-7	11-5 11-7
Thrift Shop 265-3902	closed	10:30-2	10:30-2	3-6	10:30-2	closed	closed

Take Note

For three weekends beginning June 17, Poepjoy Hall will be the setting for ACLOA's presentation of the musical comedy "Oliver!" A release states that "the story has dramatic impact, the lyrics are clever and the score haunting . . . as the sad but happy story of Oliver Twist moves from starvation to salvation." Tickets are available at Popejoy and all TicketMaster box offices.

* * *

Art Clark, manager of Systems Environmental Testing Dept. 9330, has been re-elected VP of the Rocky Mountain/Northwest Region of the American Society of Mechanical Engineers. He was sworn in this week at ASME's annual summer meeting in Tampa, Fla. Active in ASME since 1957, Art has held many local and national offices in the society.

* * *

Like to see a nature center along the Rio Grande bosque? Then pull on your grubbies and gloves, take your shovel or rake and a picnic lunch, drive west on Candelaria till you come to the irrigation ditch, and join a clean-up party tomorrow at 9. The City will provide trash bags for the cleanup and soft drinks to accompany your lunch. Bring your teenagers if they're capable of productive toil. The goal? A real live nature center operated by the Bosque del Rio Grande Nature Preserve Society a year from now.

* * *

A group of Japanese educators will visit Albuquerque for two weeks in September to take part in day-to-day classroom activities at Albuquerque schools. Margaret Dike, coordinator for APS community affairs, called to inquire if Sandians would be interested in housing one (or more) of the visitors, all of whom speak English (in fact, they're English teachers). We assured Margaret that the answer is "yes!"—so call her on 842-3568. About 30 visitors are coming.

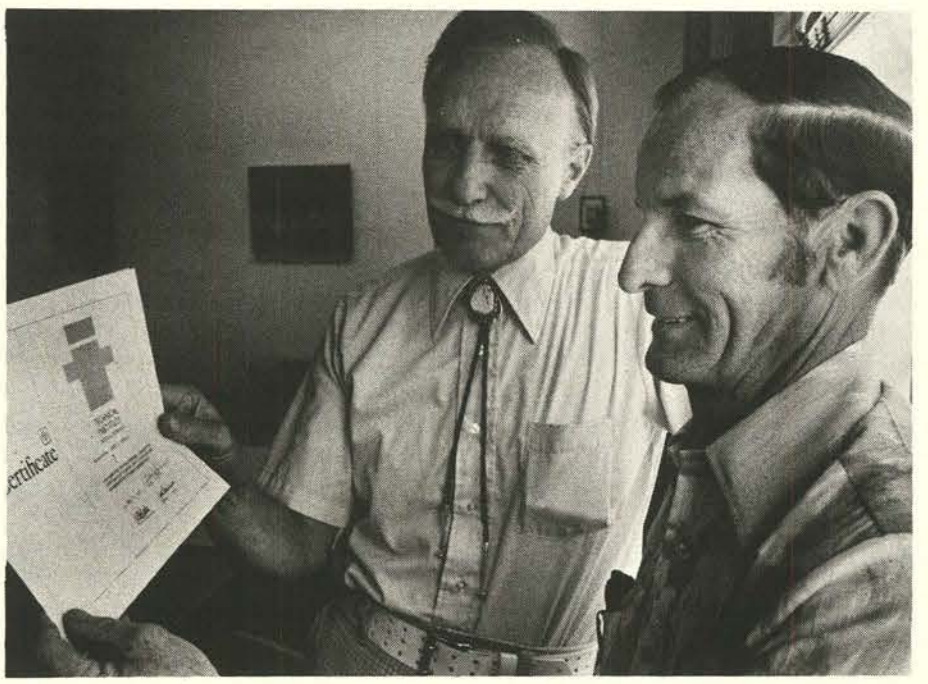
* * *

Volunteers are needed for the Meals on Wheels Program—delivery of meals to elderly, handicapped or convalescent persons who are unable to prepare their food and have no one to do it for them. In addition to a full delivery schedule, Meals on Wheels has a waiting list of 25 people who have requested this service. If you have a couple hours a week to spare, call the Meals on Wheels office, located at Presbyterian Hospital, 843-9211.

* * *

Gene Ives (4360), Sandia's answer to Nelson Eddy, has the lead in Corrales Adobe Theatre's *Celebration.* The musical comedy runs Thursdays through Sundays till June 26; performance time is 8:30. The theatre, the old San Ysidro Church, is half a mile west of the road through Corrales; turn just north of the Territorial House.

AMIGOS—Gerse Martinez (3171) shakes with Congressman Manuel Lujan in the Tech Area cafeteria. Mr. Lujan had just concluded a talk before employees in Bldg. 815 on the state of the Congress and various legislation. After lunch, the Congressman toured a number of Labs facilities.



FIVE YEARS of study and a tremendous drive earned Perry Randall (9572) a Technical Institute Equivalency certificate, awarded by Luke Heilman (9500). "Didn't think I'd survive organic chemistry and calculus," reports Perry. "I owe it all to my boss, Bob Weaver. He said I'd never make it."

WANT TO TRADE? Gary Shepherd needs the use of an air-conditioned station wagon from July 30 through Aug. 12 to take a group of five students, members of the Neighborhood Drama Project on South Edith, and a sixth foreign student on a trip to California. They will visit San Francisco, Disneyland, Marineland, movie studios, etc. He will leave his Thunderbird with the owner of the station wagon, promises to treat the borrowed car "with honor and respect." Call Gary on 4-1450.

In connection with the demonstration and dedication of the solar-powered irrigation system near Willard on July 8, a national solar irrigation workshop will take place July 7 at the Convention Center. Several hundred farmers, scientists, engineers, and government officials have been invited. The workshop includes a welcome by President Sparks and presentations by Dick Braasch, Bob Alvis (both 5715), Sam Varnado (5742), and Audrey Perino (5711); Lyle Wetherholt (5700) is workshop chairman. Evening banquet speaker is Rupert Cutler, Assistant Secretary for Conservation, Research, and Education, ERDA. On the 8th the group will attend the ceremonies at Willard marking the operation of the first large-scale system to use solar energy to pump water from a well for irrigation.

* * *

Security's Russell Curtis reports that the first big wave of Sandians participating in Operation ID has passed, and that engravers are now generally available for loan at the badge office. Operation ID consists in engraving your SS number on your valuables and reporting this action to APD. When the burglar shows up at your house and sees the "OPERATION ID" label on your doors, he presumably is dissuaded and hits your neighbor instead (the golden rule with-a-twist). If the burglar can't read or is a resolute type, he'll have a hard time fencing stuff with your SS number on it.

El Morro—Inscription Rock—Nearby, Noteworthy

West of Albuquerque and an easy one-day outing, El Morro National Monument—"Inscription Rock"—offers both history and scenery.

Most New Mexicans know the story. Like Scott's Bluff in Nebraska, El Morro (Spanish for headland or bluff) stands above the surrounding valley floor and was a landmark for explorers. In addition, a catch basin at the base of the 200-foot high escarpment usually held water—a rare commodity on the high and dry plains. One can visualize the parties of horsemen, hot and dusty after the day's ride, drinking and splashing in the pool and making a comfortable camp in the pinons.

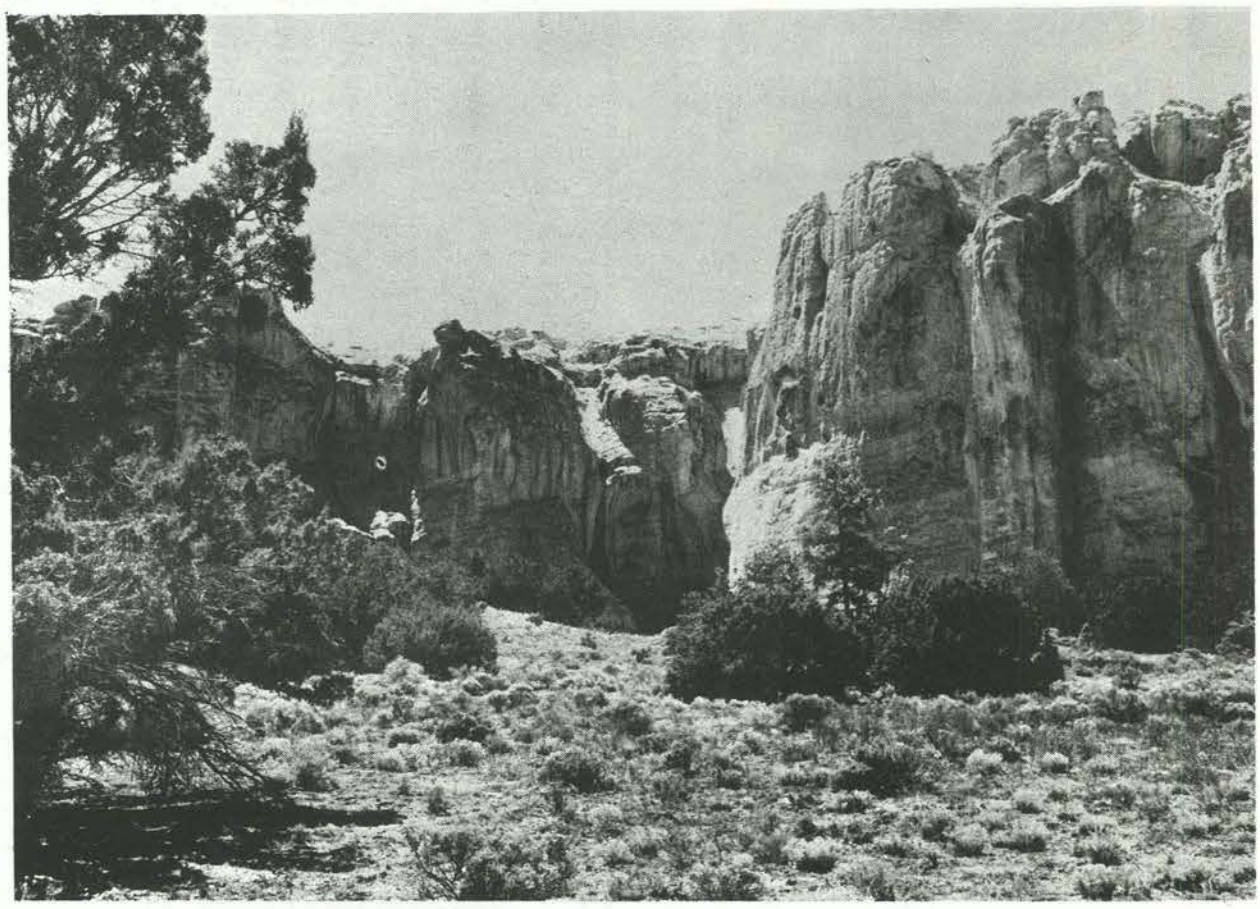
And one can also visualize that early explorer, rested and relaxed, idly poking at the soft sandstone with his knife and suddenly deciding to etch his way into history. It was 1605 (15 years before the Pilgrims' landing on Plymouth Rock) and Don Juan Onate was returning from exploration of western Arizona and a descent of the Colorado River to the Sea of Cortez. "Passed by here the Adelantado Don Juan de Onate, from the discovery of the Sea of the South, the 16th of April of 1605" is the translation of his words, apparently the first inscription by a European (Indian petroglyphs abound, thought to have been put there by the nearby Zunis).

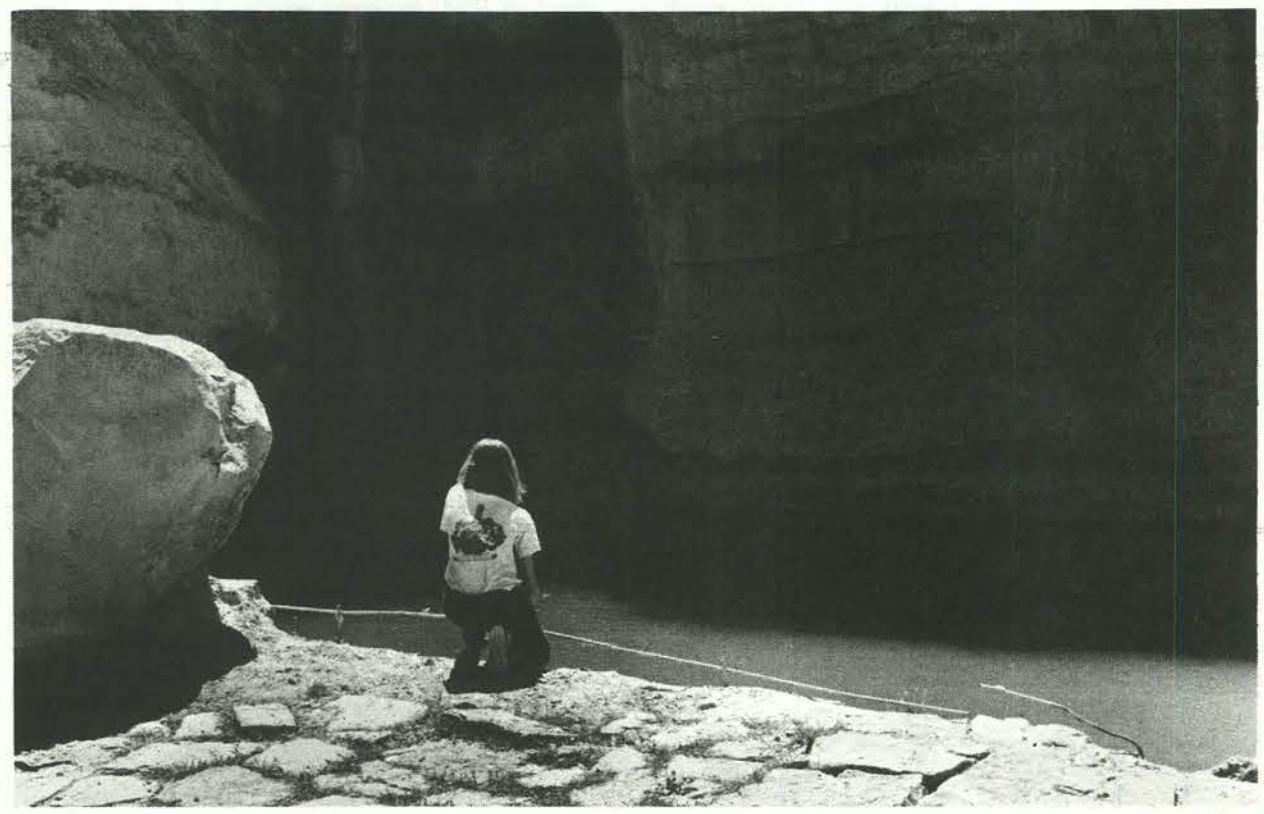
The inscriptions themselves are weathered but generally in good, i.e. legible, condition. Fainter inscriptions are enhanced with what appears to be a soft pencil or charcoal so as to be easily readable. A rustic rail several feet out from the rock surface helps discourage sightseers who like to touch and rub—the soft sandstone is obviously fragile. The trail around inscribed portions of the rock is perhaps a quarter-mile long and continues on to the top of the mesa where pueblo ruins can be seen.

After Onate left his mark, those who followed quickly got into the spirit of the thing. It's probably safe to assume that the bulk of passers-by were illiterate, yet El Morro bears hundreds of inscriptions, in Spanish and in English. The many that are executed with precision, even elegance, show that their authors did this not casually but with a sense of their place in the unfolding history of the West. In September 1849, soon after the occupation of Santa Fe by the American Army, the first Anglo-Americans left their mark: "Lt. J. H. Simpson USA & R. H. Kern Artist visited and copied these inscriptions, September 17th, 18th 1849."

After Simpson, many other names, including those of emigrants, traders, Indian agents, soldiers, surveyors, and settlers were added. An early traveler of special interest was Lt. Edward Beale, whose camel caravan passed El Morro in 1857 en route to Zuni and the coast. The camels were being tried out as pack animals for the Army in the arid Southwest.

Our favorite inscription reveals that the Army, Generals, and Corporals haven't changed much over the years. It comes in two parts: "The 14th of July 1736 passed by here the General Juan Paez Hurtado, Inspector." Beneath this, probably inscribed after the General was on his way, "And in his company the Corporal Joseph Trujillo." The Corporal wasn't about to forsake his place in history to a mere General.





EL MORRO NATIONAL MONUMENT, usually called "Inscription Rock," lies some 40 miles south of Grants. The many inscriptions are etched in Spanish and English. Travelers were drawn to the rock by the fresh water pool. Mr. E. Pen Long's inscription (below) is one of the more artistic. It's undated, probably goes back to late 1800's.

* * *

To get there, drive to Grants and get off I-40 at its intersection with NM53. Follow this route south and west for about 40 miles to the monument. There is a small campground, a picnic area and a visitor center. Elevation is 7200 feet. El Morro is part of the National Park Service. •js

Credit Union Reporter

Feds Audit Credit Union

By Alan Pope, Executive Committee

Credit Union members would have enjoyed a meeting held at the Credit Union in early May. The occasion was the yearly report of the Federal Examiners to the Executive Committee (Clarence Sandy, President; Marv Daniel, Vice President; Alan Pope and Bill Bristol). Usually this is a recount of things found wrong by the Federal Examiners and our reply as to how we plan to improve our procedures; or maybe we disagree with their findings.

In years past the confrontation has never reached the shouting stage, but we have had our differences. Not this year. The week-long random inspection of 370 loan accounts (5% of our total) produced only one trivial error, quickly corrected. An audit of 90 real estate loans failed to uncover any errors at all. Our total losses since organization—$16,359 out of loans totaling $300,010,258—is the lowest of any credit union in the country and "too small to compute." (Well, not really. It's fifty-three ten thousands of one percent.)

Lead auditor Stephen Dennison spoke for the inspection team. He complimented the Loan Officers for being well versed in credit and counseling; the Board for being unusually active in the Credit Union's operations; and concluded (a) that this was a very well run credit union, and (b) they had never audited a better one.

All this doesn't mean we can't improve our service, or expand into new areas. It just means that three Federal Examiners poked into every nook and cranny for a week and couldn't find a thing out of line. Who paid for this? You and I and all the other members. It came to about $5000, but we don't have a choice. Being audited is a federal requirement.

A review like this made the Executive Committee and our General Manager, Bill Bristol, mighty happy.

Steps were immediately taken to inform the other members of the Board and the Credit Union employees as well. We thought you'd like to know too.

Congratulations

Mr. and Mrs. Eugene Royer (2316), a daughter, Allison Elizabeth, May 26.

Mr. and Mrs. Charles Joerg (2531), a daughter, Erin, June 2.

Mr. and Mrs. Loren Lundquist (4361), a daughter, Loraine, June 7.

Sympathy

To Dorothy Garcia (3533) on the death of her sister in Albuquerque, May 28.

To Don Spatz (4341) on the death of his mother in Albuquerque, June 6.

To Verna Clark (9573) on the death of her sister in Nanticok, Pa., May 28.

CONCENTRATED sunshine is viewed by Gene Hammons (5132) in this system that includes 135 plastic Fresnel lenses (right) focusing upon an equal number of silicon solar cells at left. Electrical output of cells is increased about 50 times using concentrated light.

Design Contracts Let For Solar Array

Sandia Labs has awarded contracts to Martin Marietta and Spectrolab, Inc., and is negotiating with a third firm, for each to design a 10-kilowatt photovoltaic concentrator array. The contracts also call for fabrication of a 100 to 300 watt prototype section of the array to be used for performance evaluation.

The prototypes are to be delivered to Sandia by October 31. A contract to build the full 10-kilowatt array will be awarded to one of the firms on the basis of design efficiency and test results on the prototype sections.

Photovoltaic concentrator arrays are systems that use lenses or mirrors to concentrate the sun's rays onto solar cells which convert sunlight directly to electricity. The concentrated sunlight increases the cell's power output, thus fewer cells are required to produce a given amount of electricity.

The 10-kilowatt system will be designed for a solar concentration of between 20 to 50 suns and will have a projected operational lifetime of 20 years. It will use silicon solar cells to convert a minimum of nine percent of the solar energy striking the array to electricity.

The Spectrolab contract is for $277,009, and the Martin Marietta contract is for $255,510. Both contracts cover estimated costs plus fee for design optimization and fabrication of the prototype units.

Development of photovoltaic concentrator technology is being directed by Sandia as part of the Labs' technical management responsibilities under ERDA's National Photovoltaic Conversion Program. The program is aimed at lowering the cost of photovoltaic power systems, making them reliable, and developing designs for residential, load center, and central station power plants.

A major, near-term objective of the concentrator project is to achieve array costs of $2000 or less per peak kilowatt. It is expected that the 10-kilowatt array development will be a major step toward meeting this objective.

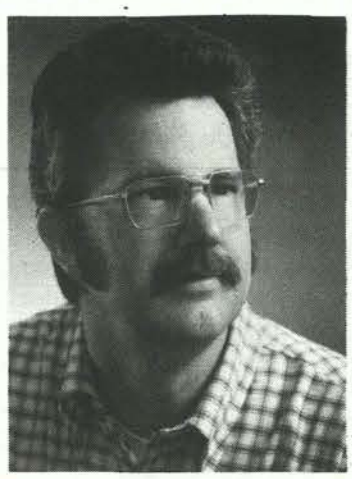
Sandia has constructed and is now evaluating a prototype photovoltaic array that converts solar energy to one kilowatt of electricity and about five kilowatts of thermal energy. The system includes 135 plastic Fresnel lenses which focus sunlight onto 135 specially-designed silicon solar cells. The 12-inch-square lenses concentrate the sunlight about 50 times, causing each cell to produce about 50 times (up to 7.4 watts each) the output of a cell illuminated with ambient light.

Because the cells are expensive and the lenses are relatively inexpensive, it appears that the concentrator approach to energy production may have significant economic advantages.

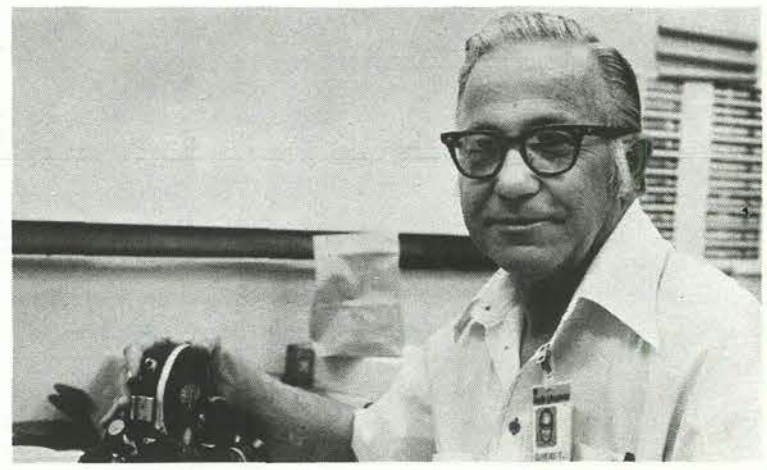
The photovoltaic project is headed by Don Schueler, supervisor of Sandia's Photovoltaic Project Division 5719.

MILEPOSTS
LAB NEWS

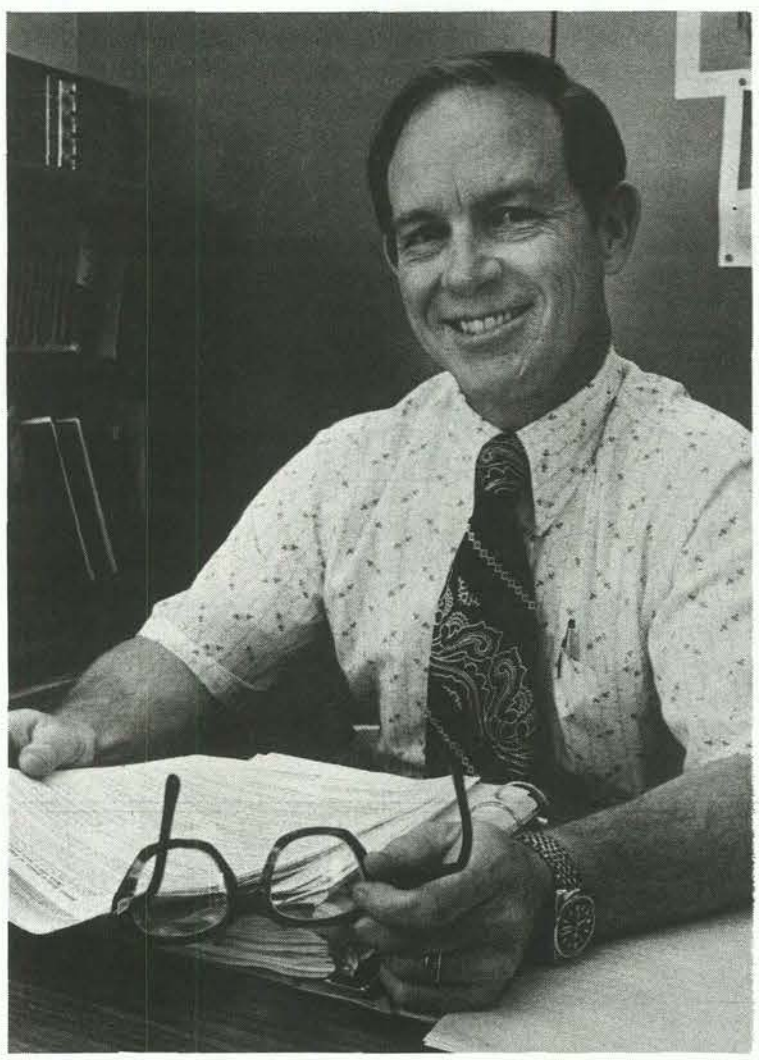
JUNE 1977



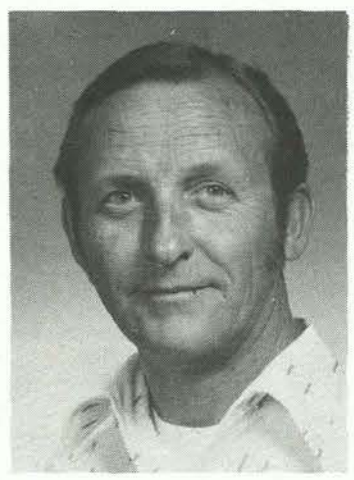
Steve Schwegel - 8431 10



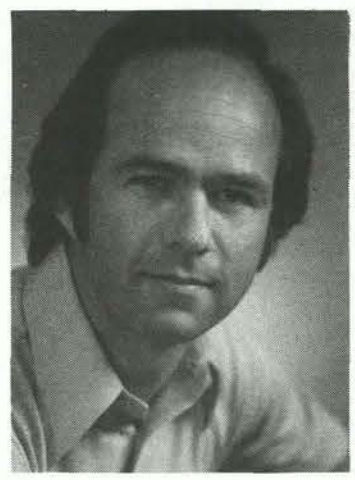
Clarence Wilson - 9473 20



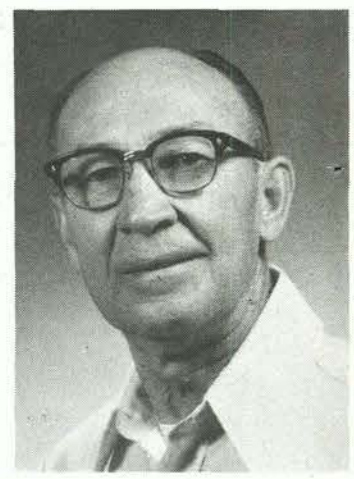
Norris Rose - 4113 20



Robert Hole - 3414 20

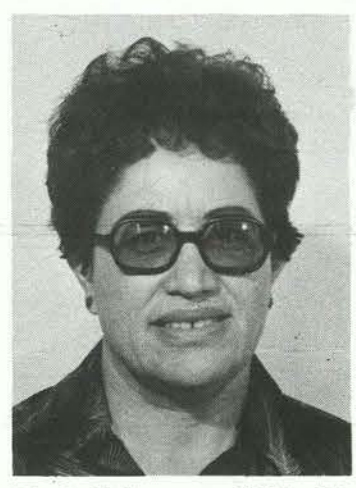


Vern Byfield - 8432 15

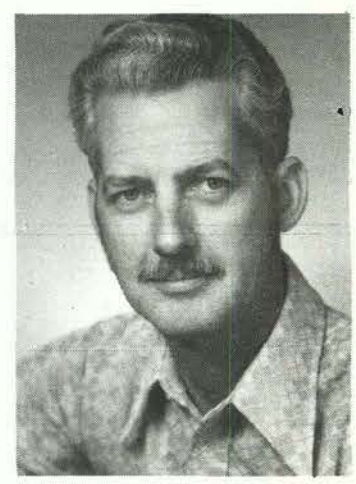


James Wolfe - 9713 20

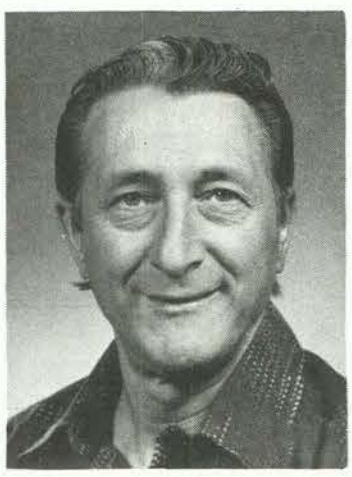
Glenda Day - 8345 10



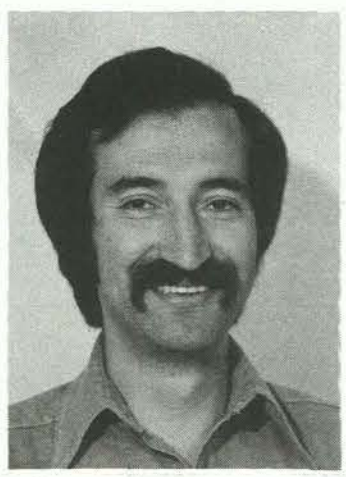
Gloria Velasquez - 3521 10



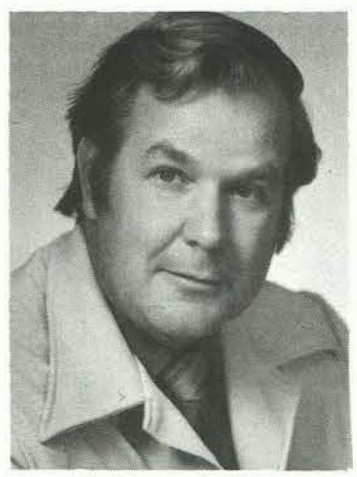
Bill Irwin - 8424 15



Frank Mistretta - 2328 20



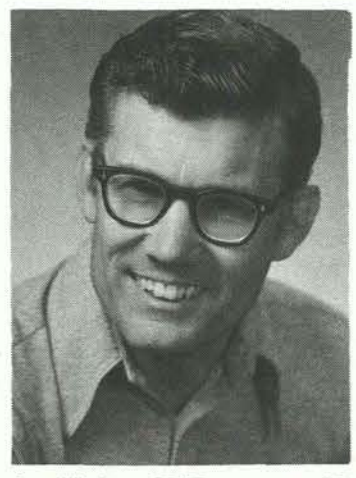
Bill Mantelli - 3425 10



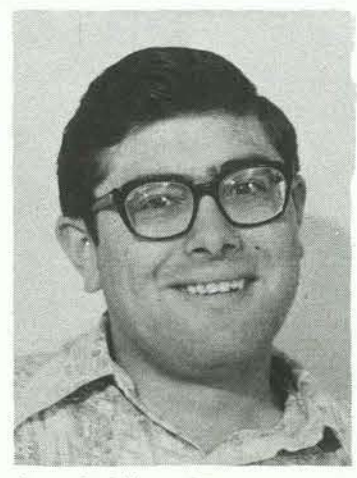
Larry Humpherys - 8181 15

Eloy Gutierrez - 9658 10

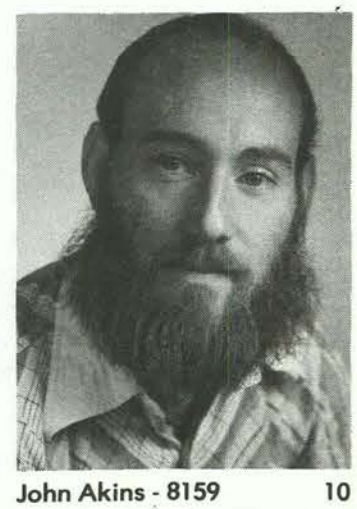
Dean Thornbrough - 1245 25



Joe Vieira - 8167 20



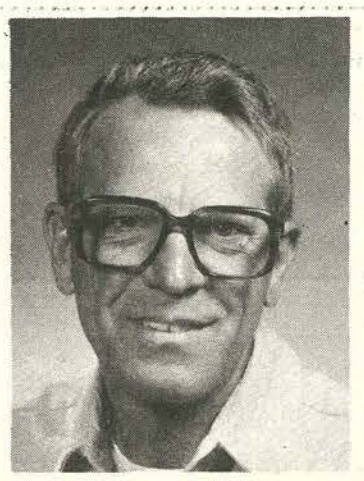
Joseph Allen - 9743 10



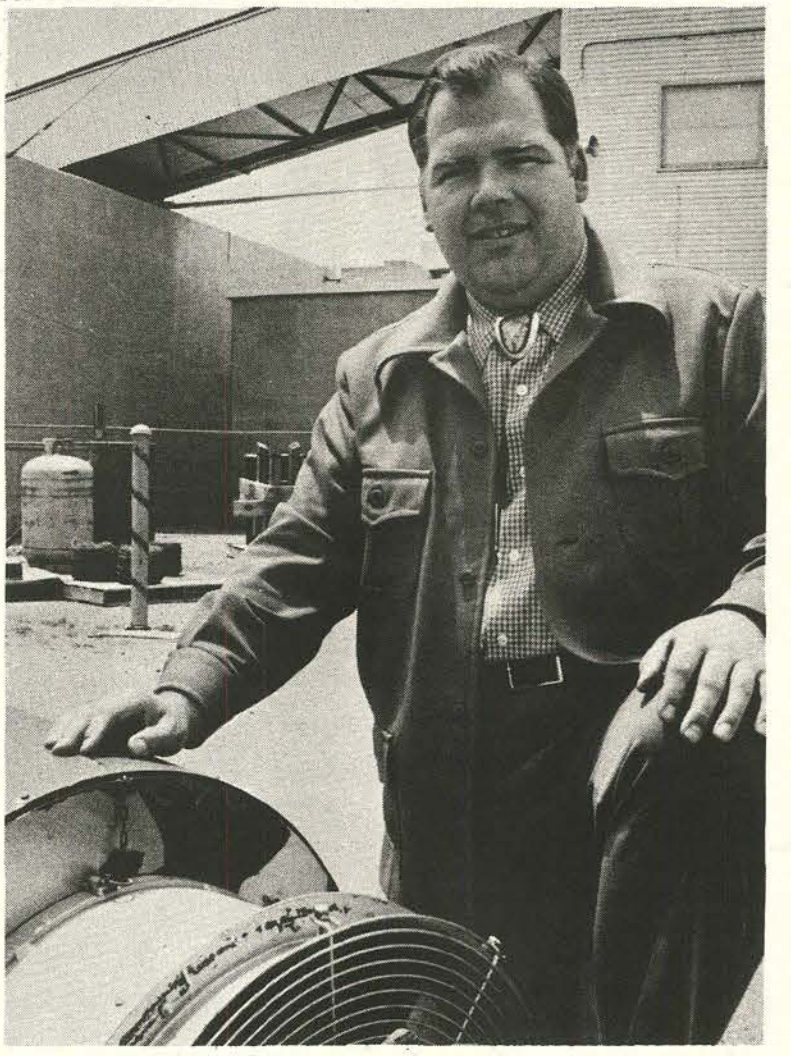
John Akins - 8159 10

Don Larson - 1336 25

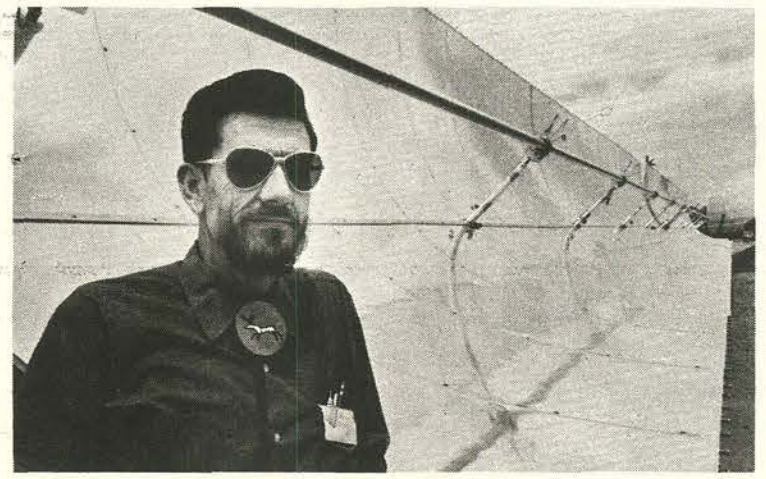
Roger Crawford - 8254 10



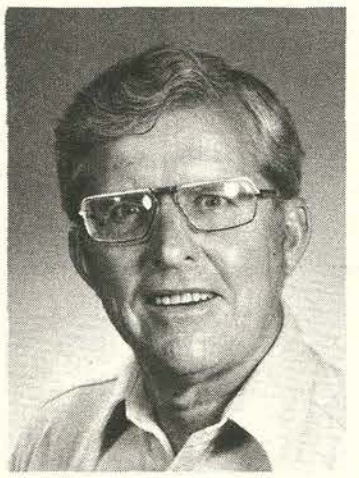
Joseph Ashcraft - 2641 20



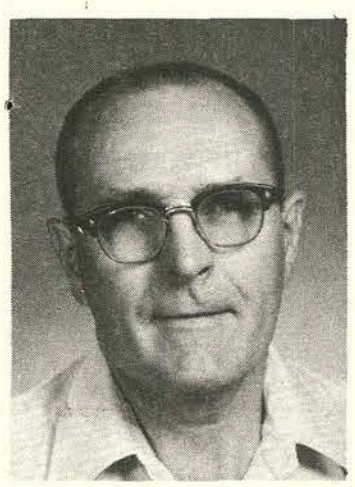
Christian Hartwigsen - 1712 10



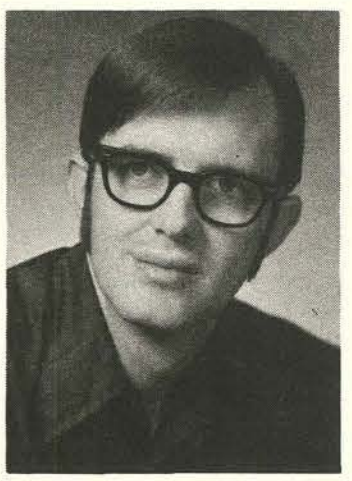
Roscoe Champion - 5712 25



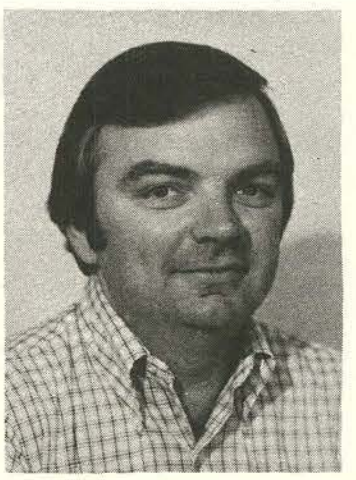
Randy Maydew - 1330 25



Elmer Pitts - 9581 25



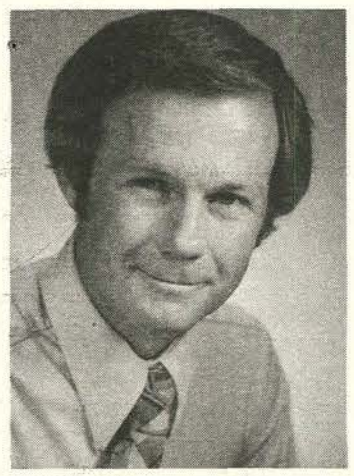
Charles Ray - 8432 10



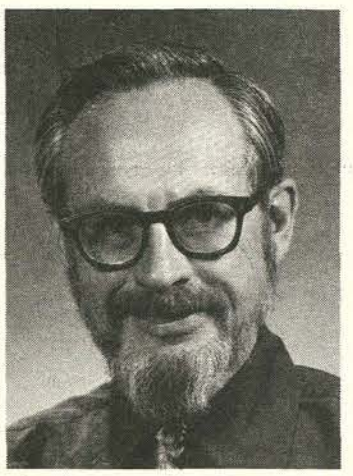
Rod Quinn - 2516 10

Don Kasberg - 8431 10

Sally Dyer - 3252 20



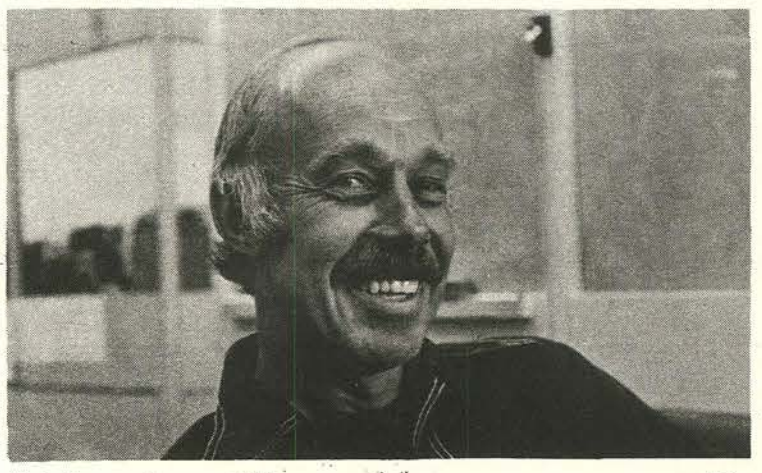
Bob Huddleston - 8325 10



Charles Arnold - 5811 10

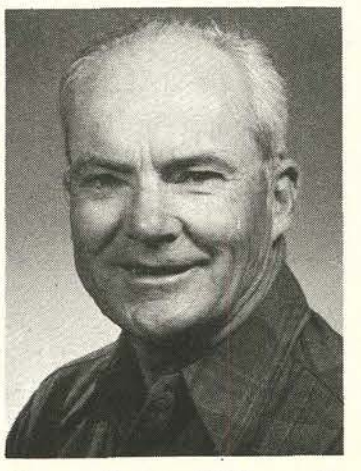
Dick Feil - 8181 15

Ken Seaver - 4114 30



Bob Sonnenberg - 4311 20

Maurie Reynolds - 8161 20



Thomas Corpe - 2325 20

Lupe Martin - 8161 10

G. W. Arnold (5112) and J. A. Borders (5111), "Aggregation and Migration of Ion-Implanted Silver in Lithia-Alumina-Silica Glass," Vol. 48, No. 4, JOURNAL OF APPLIED PHYSICS.

K. D. Bergeron (5241), "One- and Two-Species Equilibria for Magnetic Insulation in Coaxial Geometry," Vol. 20, No. 4, THE PHYSICS OF FLUIDS.

C. B. Norris (5112), C. E. Barnes (5133), and K. R. Zanio (HRL), "Cathodoluminescence Studies of Anomalous Ion Implantation Defect Introduction in CdTe," Vol. 48, No. 4, JOURNAL OF APPLIED PHYSICS.

C. E. Barnes (5133), "Neutron Damage in GaP: Zn,O Light-Emitting Diodes," Vol. 48, No. 5, JOURNAL OF APPLIED PHYSICS.

M. A. Butler (5154), "Photoelectrolysis and Physical Properties of the Semiconducting Electrode WO_3," Vol. 48, No. 5, JOURNAL OF APPLIED PHYSICS.

W. F. Chambers (5822), "Comment on Calculator Program Yielding Confidence Limits for Least Squares Straight Line," Vol. 49, No. 6, ANALYTICAL CHEMISTRY.

D. S. Ginley and M. A. Butler (both 5154), "The Photoelectrolysis of Water Using Iron Titanate Anodes," Vol. 48, No. 5, JOURNAL OF APPLIED PHYSICS.

G. L. Kellog (5114) and T. T. Tsong, "Measurement of the Dipole Moments of Single 5-d Transition Metal Adatoms on the Tungsten (110) Plane," Vol. 62, No. 6, SURFACE SCIENCE.

D. W. Schaefer (5814), "Colloidal Suspensions as Soft Core Liquids," Vol. 66, No. 9, THE JOURNAL OF CHEMICAL PHYSICS.

S. M. Myers (5111) and J. E. Smugersky (8312), "Low-Temperature Solubility of Copper in Beryllium, in Ion Beams," Vol. 8, No. 4, METALLURGICAL TRANSACTIONS A.

J. C. Swearengen (5847) and R. W. Rohde (5832), "Application of Mechanical State Relations at Low and

Authors

High Homologous Temperatures," Vol. 8, No. 4, METALLURGICAL TRANSACTIONS A.

T. R. Guess, R. E. Allred and F. P. Gerstle, Jr. (all 5844), "Comparison of LAP Shear Test Specimens," Vol. 5, No. 3, JOURNAL OF TESTING AND EVALUATION.

R. L. Iman (1223), "Graphs for Use in Testing Equality of Two Sample Correlation Coefficients," Vol. 9, No. 2, JOURNAL OF QUALITY TECHNOLOGY.

R. R. Lagasse (5813), "Domain Structure and Time Dependent Properties of A Crosslinked Urethane Elastomer," Vol. 21, March 1977, JOURNAL OF APPLIED POLYMER SCIENCE.

R. A. Kiehl (5133), "Control of TRAPATT Oscillations by Optically Generated Carriers, Letter to the Editor, March 1977, IEEE Transactions on ELECTRON DEVICES.

E. L. Burgess (5133) and J. G. Fossum (2141), "Performance of n^+-p Silicon Solar Cells in Concentrated Sunlight," Vol. 24, No. 4, IEEE Transactions on ELECTRON DEVICES.

H. J. Rack (5832), "Thermomechanical Treatment of Al-Mg-Si-Cu Alloys," February 1977, METALLURGICAL TRANSACTIONS.

J. S. Pearlman (5214), "Low-Cost Ellipsoid Lens for Sub-Kilovolt X-Ray Imaging," February 1977, REVIEW OF SCIENTIFIC INSTRUMENTS.

T. M. Kerley (5423), D. A. McArthur (5423), and D. J. Sasmor (5422), "Construction of Supported Fission Foils for Laser Excitation," Vol. 48, No. 5, REVIEW OF SCIENTIFIC INSTRUMENTS.

L. P. Robertson (1756), "Technical Education in Brazil," Vol. 15, No. 2, JOURNAL OF TECHNOLOGY.

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

CLASSIFIED ADVERTISING

Deadline: Friday noon prior to week of publication unless changed by holiday.

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 ERDA employees.
6. No commercial ads, please.
7. Include name and organization.
8. Housing listed here for rent or sale is available for occupancy without regard to race, creed, color, or national origin.

MISCELLANEOUS

TRASH BAGS, city-approved, $4, South Hwy. 14 Project, LAB NEWS office, Bldg. 814.

HIGH performance Schiefer trans-torg ring and pinion gear, new, plus spacers, bolts, for 12-volt GM differential, $85. DeVenzio, 299-0088.

TWO RUGS: all wool, sandlewood, 9x12. Krahling, 268-8126.

17' TRAVEL TRAILER, sleeps 6, range, oven, 30 gal. water tank w/compressor, heater, ice box, elec. brakes, used very little, $1500. Tipton, 298-1944.

KENMORE dishwasher, needs new motor, $15. Fite, 255-6943.

UTILITY TRAILER, light, 15" wheels, tubeless tires, lights, 5x7x1'; Sears reel-type lawnmower, 2½HP. Larsen, 299-3496.

PEEK-A-POO, black, furry, w/shots, $10, dog house included. Blewer, 268-9019.

PEEK-A-POO puppies, $75; dome climber, $25; small tricycle, $6; working color TV, $125; child's table & chairs. Hughes, 265-1698.

EXECUTIVE DESK, walnut, 41"x76" w/protective plate glass top, 1 letter file & 4 drawers, $350. Jones, 296-1755.

KODAK Supermatic 500 slide projector, remote changing & focusing, $35; 35mm Sears model 65 camera, filter, case, $25. Dalphin, 265-4029.

TENT TRAILER, Sears, sleeps 4; golf clubs, women's starter set. Hart, 299-8832.

SPLIT RIMS, 4 ea., 5-hole 15", $7.50 ea.; 1 ea. 5-hole 16" w/6.50x16 almost new tire, $15. Luikens, 3500 Dakota NE, 881-1382.

AKC Welsh Terrier puppies, champion sire & dam. O'Neal, 298-2859.

ORGAN, Thomas Malibu, 2 manual, Color-Glo, Leslie, complete instructions, sheet music & many features. Cost $1500, make offer. Probst, 268-1461.

PATIO BLOCK, 250 used, 2x6½x15½, 10c each; Toro lawn mower, 19", $10. Kenna, 298-6059.

MONOMATIC recirculating toilet, odor free, self-cleaning filter. Ward, 869-3580.

WALNUT cabinet for stereo system, 38L x 16W x 26H. Coleman, 299-2377.

MITCHELL Fishing Hut, '73 model, deluxe. Wigley, 299-5221.

TRUCK tubeless tire, new 800x16.5, $45. Lerma, 881-3836.

BRITTANY SPANIEL pups, exceptional hunting potential, $100 including AKC litter registration & veterinarian charges. Jellison, 296-9155.

TENT, Eureka nylon backpacker, 2-man, new, never erected, $100 value, $65. Colp, 255-0228.

KIDDIE BICYCLE SEAT, Sears "yellow" model, $10. Barnard, 256-7772.

MAMIYA SEKOR 35mm DTL500 F2, polarizing filter, wide angle, telephoto attachments, sky light filter, lens hood, case, all for $130. Mason, 299-2836.

10' CAMPER, All-Star coach cab-over, gas/elec. refrig., gas range w/oven, 12V/110V wiring, porta-potty, hydraulic corner jacks, $700. Brandvold, 296-4394.

SINGER sewing machine, $25; umbrella clothes line, $10; heavy solid wood work bench w/bench, underneath storage, $35. Bishop, 299-5749.

TRAVEL TRAILER, Jayco Raven, tandem axel, fully self-contained, $3600. Shepherd, 299-9066.

40 HP OUTBOARD MOTOR, controls & cables, $150. Wehrle, 255-4667.

ROLLEIFLEX twin lens reflex 4x4 cm, super 8mm movie camera, power zoom, auto exposure, built-in filters. Laskar, 299-1024.

TENT TRAILER TIRE, new Goodyear Power Cusion, 20x8.00-10, 6-ply including rim, $30. Graeber, 298-0662.

FRIGIDAIRE frostfree refrig., 17 cu. ft., copper, 2 yrs. old, $300. Cowham, 881-7193 evenings, 266-0140 during day.

AIR CONDITIONER, 21,000 BTU, 220V, made by Sears, window mount, make offer. Stoker, 299-7221.

CHILDCRAFT BOOKS, 15 vol. set, $50. Moss, 298-2643.

AMATEUR RADIO licensing classes, free. Smith, 296-8519.

HI FI AM Heathkit tuner, plus home-made amp and power supply, all for $10. Sherwood, 299-2169.

8' COUCH, $100; pink lavatory, $5, w/dressing top, $7.50; assorted flagstone, $2.50, available June 20. Irwin, 881-3985.

2-HORSE stock trailer, $350. Oravecz, 281-3667.

BELL & HOWELL 126 camera w/case, $30. Watterberg, 294-6759.

CHAIRS, overstuffed, brown Herculon upholstery, two, $40 ea.; lawn mower, reel-type, manual powered. Nagel, 298-2779.

20" BIKES, 1 boy's & 1 girls's, $25 ea.; 2 Ford camper tie downs, $10; child's desk, $10. Brown, 296-9009.

COWBOY felt hat, XXX Beaver, 7¼ extra long oval, color silver belly, 3½" brim, $20. Rutledge, 281-1155.

NAVAHO MOD-TRC-S7 CB-base, sidebands, antenna, coax, ground stake & wire, $300; Garrett B.F.O. Master Hunter metal/mineral detector w/2 coils, carrying bag, head-phone, $200. Stott, 293-8533.

TRADE OR SELL: front tire mounting rack; need rear bicycle rack. Baxter, 344-7601.

DACHSHUND puppies, miniature, 2 black & tan males, 6-wks.-old, temporary shots, $125 ea. Brown, 821-9796.

TRAVEL TRAILER, 1976, 30' Holiday Ramblette, plush, orig. cost $11,500 plus. King, 296-6144.

FRIGIDAIRE elec. stove, white, 40"; fish aquariums, various sizes, stands, etc. Stanfill, 255-6652.

FREE: Labrador cross pups to good homes, extra fine animals w/shots. Kane, 881-7672.

BEN HOGAN WOODS, 1 & 3, stiff shaft, D 1 weight, $30; ladies Bagboy golfcart, $35; lavender nylon carpet, 15'x15', $50; 8mm movie camera. Chandler, 296-3323.

FREE: 1-yr.-old Shepherd-Elkhound cross to good home w/room to run, good with kids; Westinghouse 7500 BTU window air conditioner, used 4 mos. Richards, 821-9046.

GARRARD turntable w/base & cover, $35; Scott tube FM receiver w/case, $40; wood speaker enclosure, $10. Henning, 299-0318.

REAL ESTATE

FIVE ACRES between Edgewood & Moriarty, water, phone & power to land. Hamilton, 298-7226 or 298-5777.

3-BDR. HOUSE, 2 full baths, carpeted, den, patio area, elec. eye garage, $47,500, take over payments or cash. Henson, 293-0744.

3-BDR., den, fp, dbl. garage, $39,500, cash to loan, $245 monthly payment, Eubank & Candelaria area. Lin, 292-1378.

2-BDR. & den, near schools, churches & shopping centers, southwestern landscaping w/rock falls. Keeling, 293-6850.

3-BDR., 1270 sq. ft., 6 yrs. old, NE, 1½ baths, FR, breakfast bar, pantry, 120 sq. ft. workshop, carpeted, FHA appraised $32,800, assume mortgage or refinance. Heerdt, 294-1712.

½ ACRE mobile home site w/lg. garage w/wo mobile home in Bosque Farms, terms. Johnston, 869-6962.

SALE OR RENT: 3-bdr. house, carpet, drapes, 1¾ bath, den fp, 20x25 game rm. & study, lg. covered patio, sprinklers, basement. Putz, 298-7009

5 ACRE PLOTS, Los Chavez, under ditch. Baca, 869-6637 after 4:30.

SEVEN irrigated acres at Los Lunas, just off pavement on good road, utilities nearby. Causey, 881-7534.

SELL OR TRADE: nearly 5 heavily wooded acres near Heber, Ariz., utilities nearby, road to property. Puk, 821-7131.

NEW Candlelight home in Taylor Ranch, 3-bdr., fp, dbl. garage, 1¾ bath, sprinklers, carpet, drapes. Sanders, 897-0533.

60 ACRES, heavily timbered, Juan Tomas area, $500/acre. Platt, 281-5318.

5-YR-OLD 3-bdr., approx. 1165 sq. ft., den w/fp, landscaped, sprinklers, carpet, Lomas & Tramway area, $34,750. Chapek, 294-5462.

DOUBLE-WIDE mobile, 3-bdr., 2 full baths, den, DR, refrig. air, humidifier, forced air heat, dbl.-pane windows, 2 10x50' covered patios. Syme, 898-3532.

FOR RENT

VACATION CABIN on Hondo River, near Taos Ski Valley, modern, furnished, sleeps 8, 3-day minimum. Peet, 294-1250.

2-BDR., unfurnished in 4-plex, color coordinated, outside storage, laundry facilities, near KAFB, 136 Gen. Arnold NE. Cashwell, 292-1150.

NEAR GIBSON GATE, 4-bdr, 3 baths, den, carpeted, near schools, 1 yr. lease, appliances, available Aug. 15. Murfin, 255-4332.

3-BDR. HOUSE, unfurnished, stove, washer/dryer hookup, fp, AC, garage, near shopping centers, available July 1. Kelly, 268-2235.

LOST AND FOUND

LOST—Ashley Italian sunglasses w/plastic rim, man's silver-turquoise-mother-of-pearl ring, tri-focal safety glasses, dark blue jacket w/zipper & leather briefcase labeled Raytheon, green hair fastener w/elastic loop, horn rim glasses w/name June Moore on ear piece.

FOUND—Ladies' Rx glasses w/tan/brown plastic frames, lt. brown sunglasses w/grey frames, key on wire ring w/metal HG 002 token, gold-colored dangle earring w/filigree loop, gold-rimmed Rx glasses w/nose piece, small brass key #Z575.

LOST & FOUND, Bldg. 832, 264-1657.

TRANSPORTATION

'74 CHEVY Nova hatchback SS, $2800 or best offer. Riley, 344-3456 weekdays or 898-7355 home.

'76 FORD Courier, AC, 5-spd. trans., HD rear bumper, Custombilt insulated camper shell, $3695; '70 FORD Bronco, $1995. Oravecz, 281-3458.

'69 SIMCA wagon, 43,000 miles, 28 mpg town, $700. Barnette, 298-9227.

'72 PONTIAC Ventura II, 4dr, AC, AT, PS, small like a Nova, needs a grille, below wholesale. Wehrle, 255-4667.

'71 CHEVROLET stn. wgn., well equipped, make offer. Nuttall, 821-2895.

'70 AMC Hornet, 2-dr., 6-cyl., 3-spd., $700. McNeill, 293-1897.

BICYCLE, Schwinn girl's 26", lightweight, single speed, $40. Clark, 296-4541.

'72 CHEVY Caprice, AT, AC, AM-FM radio, below NADA Aug. retail. Martinez, 293-1578.

'75 CHEVELLE Malibu Classic, $2900, 2-dr., power, air, AT, below NADA. Grant, 881-6243.

BICYCLE, child's, 20" wheels, coaster brake, hi-rise handlebars, rattrap pedals, suitable for child w/24" inseam, $25. Joseph, 299-6989.

'68 CAMERO, 6-cyl., AT, $700. Bentz, 299-3448.

'75 FORD F-250, 4-WD, 4-spd., 360 V-8, shell, tanks, low mileage. LeRoy, 299-4864 after 6.

BICYCLE, 10-spd. Renyu, 19" frame, generator light, bell, $40. Hendrick, 296-2163.

'71 BISCAYNE, 4-dr., PS, PB, AC, AT, 61,000 miles, $1300. Johnson, 298-7020.

'69 VW bug, radio, $850. Martinez, 294-4913.

'76 FORD F-250, 4x4, 360, 4-spd., PS, PDB, dual tanks, 12,000 miles, $4750. Campbell, 294-6000.

'71 VW pop-top camper, Michelins, AM/FM, tinted windshield, new disc brakes, awning. Buck, 296-5963.

'62 FORD TRUCK, 292 V8, F-100; new glass, brakes, king pins, water pump, recent tune-up. Caster, 299-3959.

'74 NOVA custom hatchback, PB, PS, AT, AC, radio, steel radials, lime yellow, $300 under Blue Book. Hock, 881-1318.

'76 CHRYSLER Cordoba, PS, PB, AC, PW, PS, tilt steering, AM/FM, 15,000 miles, $5300. Apodaca, 821-6304.

'64 CHEVY Carryall, ¾, 292-6-cyl., 4-spd., Positraction, AC, HD hitch, many more extras, $1000. Sanchez, 831-0668.

SAILBOAT: Wildflower, sloop rigged day sailer, carries 3 adults. Southwick, 281-3782.

'74 MINIMOTORHOME, 18½', Jamboree, Dodge chassis, dual wheels, roof & vehicle air, self contained, AM/FM radio & tapes, $7395. Sugden, 293-3239.

'65 MALIBU stn. wgn., V8, AT, AC, PS, SBR tires, $400. Tipton, 298-1944.

'65 CHEVY Malibu SS, rebuilt 283 & rebuilt AT; PS, new tires, $1200. Piro, 293-3882.

'65 CHEVROLET 4-dr. 283-V8, std. trans., $360. Dillon, 881-3843.

'73 HONDA motorcycle, 50cc, 2 seat, $500. Gallegos, 344-3290 after 5.

'73 SCOUT II, 4-wd, 37K miles, all options, below book. White, 266-7516.

'72 OPEL Manta, 1900cc engine, 4-spd. trans., new paint, $1200 or best offer. Prevender, 299-5253.

'74 HONDA CB360, crashbars, luggage rack & other accessories, $650. Riley, 821-6431.

'76 DODGE Adventurer ½-ton pickup, 8' sweptline, PS, radio, 6-cyl., 3-spd., 18+ mpg, Glasstite camper shell, sliding windows, 14,000 miles, $4450. Follstaedt, 883-1649.

'75 YAMAHA Enduro 400, less than 350 miles. Hall, 299-0009.

'75 CHEVY pickup, maroon, swb, 4-spd., 4-wd, toolbox, headache rack, new tires, PS, PB, 27,000 miles, $4000. Rupe, 881-2214.

'65 CUSTOM VW bug, 1300cc, rebuilt eng., w/sun roof, mags, headers, custom interior, sweet pea green, $1200. Jarrell, 266-7444.

'74 SUZUKI TM400, $400; '72 Yamaha DT-2 250, 10,000 street miles, $425. Wilde, 881-6910.

'72 CHEVY ½-ton pickup, V8, AT, PS, PB, AC, radio, w/camper shell, $2300. Harris, 821-8524 after 5.

'69 BUICK GS-400, PS, PB, AC, radials, bucket seats, $690. Mattill, 294-0331 after June 20.

'67 HONDA 305, 10,000 miles. Hill, 298-5925.

'71 MAVERICK, 4-dr., PS, AT, AC, vinyl top, $300 below NADA. Shoemaker, 869-2775.

'76 OLDS Delta Royale, 22,000 miles, all power, AC, $4100. Syme, 898-3532

'75 KAWASAKI 400 motorcycle, low mileage. Stake, 883-1735 after 5.

'63 CHEVROLET, 4-dr., Powerglide trans., R&H, 283 V8, $295. Zurawski, 294-1078.

'71 YAMAHA 200cc, completely street equipped plus carrying rack, $400 firm. Zimmerman, 898-3573.

'64 OLDS F-85, V8, std., AC, $150. Gals, 296-2065.

MOTORCYCLES: '70 Honda CL350, $500 or best offer; '76 Honda 500 twin, $1300 or offer. Watkins, 266-1844.

WORK WANTED

COLLEGE STUDENT needs summer work. Specialize in house painting but will do any odd jobs; have pickup. Jay, 293-4751.

BABYSITTING for the summer at my home, North 4th & Montano Rd. area; ask for Ginger. West, 345-4827.

PRIVATE swimming lessons, $4/hr. or $2 ½ hr; will baby-sit during day, $1 hr. Kathy, 296-5204.

WANTED

COLOR TV, 15, 17 or 19", single gun system preferred. Hawkinson, 281-5239.

BACKPACK, med. or small frame for 10-12 yr. old. Buck, 296-5963.

CASSETTE DECK w/capability to record in stereo. Coleman, 299-2377.

2HP Briggs & Straton gasoline engine, horizontal output shaft. Graebér, 298-0662.

CAST aluminum BBQ grill, natural or bottled gas. Watterberg, 294-6759.

VISITING Professor needs 3 or more bedroom house in SE or NE, July 10 - July 30. Krueger, 264-5894.

FRIDAY	SATURDAY
17—HAPPY HOUR BBQ RIBS BUFFET Adults $3.50 Under 12 1.92 VIKINGS (Swim Meet Opens)	18—VARIETY NIGHT Mike Anthony, Magician & Juggler PACO Food 6 Show 7 Free to Members
24—HAPPY HOUR BEEF/CRAB BUFFET Adults $3.25 Under 12 1.92 SHALAKO	25—SOUL SESSION 9-1 CASCABEL Mbrs Free Guest $1

MORE INFO— 265-6791.

FOR—some fine barbequed ribs, corn-on-the-cob, homefried potatoes, and great summer salads, join the buffet line at 6 or so tonight. For some fine dancing, join the ballroom crowd at 8:30—mellifuous melodies by the *Vikings*.

FAST—as a speeding bullet go the hands of Mike Anthony, whether he's doing magic, juggling, or clowning. He puts on a fine show to lead off Variety Night tomorrow. Then it's time for *Paco,* orphan adventurer. Color cartoons too.

FAST—as each year goes, it's no wonder it's time to plan your Fourth of July already. Bring your whole family to the Club for swimming, games for all ages, buck lunches, 20¢ beer, a band concert, and more. Check next issue for all the details.

INCREDIBLY—good deals on season football tickets (like $15 each) have become, I'm afraid, as obsolete as the tee formation (the one where the teem screws itself into the turf to hold ground gained). But *good* deals (like $20 each) are available at the Club. The earlier you get your check in (made payable to UNM), the better your seats: don't wait till the July 2 deadline. The tickets themselves will be delivered to you in August.

FAST—learning is guaranteed in Janet Winter's special swim classes for adult women: she starts her students at the bottom and encourages them to work their way up. Beginner/brush-up classes are held every Tuesday and Thursday from 6 to 7 (after the pools close—lots of privacy). Each class costs $1, payable to Janet: pay as you grow (skilled). Sign up by calling the Club. Classes begin the 21st, and they'll run all summer: come as often as you can.

RELIEF—is a week away for those who can't make it to Happy Hour tonight. Next Friday's buffet features two different kinds of pot. One's filled with beef stroganoff, the other with crab newberg. (It's a Kate Smith dinner: "From the prairies, to the oceans . . .") Then *Shalako* returns with some fine, but non-Indian, music for your dancing delight.

SEND—your cares packing (use your kitbag) next Saturday. Come out for Soul Session with *Cascabel.*

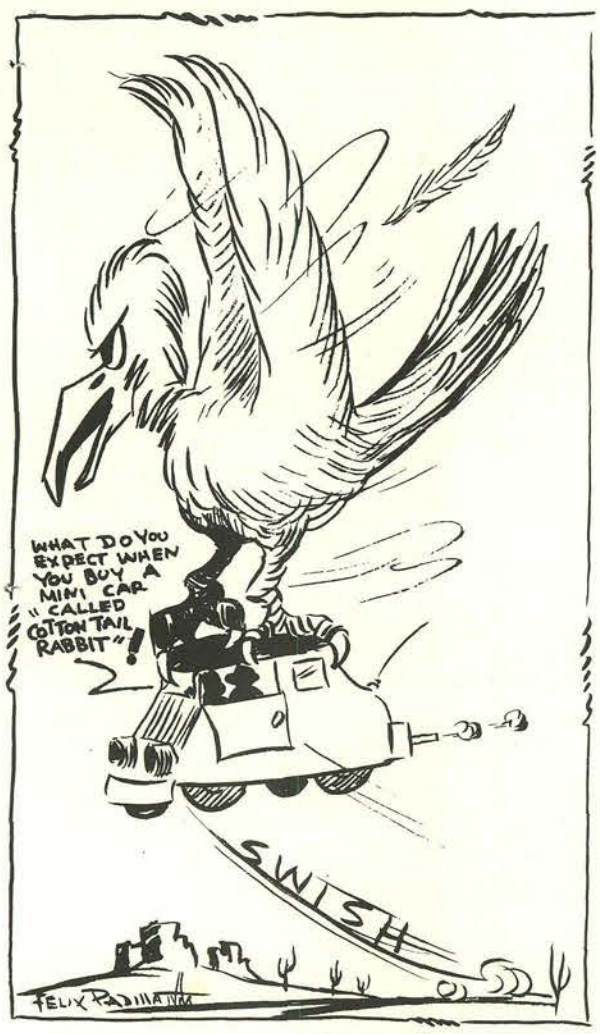
YOUR—teen-types can get turned on twice this month; the second Teen Dance is on the 23rd. The band is a new one called the *Street Rockers.* If the name indicates what they do to streets, imagine what the dance floor will look like afterward. Parents, tickets before or at the door. (Teenaged Sandia/ERDA employees can get tickets with their membership cards.) Members are $.50, guests $1.

KIDS—in the Aquatic Club compete this evening and tomorrow against swim teams from all over the state. Come out to the Club and cheer them on. (Newest Club record-breaker is Michele Dana who has broken the old record for the 50 metre freestyle twice in the last month. Congrats, Michele!)

TO—see some major league baseball, check out the Wolfpack trip August 6-9. The group will fly to LA, see the Dodger-Reds game on the 8th, get three nights lodging next door to the country's most famous shrine (Disneyland), and fly back for $143 (dbl. occ.). Wolfpackers: deduct $10.

CAMP—along the Colorado River in the depths of the Grand Canyon; thrill to the sound of the steam engine huffing along the Cumbres and Toltec RR to the top of Cumbres Pass; marvel at the magnificent mountain ranges of Alaska; find another culture in Hong Kong. The Club has great deals on each of these vacation packages. Tie up one soon.

PAGE SIXTEEN
LAB NEWS
JUNE 17, 1977



Speakers

D. W. Powers (1141), "Salt Anticlines in the Castile-Salado Evaporite Sequence, Northern Delaware Basin, New Mexico"; S. J. Lambert (1141), "The Geochemistry of Delaware Basin Groundwaters," N.M. Geological Society, New Mexico Bureau of Mines meeting, May 3-7, Carlsbad.

R. S. Claassen (5800), "University Interactions with National Laboratories," and "An Approach to Developing a Science Center," VPI Engineering College, May 4 and 5, Blacksburg, Va.; "Perspective on Materials in the Energy Program," Univ. of Virginia, May 6, Charlottesville.

J. M. Peek (5231), "Inelastic Electron-Ion Collisions for Fusion Power Plasmas," Physics Department Colloquium, Univ. of Georgia, May 5, Athens.

J. E. Davidson (3441), "Sources for Safety Information and Assistance," N.M. Chapter, American Society of Safety Engineers, May 5-6, Albuquerque.

M. A. Butler and D. S. Ginley (both 5154), "Role of Semiconductor Properties in Photoelectrolysis"; P. H. Holloway and G. C. Nelson (both 5825), "Degradation of Device Metallization by Low Temperature Grain Boundary Diffusion"; T. V. Nordstrom (5832), "Thermal Degradation of Thick Film Resistors"; H. J. Stein (5112) and V. A. Wells (2141), "Chemically-Trapped Hydrogen in CVD Silicon Nitride: Deposition Temperature Dependence and Depth Distribution"; M. L. Knotek (5155), "Study of the Interaction of H_2O and O_2 with the Surface of TiO_2 by Electron Stimulated Desorption and Auger and Characteristic Loss Spectroscopies," Electrochemical Society 151st meeting, May 8-13, Philadelphia.

R. L. Ward (5441), "Inactivation of Enteric Viruses in Dried Sludge," Annual Meeting of American Society for Microbiology, May 8-13, New Orleans.

J. W. Reed (5443), "Airblast Predictions and Measurements," Eastern Test Range Commanders Council and U.S. Navy SP-25 Quarterly Trident Program Status Review Committee, May 9-10, Harrington Sound, Bermuda.

J. F. Gonzales (9581), "Machinability Data for Alumina Oxide Materials," 1977 Engineering Conference in International Tool and Manufacturing Exposition, May 9-12, Detroit.

J. O. Harris and J. T. Cutchen (both 2524), "Eye Protection Devices Utilizing PLZT," Aerospace Medical Association, 48th annual scientific meeting, May 9-12, Las Vegas, Nev.

S. L. Pohlman and D. D. Dees (both 5831), "7079 Aluminum Pitting—A Synergistic Effect"; S. L. Pohlman, "Interfacial Attack of Boron/Aluminum Composites"; N. J. Magnani and K. D. Boultinghouse (both 5831), "Stress Corrosion Cracking of U-6 Wt. % Nb"; W. H. Smyrl, L. L. Stephenson and D. D. Dees (all 5831), "Materials Compatibility with Explosives"; S. L. Pohlman and D. D. Dees, "Examination of Galvanic Couples of Interest in Military Applications"; J. W. Braithwaite (5831), "Corrosive Failures in Nichrome Wire-Wound Resistors"; N. J. Magnani and P. H. Holloway (5825), "The Correlation Between Oxidation and Stress Corrosion Cracking of U-4.5 Wt. % Nb," 17th meeting of JOWOG-12, May 9-12, LASL.

W. D. Drotning (5842), "Solar Absorption Properties of a High Temperature Direct-Absorbing Heat Transfer Fluid"; H. P. Stephens (5842), "Determination of the Enthalpy and Specific Heat of a (UC-ZrC)-Graphite Reactor Fuel Material"; R. C. Heckman (2151), "Intrinsic Thermocouples in Thermal Diffusivity Experiments," 7th Symposium on Thermophysical Properties, ASME & NBS, May 10-12, Gaithersburg, Md.

J. W. Reed (5443), "New Details on Wind Power Climatology," American Wind Energy Association Conference, May 13, boulder Colo.

R. K. Traeger (5731), "Organics Used in Microelectronics: A Review of Outgassing Materials and Effects," IEEE Electronics Components conference, May 15, Washington, D.C.

G. Voida (2154), "Micro-Size Plated Through Connections in Flexible Cables"; J. T. Grissom, R. E. Knutson and D. R. Johnson (all 2152), "Testing of Thick Film Technology in Ionizing Radiation Environments"; D. H. Loescher (2153), "Testing Magnetic Memory Cores"; R. K. Traeger (2151), "Organics Used in Microelectronics Outgassing Materials and Effects"; D. W. Palmer (2151), "Hybrid Microcircuitry for 300°C Operation," IEEE Electronic Components Conference, May 16-18, Arlington, Va.

R. E. Knutson (2152), "Thick Film Hybrid Microcircuit Controller for Thermal/Flash Protection Goggles," International Microelectronics Conference '77 East, May 17-19, Philadelphia.