

Major Step Toward Particle Beam Fusion

In a major advance in particle beam fusion research, Sandia scientists have focused an intense beam of ions to the smallest spot size ever achieved — roughly to the size of a pinhead.

This result, achieved repeatedly in recent "proof of principle" experiments, greatly increases confidence that ion beams will be able to ignite a fusion pellet as scheduled for experiments beginning in 1988.

Some researchers had said particle beams could never be focused well enough to be directed effectively onto a fusion fuel pellet. However, Sandia scientists discovered that one major focusing problem could be corrected by slightly reshaping the diode's cylindrical anode. Carefully changing its interior surface from a simple curvature to a compound curvature gave a two-and-a-half-times tighter focus. This proved to be a breakthrough in beam optics.

"This is a significant advance, similar to the first focusing of high current electron beams in 1972," says Pace VanDevender, manager of Fusion Research Department 1260.

David Johnson (1264), lead investigator for the focusing experiment, and Ray Leeper (1234), developer of the technique that verified the achievement, presented the details of the focusing experiments last month at the IEEE (Institute of Electrical and Electronic Engineers) International Conference on Plasma Science in St. Louis.

In Inertial Confinement Fusion (ICF), extremely large powers and energies must be deposited onto a target containing deuterium and tritium — two forms of hydrogen. The two parts fuse together to make helium and a neutron and to release energy.

Sandia is the lead laboratory for particle beam fusion in the nation's ICF program funded by the DOE. "Particle beam ac-
(Continued on Page Four)



AT A RECENT PRESS CONFERENCE, Pace VanDevender (1260) formally announced Sandia's recent advance in focusing particle beams.



THAT TINY HOLE in the copper target plate proves the effectiveness of David Johnson's (1264) discovery that particle beams can be focused like optical beams to concentrate a diode's power on a target a millimeter across.



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AMONG THE SANDIANS working on the First National Indian Industrial Trade Fair on June 11-13 is Ray Powell (3000). He's heading the steering committee that's planning the opening night reception, which will be hosted by Clare Jones, NM secretary of state, and Mike Runnels, lieutenant governor, along with the Hopi and Navajo tribes. Sandia is a corporate sponsor of the Fair; Jim Shorty (3511) and Lewis Sisneros (3731) have helped to plan the event. Here Ray meets with Vivian Tapahe (left), a Navajo who is overall chairperson of the Fair, and Melody Lightfeather, a Pima whose godparents live in Jemez Pueblo; one of her paintings serves as the official Fair poster. Not shown is Bertha Torres, who is coordinating the reception for the Hopi tribe.

SNLL/SNLA Experiment

Solid Particles Feasible in SCR

Heating a falling curtain of sand-sized particles in a solar central receiver (SCR) is feasible. More important, solar heating of solids produces higher intensity heat than do gases or liquids, such as water-steam or molten salts. That's the conclusion of a simulation completed recently at Sandia Albuquerque's Radiant Heat Facility by Solar Components Division 8453 and Centrifuge, Climatic, Radiant Heat Division 7531.

Solids could be heated in a central receiver by a field of heliostats, then used in high temperature (550°C to 1500°C) industrial process applications ranging from the production of petroleum fuels in a refinery (the cracking process demands high temperatures) to the making of several chemicals demanding large inputs of energy. "We consider the results of the experiment a major step in high temperature solar central receiver technology," says Rex Steele (8453).

Using solids rather than liquids or gases

(Continued on Page Three)

Antojitos

"Mr. Watson, come here, I want you." The telephone is, of course, Sandia's most widely used scientific device. I don't think that fact has anything to do with our corporate origins; it's rather that, unlike an army that moves on its stomach, a high-tech R&D lab moves on its ear.

But what happens when you cross the science of telecommunications with the art of avoidance? It doesn't happen often, but twice lately I've run into situations in which the phone is more problem than solution:

Scenario A I call. The phone rings. Someone: "Yeah." Me: "Is Mr. Watson there?" Someone: "Nope." Me: "Do you know when he might be back?" Someone: "Nope." Me: "Can you have him call me back?" Someone (begrudgingly): "Okay, okay." (Long pause here; I don't know whether Someone is off looking for pencil and pad or waiting for me to provide my name and number--and I'm wondering whether I want to tell Someone This Unfriendly who I am at all.)

Scenario B I call. The phone rings. Phone recorder device: "This is Watson. I'm unable to answer the phone just now, but if you'll leave your name and number I'll call you back just as soon as I can."

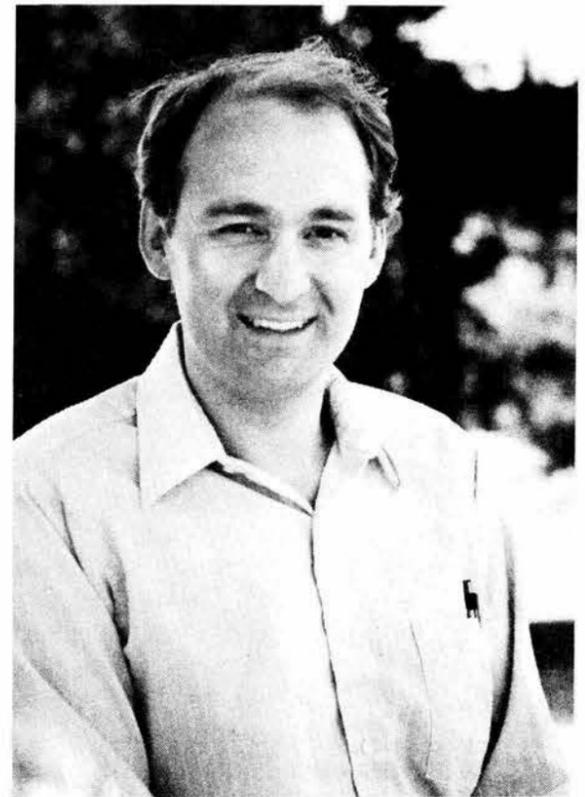
Well, the latter scenario is polite, at least. But I'm frustrated in both cases: in the first, because I immediately slip into Woody Allen-esque paranoia--that message is NEVER going to get to Mr. Watson. I'm frustrated in the second case because I can't tell whether the person to whose taped tones I'm listening is planning to return to the phone to return my call in a minute or a month. I don't have a recorder, but I'm told that it's easy to change its message so it gives some indication of whether its owner is out for an hour or in Juneau until July or whatever. (I was further told that Gary Shepherd in 2614 does a good job of updating his recorder. So I called him, hoping--just this one time--to get a recording. Instead, I got Gary. He confirms that changing the message is as easy as pressing a red button and talking simultaneously.)

When I phone I'd rather get no answer at all than either scenario above. Then I can call the supervisor or the secretary or someone else in the division and have some hope of getting the information I need. I suspect I'm not the only Sandian who shares that feeling. So get with it, troops to whom this exhortation is applicable! ●BH

* * *

El árbol se conoce por su fruta. (A tree is known by its fruit, or persons are known by their character.)

Supervisory Appointments



JOHN SAYRE to supervisor of Process Development Laboratories Division B 7472, effective May 11.

John has been with the Organic and Electronic Materials Department 1810 since coming to Sandia in 1977. His work has been with polymeric materials.

He received a BS in chemical engineering from West Virginia Institute of Technology and an MS and a PhD, also in chemical engineering, from the University of Utah. John is a member of the American Chemical Society and the Society for the Advancement of Materials and Process Engineering. He enjoys backpacking, cross country skiing, and bicycling. John and his wife Teresa have two children and live in NE Albuquerque.

Neighborhood Center Seeks Computers

Gary Shepherd (2614) has directed the Neighborhood Drama Project since 1970. It's part of the Neighborhood Center, 1020 Edith SE, which serves as an education, recreation, and social center for young people and adults of the South Broadway area of the city. At Sandia, Gary is a member of Computer Consulting and Training Division 2614 and editor of *Sandia Computing Newsletter*, so he knows about computers. What he wants to do is to get the Neighborhood Center and computers together.

Here's the pitch: Recently, Sandia installed a number of IBM PC systems throughout the Laboratories. Many Sandians are upgrading their home computers so they can have the same system at home as at work. The question is what to do with the old system? Certainly they could be traded or sold.

Gary suggests a better idea -- donate them to the Neighborhood Center to be used to teach disadvantaged youth about computers. It's a tax deduction.

"Our Center works on a micro-shoe-string and can't really afford systems to perform this training, but the need is there," Gary says.

If you are interested, contact Gary, 296-1238.

Events Calendar

June 9 — NM Symphony Orchestra's 1984 June Jamboree, "Music Under the Stars," outdoor concert of light classics and popular favorites, around the pool at First Plaza (Second and Copper NW), 8:15 p.m.

June 9-11 — Second Annual Arts & Crafts Trade Fair, Anna Becker Park, Belen, information, 1-864-8091.

June 15-17*, 22-24*, 29-30 — Albuquerque Civic Light Opera Assn., "Gigi," 8:15 p.m., *2:15 p.m., Popejoy.

June 15-17, 22-24, 29-July 1 — Corrales Adobe Theater, "Sister Mary Ignatius Explains It All For You" and "An Actor's Nightmare," 8:30 p.m. \$4. Reservations, 898-3323 (4-8:30 showdays).

June 19 — Lecture and Slide Show: "Earthquakes and Volcanos: The Geology of the Rio Grande Rift and Jemez Mountains," Jon Callender, Director NM Museum of Natural History, 7 p.m., KiMo, admission: donation.

June 22-24 — 33rd Annual Arts and Crafts Fair, State Fairgrounds.

Month of June — One-man show by the young Navajo artist, Benny Nelson-Yellowman, reception on June 9, 1-4 p.m., Indian Pueblo Cultural Center, 2401 12th St. NW.

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Editorial Offices in Albuquerque, 87185
Phone 505/844-1053 FTS 844-1053
In Livermore 415/422-2447 FTS 532-2447

BRUCE HAWKINSON, Editor
DON GRAHAM, Assistant Editor
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Solid Particles Feasible in SCR

has several advantages: they can absorb the solar energy directly (without tubes); they do not require high pressures; and they can be used to store heat for use at a later time.

But the major attraction of solids is their ability to absorb the solar energy at much higher intensity than is possible with either gases or liquids. This reduces the receiver size dramatically, making thermal losses much more manageable.

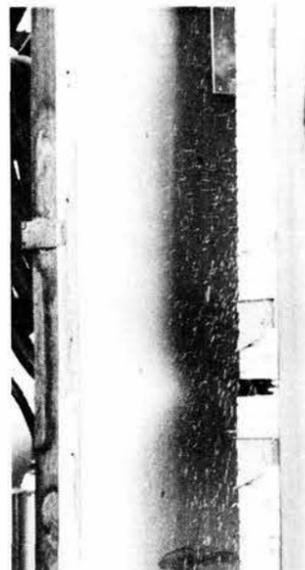
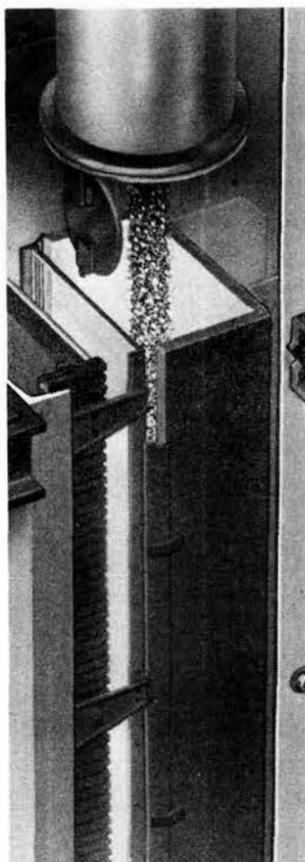
In a solid particle receiver system, particles would be heated with solar energy concentrated by a heliostat field as they free-fall inside a chute in which one wall allows solar thermal energy to enter. After the particles are collected, the heat is extracted, with a heat exchanger yet to be designed, in an appropriate industrial process. The cooled particles are then recycled through the receiver. A commercial-sized receiver of this type could heat more than 500 tons of particles per hour to temperatures exceeding 1000° C (1800°F).

The original concept for the solid particle receiver was a joint effort of Jose Martin, a visiting summer professor at SNLL, and John Vitko (8348). Patricia Falcone and Jon Noring (both 8453) spent a year evaluating the concept — making a conceptual design, investigating the materials and the handling equipment necessary for such a design, and estimating the particle size and fall distance needed to produce maximum benefit from the process. In addition, their economic analysis indicated that the concept is cost-effective when compared with other high temperature solar receiver concepts.

The experiment at the Radiant Heat Facility was the culmination of several cold flow experiments conducted in Livermore. These earlier experiments were designed to verify mass flow characteristics and to develop a portable laser Doppler velocimetry (LDV) system to measure particle velocity. This latter diagnostic instrumentation was adapted by Vic Burolla (8313) and Jill Hruby (8453) from LDV equipment normally used to measure much smaller (sub-micron) particle velocities in a gas flow.

The radiant heat test apparatus, mounted onto a tower at the Albuquerque facility, consisted of a 3-walled sheet metal chute, 10 meters high and 0.3mm deep, lined with a refractory insulating material. A bank of infrared lamps along the length of the chute made up the fourth wall. Particle distribution and handling equipment metered the flow of various candidate materials through the solar-simulated environment. The LDV system mounted on a hydraulic platform allowed particle velocity measurements at several heights.

Approximately 100 pounds of silicon carbide particles were loaded into the discharge hopper, allowed to fall into the chute past the lamps, where they were heated radiantly, then caught in a bin. Particle temperatures in the catch bin ranged from 500° C to 1000° C, depending on the level of



SOLID PARTICLE heating experiment at the Radiant Heat Facility in Albuquerque showed that silicon carbide particles could be used as a solar central receiver medium. Upper right, a handful of particles. Top left, artist's sketch of the experiment. Lower left, black particles glow white as they fall past the infrared lamps that simulate solar thermal energy sources. Lower right, Jill Hruby and Rex Steele (both 8453) illustrate the success of the experiment by using the hot (600° C) particles to make some wood smolder.

Take Note

The value of Sandia's CPR course was proved again recently. Fred Perez (8257) was called by a frantic neighbor in Manteca at 4 on a Sunday morning because she knew Fred had been trained in CPR at work. He

was able to assist the woman's husband, who was having difficulty breathing, and then drove the man to the Manteca hospital. Fred first took CPR at Sandia four years ago and then took the latest refresher course earlier this year.

the radiant energy emitted by the lamps and on the particle material and size.

According to Rex, the data generated in this equipment will serve as boundary parameters for receiver designers who want to incorporate the solid particle concept into solar industrial process applications.

Sandia retiree Clarence Loveless and wife Freddie just left on a year's sailing trip in the Pacific Ocean on their 37-foot ketch. The first leg of the journey will be a 15-to-21-day crossing to the Hawaiian Islands. Crew members for this portion are Jim Rego (8315) and Norm Julian of LLNL. Jim's wife Joann will fly to Hawaii to be with them.

Particle Beam Fusion

celerators provide lots of energy, they are cost effective, and the ions deposit their energy effectively," says Pace. "But until now no one knew whether or not they could be focused onto a sufficiently small target. This experiment demonstrates that an intense ion beam can be focused onto the most demanding inertial confinement fusion target — the 3-millimeter-radius target scheduled for use with PBFA-II, the 100-trillion-watt Particle Beam Fusion Accelerator now under construction." When completed in early 1986, it will be the world's most powerful particle beam accelerator.

The recent beam focusing experiments were conducted in Area V on 10-year-old Proto I (now scheduled for dismantling), using a smaller diode but a higher current density — 1.5 trillion watts per square centimeter — than will be used in the PBFA-II machine.

An experimental discovery was responsible for the dramatic improvement in focusing ability. It involved the "Applied-B" (B is the symbol for magnetic field) diode, which was invented at Cornell University almost 10 years ago, developed for high power at Sandia, and recently selected for use in PBFA-II (LAB NEWS, March 2, 1984). This circular device, located at the center of a particle beam fusion machine, converts a flow of electrons (electromagnetic energy) into an ion beam that can be focused onto a target.

"For the first time, we were able to show that intense ion beam diodes behave like optical elements — a small change in the lens curvature produces a precisely defined change in the focal spot," says David. Before this discovery, it was thought that beam spreading was caused by a number of different effects, and that extensive changes would be required to improve the device.

"The beam is so good now that the remaining spot size seems to be caused primarily by simple scattering of the ions," David continues. "There is room to improve on that to get even better focusing." (See related story.)

Using a power source with a 20 percent greater current density than that necessary for PBFA-II fusion experiments, the particle beam was focused onto a spot 1.3 millimeters across — about the size of the head of a pin. If "scaled up" to the PBFA-II diode, which is more than three times larger, the focus would be 4.4 millimeters across. This is a tighter focus than the 6 millimeters diameter targets under consideration for use on PBFA-II.

The diode gave the same size focus in both vertical and horizontal directions. The tight focus was initially verified by Ray Leeper's (1234) system of detecting protons scattered from the target, imaged through a pinhole camera, and recorded with an array of PIN diodes. Photographs of titanium K-alpha radiation taken with an X-ray framing camera developed by Bill Stygar (1234) confirmed the tight focus.

Solving the Focusability Problem

High current ion diodes have so many electrons and ions running around them that scientists had feared that they would slosh around like ocean waves and disrupt the ion focusing. Over the past few years, techniques have been developed for neutralizing the effects of these charged particles on their way to the target, but little was known about what happens during their acceleration.

James Poukey, David Seidel (both 1241), and Stephen Slutz (1265) developed computer simulations of the electron and ion motion. The simulations showed that the electrons moved about and mixed randomly without any sign of collective wave effects. However, the computer simulations were two dimensional, so there was the possibility that three-dimensional effects might make the electrons slosh about and disrupt focusing.

Insight came when a new diagnostic method was developed and applied to the problem. "By putting in a mask to stop part of the beam, I could look at the beam from each part of the source and see where the beam was imperfect," says David Johnson (1264). "I calculated what a perfect beam should look like when it passes through a spiral mask and hits a large radius cone. Then I compared the experiment with the calculation.

"Different parts of the beam focused at different positions and did so every time. The surprise was that the beam was so reproducible from trial to trial. If the electrons and ions were sloshing about, the beam would not have been so reproducible. It was like trying to focus light through a bad lens, so I changed the curvature of the ion-emitting surface to correct the astigmatism and got a tighter focus by a factor of two or more.

"This is the first time we have shown that intense ion beam diodes behave like

optical elements — a small change in the lens curvature produces a precisely defined change in the focal spot."

Before this discovery it was thought that beam spreading was caused by a number of different effects, and that extensive changes would be required to improve the device. "The beam is so good now," says David, "that the remaining spot size seems to be caused primarily by simple scattering of the ions as they pass through the neutralization cell on the way to the target. There is room to improve on that to get even better focusing."

In fact, just a few weeks ago, Sandia experimenters discovered that (in the diode) scattering of ions by gas molecules — which diverges the beam and prevents a sharp focus — can be reduced by using a gas of a lower molecular weight, for example helium instead of argon. (The particle beam has to be passed through a gas in order to neutralize the protons' positive charges, which would otherwise create a self-magnetic field that would bend the protons away from their ballistic path to the target. The protons ionize the gas molecules, stripping loose negatively charged electrons that negate the positive charge of the protons.)

Recently, with a source current density of 6 kiloamperes per square centimeter — 20 percent greater than that necessary for fusion experiments on PBFA-II — and a diode with a 4.5 centimeter radius, the particle beam was repeatedly focused onto a 0.65 millimeter radius spot.

The same quality beam from a PBFA-II diode, which will have a 15 centimeter radius, would produce a 2.2 millimeter radius focus. "Our most challenging target on PBFA-II is 3 millimeters in radius," says Pace VanDevender (1260).

Furthermore, the focused beam has produced a less-than-millimeter-sized hole in a 1.5 millimeter thick copper witness-plate target.

The experiments demonstrate conclusively that intense ion beams are focusable to the desired spot size. The remaining effort is to scale the work to higher power on PBFA-I (the testbed for PBFA-II) in 1984-85 and then on PBFA-II in 1986-87.

"Feasibility of focusing is no longer the issue," says Pace. "Scaling the present results to larger accelerators is our next objective.

"Scaling up to more powerful machines involves no greater current density than has been achieved. The voltage will be higher and the ions more massive [lithium ions will be accelerated onto the target in PBFA-II rather than protons]. But both theory and previous experiments have shown that focusing improves with higher voltage and with heavier ions.

"It is clear now that the physics will allow us to focus the beam," says Pace. "This is one step along a long road, but it is a solid advance and very important."

Sympathy

To Mary Heerdt (6312) on the death of her mother, May 5.

To Luberto Ortiz (3618) on the death of his father in Albuquerque, May 13.

To Diana (3543) and Al Mares (3715) on the death of her father in Albuquerque, May 20.

To Dick Shaum (7556) on the death of his mother-in-law in Albuquerque, May 24.

To George Edgerly (7471) on the death of his father in Albuquerque, May 29.

To Charles Hall (2531) on the death of his mother in Albuquerque, May 28.



Death

Erminio Candelaria of Plant Modification Division 3613 died suddenly May 28. He was 59.

He had worked at the Labs since January 1969.

Survivors include his wife and two daughters.

New Foam System Awarded Patent

DOE has been awarded a patent for a long-lived aqueous foam system that is finding applications in Sandia's Safeguards program and in explosives attenuation (see box). Inventor is Pete Rand of Physical Properties of Polymers Division 1813.

"The foam is essentially soap and water bubbles," Pete says "but with this difference — as a concentrate, it can be stored for a long time." When mixed with water and expanded in a high expansion foam generator, it will rapidly fill a room. In six hours there is only 50 percent drainage (density decrease).

The Safeguards application is this: It acts as a visual deterrent, like a smoke screen. "If you are one of the bad guys breaking into a room where you're not supposed to be, and suddenly that room is full of foam, then you're in trouble," Pete says. "Your vision is blurred, everything is slippery, you can't hear much, and you're disoriented. The good guys can haul you away."

The liquid concentrate, with expansion ratios (foam to concentrate) that can be tailored from 20-to-1 to 600-to-1, was developed primarily to produce foam to protect high-security areas such as nuclear material storage facilities. The material has also other safeguards and security applications and could be adapted for a wide number of other uses: firefighting, insecticide spraying, gaseous fumigants dispersal, and possible medical applications. Since the announcement of the development last December, Pete has had about a hundred inquiries about the foam.

Special Projects Division 5256 is investigating the foam's ability to absorb explosive blast energy and finds it to be significant — about a tenfold reduction of overpressure and a fivefold decrease in blast impulse. It also absorbs particulate matter and inhibits flame and burning. "This material could have been a great help and an added safety factor during the recent oil storage tank fire in Albuquerque's South

Valley," Pete says.

"The foam's stability is the attraction for most applications," Pete continues. "Just five weight percent of the water-based foam drains to the bottom of a container in an hour; half remains as foam after six hours. Half of a typical 'stable' firefighting foam that expands 500 percent drains in 30 minutes."

Pete has had a number of inquiries from agricultural insecticide manufacturers. His invention has appeal in spraying fields with an insecticide-laden foam. With its long life, it would be easy to keep track of. With its stability, it could also be applied with great precision.

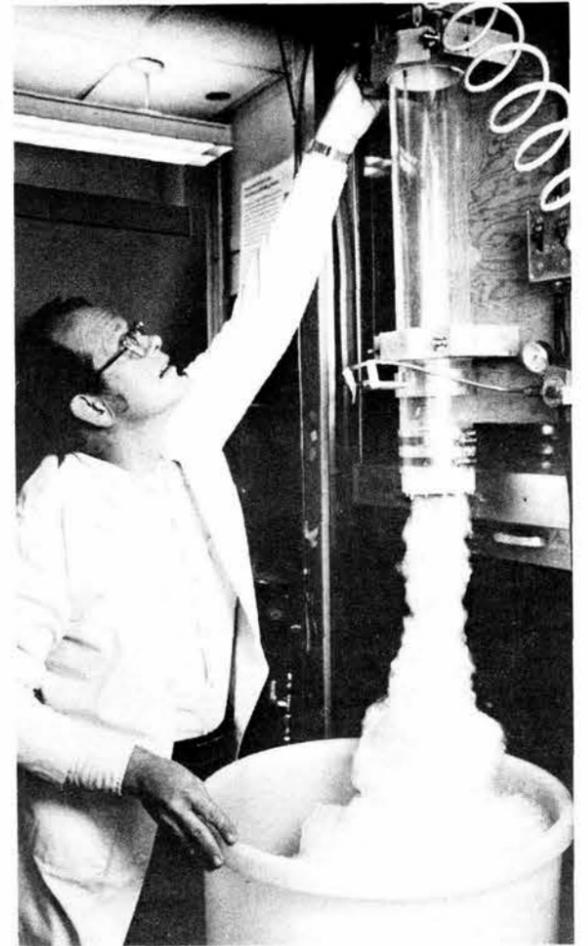
The foam's exceptional stability results from a synergistic effect achieved when small amounts of a water-soluble polymer and a fatty alcohol stabilizer are mixed with the foaming solution's other active ingredients — surfactant (a foaming agent) and a solvent that concentrates and reduces the viscosity of the foam.

"Early experiments indicated that a type of ordering, possibly liquid crystal formation, occurred when certain types of surfactant mix with precisely-measured amounts of polymer and stabilizer," Pete says. "This ordering, which does not occur if polymer or stabilizer are used separately, apparently produces the foam's superior stability."

The new foam consists of water, surfactant (sodium lauryl sulfate or alpha olefin sulfonate), polyacrylic acid-type polymer (Carbopol 941, manufactured by B.F. Goodrich, for example), stabilizer (n-dodecyl alcohol), and solvent (water-soluble alcohols such as n-butanol and n-propanol).

The early work on the foam was performed by Edgewood Arsenal, Edgewood, Md., under Sandia sponsorship. Later work at Sandia, which led to an understanding of the stabilizing mechanism of the Edgewood foams, allowed these stable foams to be developed.

A concentrated form of Sandia's foam is



INVENTOR PETE RAND (1813) creates a batch of his new aqueous foam with laboratory apparatus. The new foam, basically soap bubbles, was developed for safeguards applications, but its stability and long life have led to agricultural and other possible applications.

made by dissolving the stabilizer in the solvent, dispersing the polymer in this solution, and then slowly adding this blend to a water-surfactant mixture. Before use, the concentrate is diluted with water at a nine-to-one ratio.

Pete holds one other patent, a "sticky foam," also developed for safeguards applications.

Ansel Adams Photos on Display

One of the world's great photographers, Ansel Adams, was well known to several Sandians — Tom Zudick, Oscar Goodwin (both 3155), and Wayne Gravning (3153) among them. With Adams' death last Easter Sunday, his work is receiving wide attention and acclaim. Sandia owns a portfolio of his prints and is displaying them, along with some prints owned by Tom and by Molly and Wayne Gravning, in the Bldg. 802 lobby through June 29.



DRAMATIC BLAST MITIGATION effect of aqueous foam is illustrated in these two photos taken during a joint study by Sandia's Special Projects Division 5256 and the Naval Tech Center's Explosive Ordnance Disposal group at Indianhead, Maryland. In the photo at left, a two-story frame test structure was filled with aqueous foam, then 15 lbs. of C4



high explosive was detonated. Some damage resulted (left corner) when a desk and other office furniture smashed through the wall. The structure was repaired, and an identical charge was exploded. Results are illustrated in photo at right. The foam reduced blast effects tenfold and trapped more than 90 percent of particulate matter.

What Was the Question?

I never make predictions, especially about the future.
(Casey Stengel)

In the prolegomena to his talk entitled "Which Came First, the Universe or the Laws of Physics?" Kenneth Brecher (Dept. of Astronomy, Boston University) posed a number of questions. First, does the universe have laws, or is it just a particular example of the laws? And what can astronomy teach us about the laws of physics? — this is the reverse of a 200-year-old trend (since Isaac Newton) during which physics was teaching us about astronomy. Moving right along, where might contemporary physics be different from that of the early universe, or from our sector of the universe? These different conditions might be found, suggests Brecher, in collapsed objects, particularly neutron stars.

No wonder then that host Crawford MacCallum (1231) remarked that when he starts thinking about this subject, he reaches an impasse in about two minutes: "It's amazing to me that anyone could talk for a full hour on it."

Talk Brecher did — over an hour. And a fascinating colloquium it was, too.

The universe appears to be structurally isotropic — more or less the same everywhere. In fact, the perfect cosmological principle maintains that the universe is isotropic in both *time* and *space*. But this doesn't fit in with the observational evidence. Does this portend an interesting new physics? "You shouldn't fantasize a new physics unless you have your back up against the wall," says Brecher.

Well, what is physics? Brecher broke it down into "super-duper principles" that include conservation laws governing energy, momentum, symmetries, and causalities (the past determines the future). Under "covering theories," he has special relativity and quantum mechanics; and finally "theories of specific interactions" comprise gravitation, strong and weak interactions, and electromagnetism.

"The model of cosmology we use is based on the general theory of relativity," says Brecher. "This is the standard Big Bang model in which the theory of matter is plugged into gravity theory."

The theory of matter deals with basic subatomic particles or "stuff." Seventeen kinds of stuff have been identified by particle physicists including six kinds of quarks. These "stuff" particles make up the "carriers of forces": photons, gluons, Z bosons, W bosons. These forces (gravity, electromagnetic force, strong force, weak force) determine how matter in the universe is distributed and organized.

The universe, says Brecher, appears to be expanding. We see the more distant objects receding at a velocity proportional to their distance, i.e., speed increases with distance. The universe is expanding in such a way that there might have been a singularity at one time. This expansion either will continue forever (open universe) or gravity will eventually halt the expansion

and begin a process of contraction (closed universe).

The infant universe was "hot," that is, it was composed of protons and neutrons. At 10^{-3} second after the Big Bang, the protons and neutrons began to interact to form the "working elements." First the light elements such as deuterium and tritium would have been formed. These are the elements left over from the Big Bang in addition to a general blackbody radiation background. This radiation is a tracer to events in the early universe — the same temperature that we detect in every direction comes from the matter formed at the outset of the history of the universe.

This early universe presents us with a "horizon problem" and therefore a paradox concerning the "laws" of physics. Since the universe was expanding faster than the speed of light (186,000 miles a second), the farthest points could not receive "messages" from each other. If one part of the universe could not know what was happening in another part, how could they develop in the same way?

The Hubble Constant shows us that these events occurred something like 18 billion years ago. (This figure, Brecher noted, has been approved by the Vatican; in fact, the universe has steadily been getting older since the 1600s when Bishop Usher calculated that the universe was created on Oct. 22, 4004 B.C. at 6 p.m.) If the universe is closed, however, its age is two thirds of the Hubble Constant; this creates a problem since the oldest objects (Population I stars, globular clusters) would then be older than the cosmos. And for the universe to be closed, we need to find more matter.

"Matter might exist in forms we can't see, like magnetic monopoles, tachyons, and negative mass or antimatter," says Brecher. "But there's probably no mass in neutrinos, magnetic monopoles don't seem to be around, and no antimatter has been found. Cosmologists are engaged in the pursuit of the unobserved to explain the unseen.

"Big Bang cosmology has some successes — expansion, microwave background, but many more failures like the horizon problem. Why are all its parts alike even if they never saw each other? Why is there something rather than nothing? Why no antimatter or monopoles? What happened before '0'? What did God do before the Big Bang? According to St. Augustine, He was preparing hell for those who inquire into such matters."

Brecher concluded by saying that the inflationary model of the universe (as in GUTs — Grand Unification Theories) is not a model of the universe but of a small part of the universe. The normal Big Bang model expands faster than light can travel through it. Perhaps the early universe expanded very slowly so that its different parts could communicate and smooth out fluctuations.

And what about *the* question about which came first, the universe or the laws of physics? Well, it was never answered. Said Brecher, "It's an unfortunate question."

flexi:liback

Q. If I could put my Sandia (Albuquerque) travel flights on my American Express card, I would be entitled to \$1,000,000 worth of insurance from the time I leave my house until I return to my house. Sandia policy prohibits me from doing this even though:

- 1. My family would receive \$1,000,000 in case of a fatal accident;*
- 2. The airline tickets would cost no more than purchased through Sandia;*
- 3. The insurance is my expense, not Sandia's; and*
- 4. Sandia need not reimburse me until my American Express account is due.*

I feel that this restriction denies my family of the maximum available insurance.

A. Sandia uses government funds for its operations and therefore is committed to minimize the cost and time of business travel. To assure that this policy is consistently applied and implemented in Albuquerque, we use SATO, which provides us (at no charge) with a centralized reservations/airline ticket selling service and a consolidated billing system to standardize and facilitate the payment for tickets. In return, SATO gets Sandia's travel business.

SATO's system cannot accommodate personal credit cards for company business. Allowing exceptions lessens the current built-in control, and widespread exceptions would mean that SATO would ask Sandia to again administer the reservations procedures, a costly change for Sandia. Therefore, the only authorized exceptions are when SATO services cannot be used (e.g., at a remote location, or when an airline has no interline ticketing agreement). On these occasions, a personal credit card may be used to purchase tickets for business travel, but the employee is then responsible for minimizing cost and travel time.

Sandia is certainly not insensitive to the needs of traveling employees, nor does Sandia intend to deny employees' families with appropriate insurance protection. Coverage as follows is already provided:

At no cost —

- Basic Life Insurance
- First Supplemental Life Insurance, which includes an accidental death and dismemberment feature that doubles the death benefit
- Special Risk Accident Insurance (\$50,000)

At low cost —

- Second Supplemental Life Insurance
- Voluntary Group Accident Insurance (\$250,000 maximum)

P.M. Stanford — 100

Dinner Honors Ray Powell

Administration Vice-President Ray Powell's (3000) longtime service to the community and the state will be recognized at a dinner-dance honoring him on June 12. The National Jewish Hospital/National Asthma Center (NJH/NAC), located in Denver, is sponsoring the dinner-dance. Tickets are \$100 each, tax deductible. For more information, call Hank Willis (3100) on 4-8073.



WITH TIMES of 11.0 and 23.3 seconds, Tony Teague (3435) won the open 100m and 200m sprints, respectively, again this year. He's shown here easily winning the preliminary heat in a relay race.



SECOND PLACE in the women's long jump went to Julie Garcia (7263) with a leap of 13'1 1/2" and a determined expression.

Sandia a Strong Second In Corporate Cup Event

Sandia gave Kirtland a run, literally, for its money at the Corporate Cup competition last month. Both Kirtland and Sandia scored over 500 points, but the Base amassed 18 points more than Sandia, which took second place last year as well. Sandia defeated traditional rival Los Alamos National Lab by about 100 points.

More than 100 Sandians competed in the two-day event. Chief CorpCup Coach Henry Dodd

(6252) credits his assistant coaches with Sandia's fine showing. Anthony Thornton (1633) and Mary McWherter (1636) coached the men's and women's sprint teams; Tony Taig (6415) coached the distance events; and Richard Cernosek (7555) the field entrants. "We're going to miss Anthony and Tony next year," says Henry. "Anthony will be at Purdue working on this PhD, and Tony is returning to his home in England.

"Tom Lenz, the SERP recreation director, deserves a lot of credit too. He was coordinator, facilitator, the person that really brings off an event like this one."

In addition to the meet record winners named with the photos, Kathie Hiebert-Dodd (315) set a record in the women's (30-39) 1500m open with a 5:36 time.



THIRD, SIXTH, and first place winners in the women's shotput event went to (from left) Jackie Snyder (2341), Ree Gerchow (122), and Kay Shoenefeld (6425). Kay had an exceptionally good day — she set meet records in the shot with 30'7" and in the women's (30-39) 100m dash with 13.59 seconds, breaking the record of Dora Gunckel (6410), who took second. Kay also was on the winning "fringe benefit" relay team and on the "EEO" relay team that took third. And it was her first year of competition.



SANDIA'S "BUSINESS LADY" relay team, four 100m legs, took first with a 53.63-second time, also a new meet record. Mary Anne Cunningham (155) was part of that team. Our other "business lady" relay teamed placed fifth.



FIELD EVENTS coach Richard Cernosek (7555) took first in the shotput with a 42'3" throw. But he's also a high jumper.



THE WOMEN'S RELAY team took second with a 4:48 time. Here, Mary McWherter (1636) hands off to Becky Hunter (1540). [Photos by John Shunny, ret.]

Take Note

Practical engineers with an inventive bent would do well to consider taking the Entrepreneurial Engineering course to be offered this fall at UNM. Taught by John Sharp (7601), Bill Gross of UNM's Mechanical Engineering Department, and inventor Bill Nordyke, the course focuses on the specifics of developing a new technical business. Students with ideas for new companies are especially invited; all students are committed to confidentiality. Recent classes have produced business plans for a family of novel robots, a CAD system for hotels, an energy management system, a novel building process, and a low-cost wind electric conversion system. More info from Prof. Gross on 277-6297.

* * *

Melodrama lives! The Opera House in Madrid (the former ghost town on North 14) has a treat for those who enjoy a bit of 1890s fun with dyed-in-the-wool villains and the purest of pure heroines. This Saturday and Sunday (June 9-10) its the original classic *Alaska* for the matinees and the spoof *Little Nell* for the evening performances. Call 1-473-0743 for more information.

* * *

The movie *Silkwood* and its accompanying publicity may have been good drama — but was it good history and good science? And has the *Silkwood* lawsuit represented good law? Reed Irvine, founder and chairman of the board of Accuracy in Media, will discuss the *Silkwood* case and its ramifications at the June 12 meeting of Americans for Rational Energy Alternatives; his talk is at 8 p.m. at the Hilton, and it's free to the public. Preceding the talk is a no-host cocktail hour at 6 and dinner (\$14) at 7; call Pat Wainwright at 292-7275 for dinner reservations (make them now) or for more info.

* * *

Denny Gallegos (3743) and his ECP Country Western Hoedown committee are looking for talent — male or female singers and musicians. Call Denny on 4-9233 if you're interested.

* * *

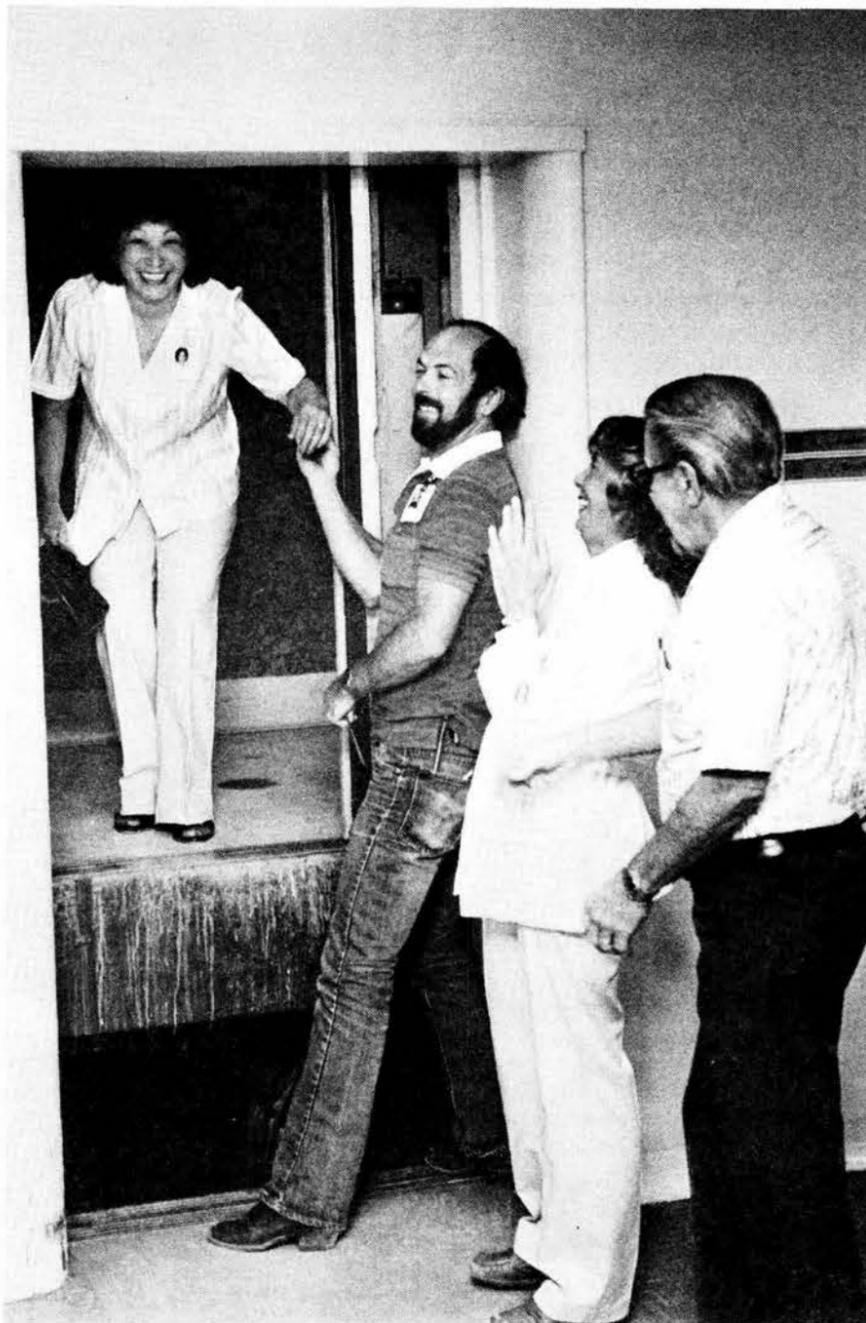
Tom Sullivan (315), national president of the Data Retrieval System User's Society (DRSUS) announces that the next national meeting of DRSUS will be held in Atlanta, Ga., on June 18 and 19. On June 20, Advanced Data Management will conduct an advanced topics class in the use of DRS recovery procedures and user exits. DRS is a database management package that is used by SNLA and SNLL on several VAX machines. For more information, call Tom at 6-7484.

* * *

Single parents with children between the ages of 6 and 16 can take part in a "You 'N' Me Weekend" sponsored by the Boy Scouts of America, Great Southwest Council. The weekend camping trip will be held July 21-22 at Camp Frank Rand, adjacent to the Pecos Wilderness, and offers horseback riding, guided wilderness hikes, swimming, archery, riflery, crafts, and a campfire get-together on Saturday night. Cost is \$15 per participant; registration deadline is July 1. Pick up registration forms and more information at the LAB NEWS office, Bldg. 814.

* * *

Learn how to control soaring energy,



THAT'S THE SMILE of a woman who was late to work last week. But Millie Griffo (7632) had a built-in excuse. She was trapped in an elevator in Bldg. 802 from shortly before 7 until 8:10 a.m. Millie and Karen Moynier (also 7632; second from right) had decided to determine the quickest route from the 802 lobby to their micrographics tasks in the basement of the building. Millie took the elevator, Karen the stairs. Karen won. Elevator repairman Curtis Domme (3662) had most of the tools and all of the know-how to play the rescuer role. Bob Scaff (7474; right) located the critical screwdriver. LAB NEWS photographer Lou Erne was there for the extrication.

food, and water bills at a Self-Sufficient Solar Home short survey course developed by the NM Solar Energy Institute at NMSU. Registration is underway for two Self-Sufficient Solar Home sessions to be represented at UNM Community College starting June 11 and 13. For registration and fees information call 277-1157; refer to course number 1300.

* * *

"Images of China: East and West," developed by the Smithsonian Institution, is on display at the Main Albuquerque Public Library, 5th and Copper NW, through June. China's goal to equal other world powers in science, education, agriculture, and industry has fostered a mass communications blitz through the medium of the poster. This exhibit — 21 Chinese posters and 74 photographs taken by Westerners — contrasts these goals of the People's Republic government with the present living conditions of the people.

In addition to the Smithsonian Exhibit, replicas of famous art works from the National History Museum of the Republic of China will also be on display. The Library is presenting a number of cultural and informational programs on the rich cultural heritage of China. These include programs on calligraphy, Chinese watercolor and brush painting, a "Chinese Game Day," films, cooking dim sum, Chinese crafts, and storytelling. Jonathan Porter, history professor and sinologist at UNM, will present two programs, "Traditional Religions in China Today" and "Popular Chinese Culture," during the month. All programs and

activities are open to the public. For more information on events for adults and children, contact the Library, 766-5045.

* * *

Que Pasa Recreation Center is sponsoring a series of lunchtime concerts at the East Parade Grounds every Wednesday from 11 to 12:30 p.m. Bring your lunch or purchase food and beverages at the snack trailer. The June schedule follows: June 13 — Stone Equal Band, Puppetry with Grover & Mike; June 20 — Black Heart Band, Mime with Chris Rivera, arts & crafts demonstration; June 27 — NM Fiddlers, arts & crafts demonstration. For more information, call the Center at 844-5420.

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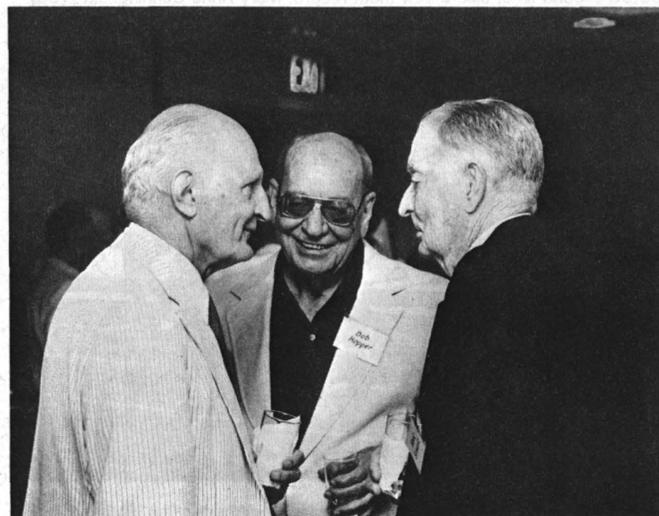
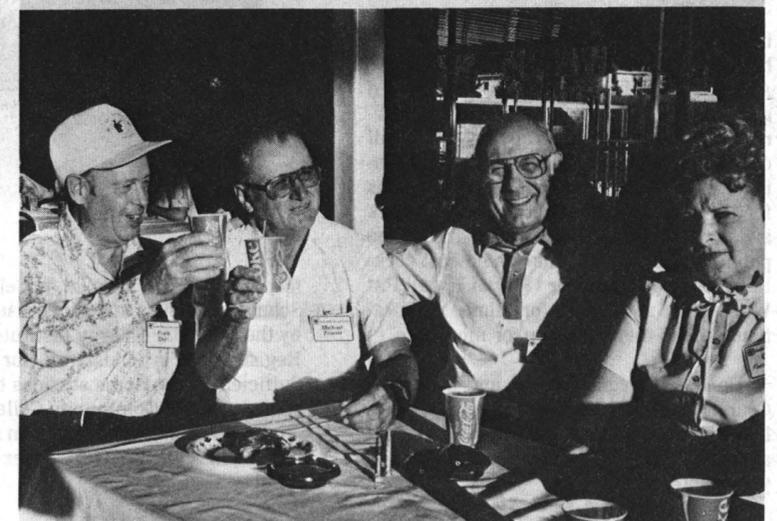
The South 14 Bookstand — Anasazi, the Navajos' name for the "Ancient Ones" who preceded them into the Southwest, is the nickname of Richard Wetherill, who devoted his life to a search for the remains of these vanished peoples. His search was successful — he discovered the cliff dwellings of Mesa Verde and initiated the excavation of Chaco Canyon's Pueblo Bonito in the late 1800s. Though not a trained archeologist, his contributions in this discipline have established him as one of its towering figures. *Richard Wetherill: Anasazi* is his biography by Frank McNitt, published by the University Press (\$8.95, paperback). The story concludes with an account of Wetherill's killing in an ambush by Navajos. McNitt leans to the theory that they shot the wrong man, a case of mistaken identity. The book is available in the LAB NEWS office, Bldg. 814.

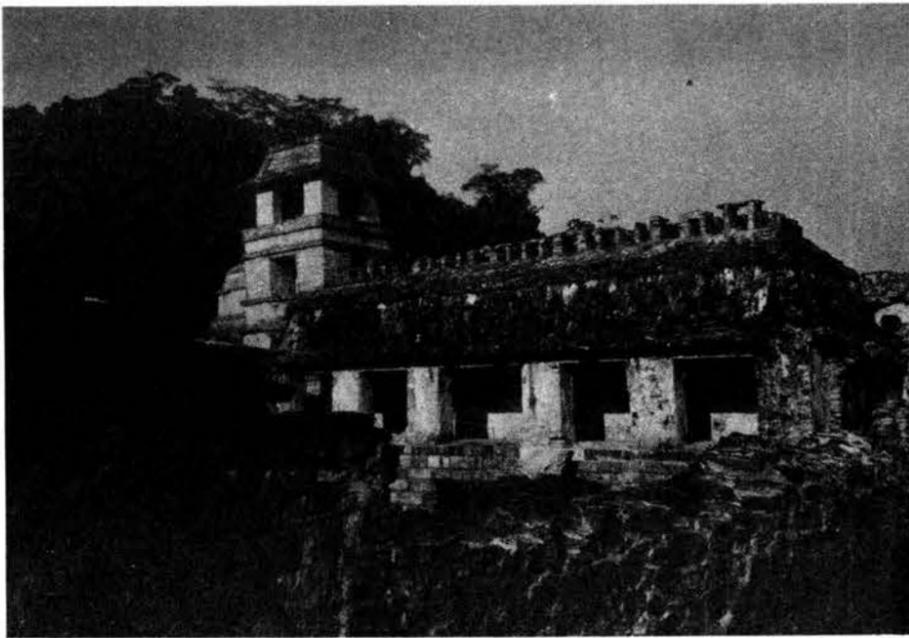
Retiree Picnic — 'Welcome Back'



Attending: 1400 Retirees

Some 1400 Sandia retirees returned to the Coronado Club on May 24 for the annual retiree picnic. They filled the newly-remodeled patio area of the Club and visited through the afternoon and early evening. There was much recalling of the early field testing efforts, of the changing technology in weapon programs, and of good friends and good work done together. Grandchildren were discussed a lot, along with travel past, present, and future. Dinner and refreshments were served; trays and trays of beef and chicken were consumed. Mike Michnovicz (7632) did his strolling troubador act and a lot of old songs were sung with gusto. *Salud!*





THE TEMPLE at Palenque is a magnificent stone structure housing ancient sculptures and the tomb of Pacal, ruler of the city during the peak of its civilization 1300 years ago.



NEAR THE CRATER of El Chichon volcano, the landscape terrain is eroded gullies between barren ridges. There is no marked trail to the volcano crater.

Unusual Vacation

Baxter Finds Ruin in Mexican Jungle

"It was a good plan," Hal Baxter (6222) says. "Fourteen of us from the New Mexico Mountain Club were going to fly into Villahermosa in Southern Mexico, rent three cars, and drive south toward Tuxtla Gutierrez, spend a day looking at El Chichón volcano, then drive on to San Cristobal and spend several days visiting the Mayan ruins at Palenque — the most elaborate and extensive remains of an ancient civilization in North America.

"What happened was we found travail, misfortune, hunger, heat exhaustion, and about the end of our rope."

Hal did his homework. As group leader, he wrote letters gathering maps and information, made contact with a friend who is a travel agent in Chihuahua, and took care of scheduling and arrangements. Group members provided for a first aid kit and chlorine tablets for the canteens, got hepatitis vaccine shots, and acquired insect repellent — all those things a group needs for a hike through a jungle and up a mountain.

"The first flat tire should have been a clue," Hal says. "After a series of them, we began to get the idea. Later, we thought one of the cars was stolen. It was merely hauled away for violating a parking ordinance."

Except for delays with the flat tires, everything went pretty well — until the dirt road ended shortly after Tectuaplan. The group hiked in 105° jungle heat for four hours into an Indian village. There were no accommodations (Hal had received misleading information) — dinner was smoked oysters, a little rum punch, and granola bars from the back packs. They slept on a concrete porch. Very early the next morning (no one slept much), a native provided tortillas for breakfast. The volcano was only a few miles away, and they thought they should be back in the early afternoon in time for a quick drive to San Cristobel, civilization, a monster dinner, and first class accommodations.

"It didn't work out that way," Hal says. "As a Mountain Club group we were in pretty good shape, but that hike through the jungle about did us in. It took much longer than we thought it would, the terrain was very difficult, we ran short of water, and the

bugs ignored the insect repellent. Then there was the mountain — incredible devastation from the lava and ash. The landscape was a series of deep gullies between barren ridges, no marked trail, and the heat was devastating."

El Chichón erupted for a week in late March and early April 1982 spraying tons of ash and sulphuric gases into the atmosphere, devastating the remote countryside, and inflicting a toll of human life that may never be accurately tallied. The cloud is still dispersing in the upper atmosphere and is thought to be changing weather patterns worldwide.

"We finally reached the rim of the crater," Hal says. "It appeared to be about a mile across and a quarter of a mile deep. We didn't linger. It was getting late and we had to find some food and water.

"On the way back, we collapsed into a stream and it was heaven. It was after dark when we reached the cars, after 10 when we found our hotel in Pichucalco. As dumb luck would have it, there were rooms available. The \$4 rate tells it all; we wondered what the jail looked like. Mercifully, the restaurant across the street still was open, so we had our first square meal in three days."

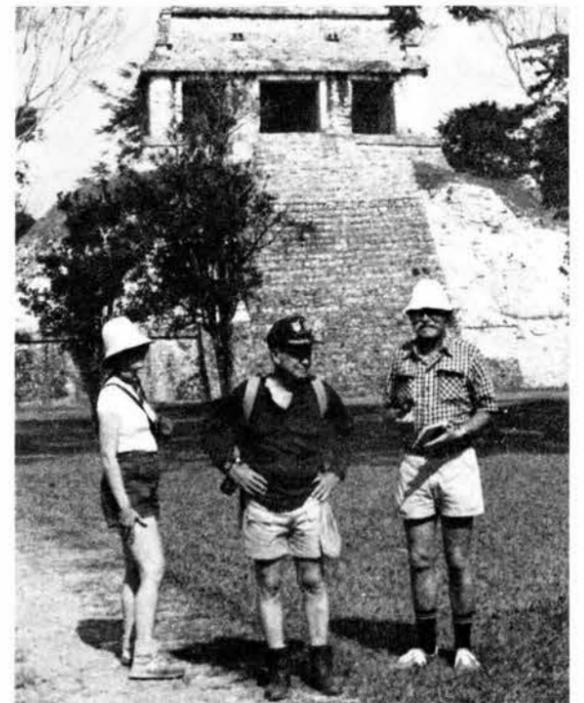
The ruins at Palenque represent the westernmost thrust of Mayan civilization. More than a dozen huge structures have been excavated over the past 14 years. Palenque's temples and pyramids stretch for seven miles along a wooded ridge, only a tiny segment of the city that flourished there in the jungle some 1300 years ago. Excavated sculptures and art treasures from the site are as magnificent as any found in Middle America.

"Visiting the ruins made the trip worthwhile," Hal says. "As an engineer, I marveled at the design and construction of the structures. By anyone's standard, they are magnificent. What is even more impressive is the fact that the structures were built without beasts of burden, without wheels or even simple machines, and without hard metal tools.

"I'd like to visit Palenque again — there's just too much to see and to absorb in a couple of days. But next time I want to see El Chichón, I'll hire a plane and a pilot."



TEMPLE ATOP STONE PYRAMID with roof decoration is unique to Palenque. The four tiny figures at the top of the stairs are members of the New Mexico Mountain Club.



TOURING TEMPLE SITE at Palenque are Verna Wood, Art Cordova (ret.), and Hal Baxter (6222). Hal was tour leader for a group of 14 New Mexico Mountain Club members who toured Southern Mexico. "Never again," Hal says. "A group leader should have some idea of where he's going."

Logistics: Hal says total airfare was \$355 and other expenses (including beer and gifts) came to \$230 for the nine-day trip. The group flew Southwest to El Paso, Mexican Airlines from Juarez. Hotels were generally selected from Fodor's Guide, and reservations were made by a phone call ahead each day.

Lab News Country (Livermore Division)

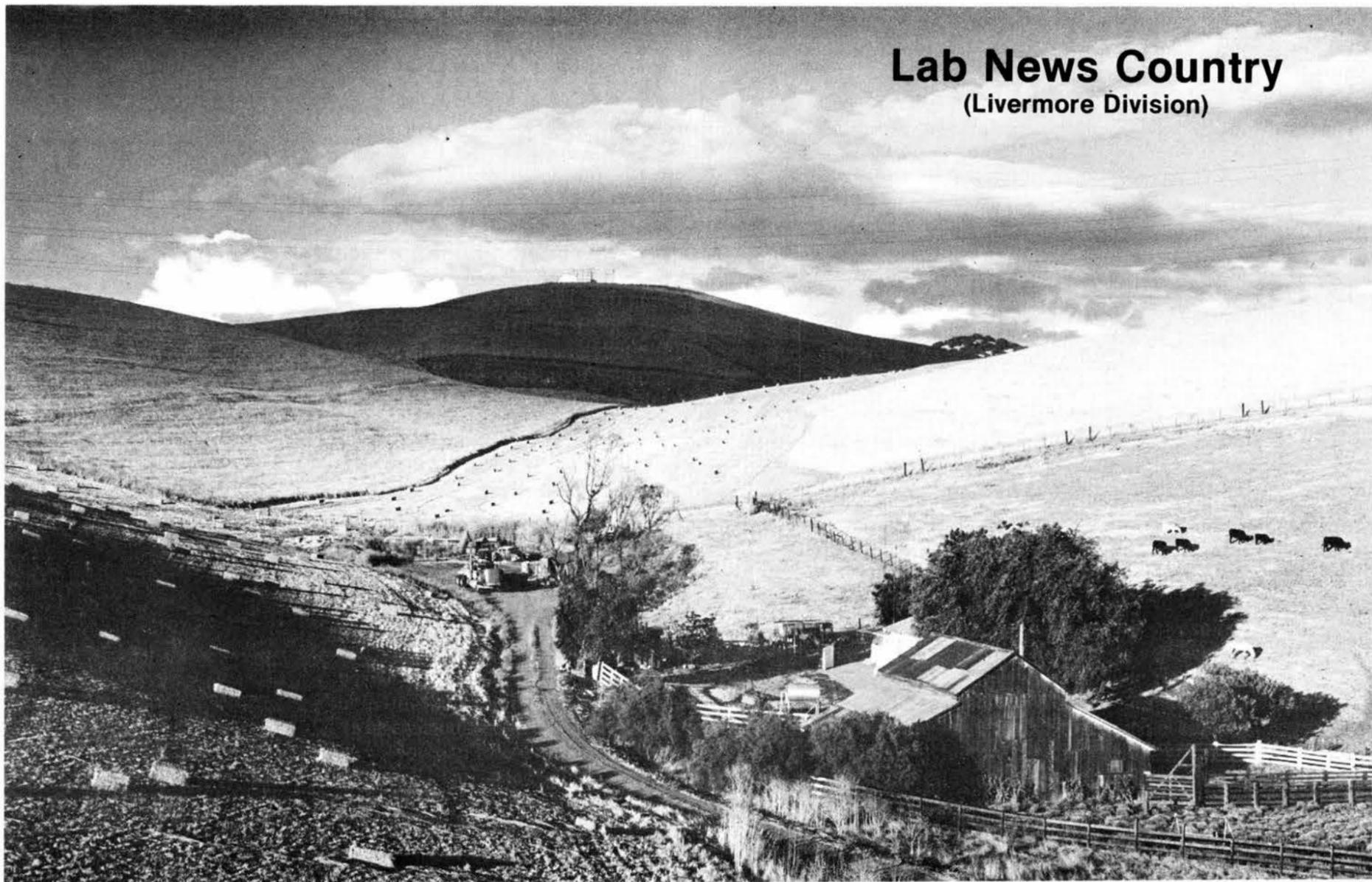


Photo by Don Spencer, Ret.

Fun & Games

Running — The City Parks & Recreation Dept. is sponsoring a series of Fun Runs at 8 a.m. every Saturday (through July 28) again this year. The run tomorrow is 3 miles long, and the course (on existing bike trails) gets a mile longer each Saturday; by the last one it's 10 miles of fun! All races start at San Gabriel Park. No entry fees; no T-shirts. More info from Steve Vargas at 766-7427.

* * *

Race Walking — In connection with the above Fun Runs is a similar series of "race walks" ranging from one to five miles (by July 28). Race walks start at 8:15. Call the same number for more information.

* * *

More Running — Build a stadium with your feet. That's the promise of the 5 to 10k Lobo Fun Run set for June 23 at 8 a.m. Event sponsor First National Bank will donate all entry fees (\$5 in advance, \$8 race day) to UNM to be used toward construction of a new track and field stadium. Course begins and ends at First Plaza and heads toward Tingley Beach for the 5k; it circles Tingley for the 10k. The run is computer timed and TAC sanctioned. Lots of age/sex categories, awards to first three places in each, drawing for prizes. Entry forms in LAB NEWS office, Bldg. 814. More information from the bank at 765-4622.

* * *

Self Defense — No need to fear those bullies on the beach this summer if you sign up for a basic self defense class taught by experienced instructor Charles Pettitt (3642). It's an 8-week course, sponsored by

SERP, that will meet every Monday and Wednesday from 4:45 to 6:15 at the East Gym; it begins June 18. Course costs \$38, and it's open to all Sandians and their dependents; pay at the Coronado Club before the first class. More info from Charles on 873-0020 or 4-4693.

* * *

Wheel-a-Thon — If you'd like to ride your bike, skateboard, unicycle, roller skates, baby stroller, wheelchair, or other non-motorized vehicle from Tramway and Central to Civic Plaza (all downhill!) and benefit the United Negro College Fund at the same time, join UNCF's "Wheel a Mile to Save a Mind" Wheel-a-Thon on June 16 at 7:30 a.m. Each entrant finds sponsors to pledge so much per mile for every mile the entrant completes; the donations go to UNCF-supported colleges and universities. More info on the entry forms available in the LAB NEWS office. First 300 participants to arrive get free T-shirts; everyone gets to meet (or see or follow) the event's grand marshal, Michael Cooper of the LA Lakers.

* * *

Golf — Winners of SGA's recent Socorro Open were Gil Lovato (7474) and Terry Hutchinson (7481), A Flight; Amadeo Carter (7472) and Edward Salazar (6445), B Flight; Ken Prestwich (1240) and William Brooks (1221), C Flight; Jerome Ford (3154) and Gerald Ward (3154), D Flight; and Tom Joy (ret.) and Richard Baehr (1823), E Flight.

SGA's next tournament, called "The Monster" (individual medal play), is scheduled June 16 at the UNM south course. Contact Kevin Linker (6227) for details.



Here are a couple of current volunteer opportunities for employees, retirees, and family members. If you are interested, call Karen Shane (4-3268).

ALBUQUERQUE CONVENTION AND VISITORS' BUREAU staffs an information office at the airport. Volunteers are needed there evenings and weekends to tout our city's and state's attractions to visitors. Orientation and mileage will be provided.

BOY SCOUTS OF AMERICA, GREAT SOUTHWEST AREA COUNCIL needs volunteers to follow up on a few prospective contacts for donations. Names will be provided.

Congratulations

Wayne Hancock (3153) and Audrey Dunblazier married in Albuquerque, May 19.

Mark Geerts (7657) and Jackie Irwin married in Albuquerque, May 25.

Wilbur (7657) and Ruth Ann Martin, a son, Randy Lee, May 20.

Joe (1524) and Nickalee Jung, a son, James Henry, May 16.

Taking a Fun Hobby to Work



Two and a half years ago, Jan Meyer was a 25-year-old professional scientist on the staff of Laser Systems, TRW, in Redondo Beach, Calif., doing system analysis for high energy laser weapon systems. Why in the world would a young woman who had everything going for her jump

out of an airplane?

Why, Jan, why?

"I wanted to."

You had a friend who, maybe, talked you into it? You're an outdoor type, bowl a lot, play softball, ride motorcycles, play tennis, and maybe some friend talked you into it?

"No, it was something I always wanted to do."

Wasn't once enough?

"No. It wasn't. Skydiving is exhilarating. Nothing else in the world compares with it. I jump every chance I get. Last month, I did my 510th jump."

From the scrapbook of pictures here I get the idea that you're pretty good.

"You progress through various skill levels until you qualify as an expert. I'm an expert, but I still learn a lot on every jump."

Perris, Calif., is the place to start skydiving. There's instruction, two DC-3s and a Twin Otter for support aircraft, a large jump landing area, and a lot of enthusiastic people around who are hooked on skydiving. "I averaged six to eight jumps per weekend at Perris when I lived in California. Now, when I visit Perris, I do five or six a day," Jan says.

The United States Parachute Association holds its annual national parachute competition and rigger's convention at Muskogee, Okla. At last year's convention, Jan was participating in a demonstration jump. The lines of her main parachute tangled during deployment. She activated the quick release of the main parachute (called a "cut-away") and pulled the ripcord for the reserve parachute. Everything was fine, but Jan landed in a lake rather than hitting trees or a power line. Jan yelled for help and an off-duty policeman picked her up and took her to shore in his speedboat.

That was the second time that Jan had a "malfunction" — skydiver talk for a parachute that does not perform properly. The first occurrence was on her seventh jump, very early in her training progression. "When it happens, you automatically go into emergency procedures," Jan says. "There's a cutaway grip on your harness, which quickly releases a bad canopy. Then you pull the ripcord for the reserve parachute. Panic is something you don't have time for during an emergency. You tell the 'there I was, thought I was gonna die' stories later in the bar ...

"The reserve parachute is packed by a FAA-licensed rigger every 120 days," Jan continues. "I pack my own main parachute.

It's a ram-air, airfoil parachute. You can make tippy-toe landings."

For Jan, the best part of skydiving is the 70 seconds or so of freefall after jumping from the aircraft and before deploying the parachute. Using her body, legs, and arms as control surfaces, she can soar, do acrobatics, "or anything you can do on a trampoline. It's also great fun to link up with others during freefall. We call it 'relative work' or RW," she says.

Jan is completing her PhD thesis at the University of Arizona at Tuscon. This summer, as she did last summer, she is working in Sandia's Aerodynamics Department 1630. Working title of her thesis is "Vortex Lattice Theory Applied to Parachute Canopy Configurations." She presented a preliminary paper with the same title at a recent meeting of the AIAA in Hyannis, Mass.

Jan completed her master's degree in physics at Purdue University and some additional courses in optical diagnostics, fluids, and thermal sciences before going to work for TRW.

Why the switch from lasers to parachutes in your professional career?

"I asked myself what it was that I always thought about, because you must be obsessed with an idea in order to do your doctorate on it," Jan says. "The answer was skydiving and parachutes. After a literature review, I found out that skydivers and riggers knew as much about parachutes as engineers. I also knew who did the most research on parachutes — Sandia!



JAN MEYER leaps from a DC-3 in a "poised student exit." Photo was made at 4500 ft. on Jan's 15th jump. The gear is conventional military surplus parachute equipment. (Photo by Norman Kent, Los Angeles, Calif.)

"Most parachutes today are designed the way they were 50 years ago — by trial and error. We now have better materials, but we're still missing precise scientific modeling of parachute deployment — what happens from the moment deployment is initiated to the time the canopy becomes fully inflated. This is something I have first-hand experience in and am compulsive/obsessive about. My life depends on parachutes." ● DG



SKYDIVERS, eight women at 10,000 ft. above Perris, Calif, link together to create a "double zipper" formation. Jan Meyer, PhD-candidate summer hire in Department 1630, is at far right. Last month, she made her 510th jump. Photo was taken by skydiver Dave Keith with a camera mounted on his helmet.

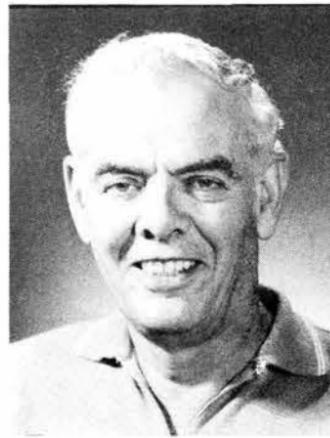
MILEPOSTS

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Jack Walker (6420) 20



Bob Bailey (5122) 35



Rebecca Dyer (7230) 10



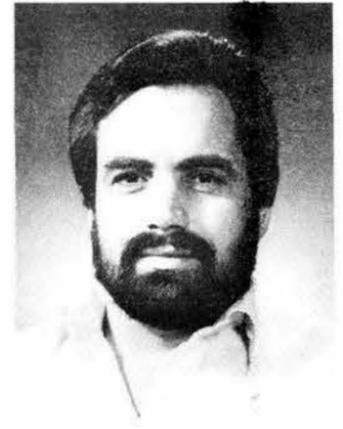
Larry Hostetter (1623) 15



Harold Linker (5213) 25



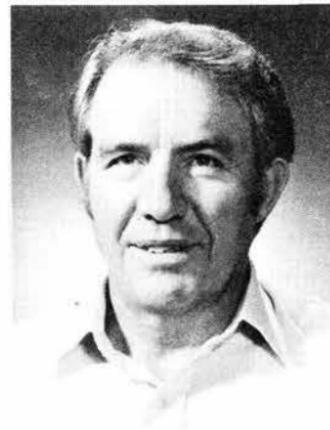
Terry Unkelhaeuser (7613) 20



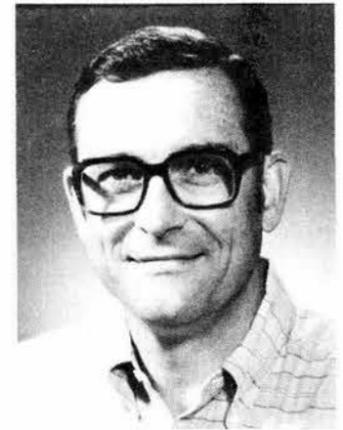
Frank Lasky (2522) 10



Ann Chipman (5255) 10



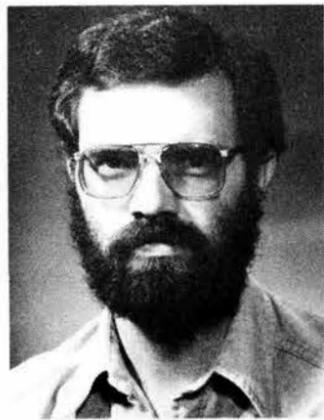
Reuben Weinmaster (2512) 25



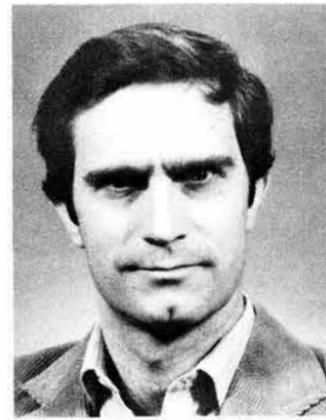
Bernie Hulme (1642) 15



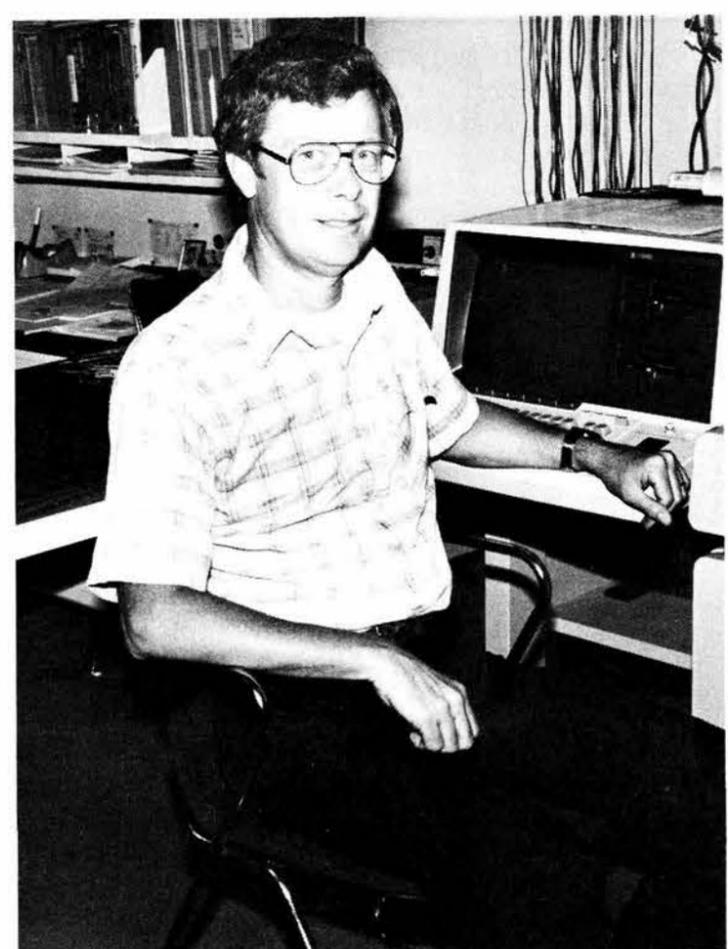
Al Smailer (3615) 25



Randy Asbill (1111) 10



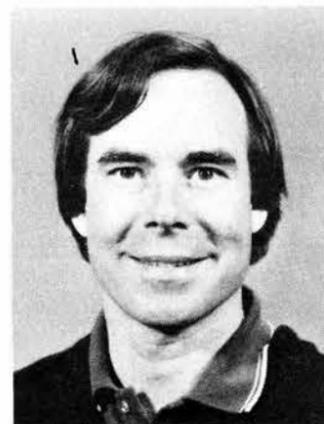
Paul Yarrington (1533) 10



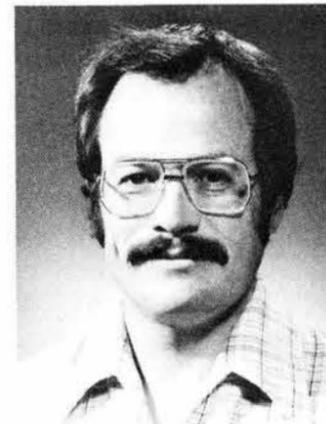
Larry Nelson (2331) 25



Earle Chapman (5119) 25



Kevin Murphy (2525) 10



Don Cowgill (2564) 10

Favorite Old Photo



When my Dad learned that Iva, my oldest sister, had asthma, and the doctor recommended the Southwest, he sold out lock, stock and barrel in Grand Rapids, Michigan, and packed the whole family, including Grandma, into the Model T and headed this way. It was 1920, and the 1600-mile trip took six weeks. With all the camping and other gear on both running boards, the car doors were blocked, so Grandma had to get in before the baggage was loaded. The family made Albuquerque and decided to stay, though Phoenix had been an alternate destination. Dad (William H.) established the Denison Coffee Co. here. My other sister, Muriel, worked for Sandia in Military Liaison and is now retired. (Bill Denison — Ret.)

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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

FLEXSTEEL couch & chair. Minter, 256-9225.
 10-SPD. bicycles, 2 ea., \$40/\$60; free standing rectangular fireplace, glass doors, \$50; Franklin fireplace, \$70. Salmi, 294-3022.
 LADIES chaps, dark brn., custom-made, never worn, size 10, \$100. Romine, 281-5682.
 TI-58C & PG100C printer, \$100 OBO. Prior, 296-2930.
 APPLE silent type printer, complete w/interface card, cord, manual, \$225; dog house for medium size dog, \$25. Church, 299-2175.
 GAS range, 36", harvest gold, \$150. Ganzerla, 265-2705.
 HAY baler, Ford model 532, \$3900. Shank, 877-4497.
 RED rug, 12 x 14, Sears best nylon, \$50. Rhoads, 298-6157.
 AKC Siberian Husky pups, 9 wks. old, all shots, black & white; tan, black & white, \$175. Boyes, 281-1171.
 FREEZER, chest model, white, 20.3 cu. ft., \$200 OBO. Cronin, 265-5229.
 SEALY full size mattress, \$50; full size box springs, \$30; 4 dinette chairs, \$20. Mason, 299-2836.
 SOFT sculptured doll, \$40; 18" Sof-tina doll, \$12; hand quilted new baby quilt; pink twin bedspread, each \$25. Larson, 299-2384.
 FREE Sams Photo Facs, No. 950/1968, covers TVs, AMC/Air-line/Emerson. King, 298-2628.
 POWER pole for temporary power/mobile home, \$50. Lyngen, 281-1822.
 LASCOLITE, 20-yr. warranty, fiberglass, 45" x 48", in original carton, \$35. Dieter, 255-8056.
 GARAGE Sale: June 8, 9, 10; several families: clothes (7-9), shoes (7-9), sofas, chairs, dinette, housewares, toys, Thomas organ. 1027 Loyola Place NE. Brooks, 299-1884.
 KENMORE auto. elec. range, 30" self cleaning, time bake, electric outlet, avocado green, \$200. Bruner, 296-6617.
 SOFABLOCK desk, 30 x 60, 3 drawers, pine, \$249; wicker rock-

ing chair & table, \$45; typewriter w/case, \$25; Princess sewing machine, \$55. Lake, 294-1751.
 MATCHING pair of nite stands, w/drawers, med. walnut color, \$100/pr. Paul, 299-6387.
 SQUARE dance dresses, skirts, etc., size 8-10. Marder, 883-3863.
 HI-HATS 15", Dzilgian, \$130; equalizer MXR 15 bands, 2 channels, for musical instrument or PA applications, \$220. Hammond, 296-9758.
 30 CU. FT. Sears upright deep freezer, \$100; Sears reed type chord organ & bench, \$20; Sears men's 10-spd. bicycle, \$50. King, 299-8768.
 KITTENS, free, they are used to people & children. Souder, 281-3121.
 CAST concrete 12 x 12 x 2 stepping stones, \$5 for 16. Stromberg, 255-6131.
 YUCCA palms, \$5, \$10, \$15. Pope, 255-6702.
 TENNIS rackets: Wilson extra over-size, \$20; Davis Topspin conventional, \$20; Spalding Targa mid-size, \$10; complete small auto air conditioner, \$35. Roeschke, 298-0365.
 COMPLETE walnut trundle set w/2 mattresses, \$200; solid oak student desk & chair, \$200; sofa bed, ribbed brown, \$300. Chavez, 881-2711.
 AUX. gas tank for pickup, 60 gals., used once, \$125. Harrison, 255-7978.
 CRIB, springs, mattress, bumper pad, \$30; bassinet, \$15; Gerry Bear swing, \$10. Quinlan, 296-1852.
 PECAN dining table, Drexel, 6 chairs; nonworking 25" Quasar console TV. Harris, 299-4559.
 PIANO, 1917 Holland grand upright, \$800; bathroom fixtures: towel bar, TP holder, light fixture for 8 light bulbs, counter top, complete w/2 sinks & faucets, \$125 for all; motorcycle parts. Johnston, 294-4574.
 GARAGE sale: June 9-10, 708 California SE: elec. range, port. dishwasher, ski equip., clothing, etc. Barnhart, 255-0574.
 SINGLE/BUNK beds, maple, complete with foam mattress and mattress board. Jones, 299-9032.
 SPRINKLER HEADS, used, 20 bras pop-ups with risers; car top carrier, enclosed, waterproof fabric; small copper-lined planter box; make offer. Suber, 294-4038.
 OLYMPICS TICKETS, 4 tickets for each of track and field, springboard diving and soccer. Carson, 898-8847.
 T/C CONTENDER target pistol in .357, Burris 4X scope, Pachmayr grip, empty brass and loaded ammo, \$200; Arvin fireplace grate with thermostat-controlled fan, glass doors, \$25. Hufnagel, 294-5949.
 FREEZER, 20.5 cu. ft. Carrier, \$75. Madden, 296-1082.
 PLANT STAND, marble top, 18" high, 14" diam, \$10. Rainhart, 821-3690.
 BABY ITEMS: carseat, wind-up swing,

variety of toys for infant and toddlers. Drotning, 294-4807.
 PARTING OUT '78 Chevrolet pickup. Walker 298-4819 days, 281-9587 after 7 p.m.
 HARDBACK BOOKS, 100s of them, 50 cents each; ham radio equipment; 6' two-door metal cabinet, \$40; Tiara glassware. Blackledge, 294-6030.
 REFRIGERATED air conditioner, 15,000 BTU, 220v, window type, cools 2 or more rooms, make offer. Ingram, 298-0390.
 FREE PUPPIES, ¾ lab & ¼ doberman, 7 weeks old. Woodford, 836-3354.
 BUILT-IN cooktop, range hood, oven, dishwasher, copper, \$45; ceiling fan with lightkit, \$35; 32" aluminum storm door, new. Aragon, 881-4795.
 HITCH, Reese equalizer, bolt on, 10,000-lb receiver, 500-lb. equalizer bars, complete hitch, \$170. Arning, 256-9229.
 SWIMMING POOL, 24-ft, above-ground pool with filter, ladder, maintenance kit, solar and winter covers, \$1000. Moore, 296-4140.

TRANSPORTATION

'83 HONDA Accord, 4-dr., 5-spd., AC, AM/FM cassette, cruise, below book. Garst, 884-5176.
 MAZDA RX-7 GS, AC, sunroof, AM/FM stereo, alloy wheels, 5-spd., louvers, \$8700. Young, 292-2805.
 '83 FORD van, E-100, 6-cyl., 300ci, AT, AC, AM/FM stereo cass., tinted windows, PS, PB, carpeted throughout, \$9350. Cole, 892-7771.
 '79 YAMAHA 1100 SP, 8500 miles, windshield, luggage rack, \$1850, will trade for ¾-ton 4-spd. pickup. Stone, 281-2819.
 '80 SUZUKI GS750E motorcycle, low miles, custom matched Vetter fairing & bags, orig. owner, \$1895. Norwood, 292-0072.
 1928 MODEL A Ford, completely restored sport coupe, 6-wheeler w/rumble seat; need good home for cockapoo, small dog, free. Bruce, 936 Gatewood Rd. SW, 898-2959.
 CANOE, 13' Coleman fiberglass w/paddles, \$200. Chorley, 296-1454.
 BOAT, '71 '19' Larson, 360 Chevy, OMC outdrive, CB, depth finder, full canvas, \$4500. Tobyas, 877-0354.
 '78 HARLEY-DAVIDSON FLH1200 Electra Glide, full dress w/trunk & Liberator fairing, black, \$3995; '80 Mercury Cougar XR7, red w/white vinyl top, 36K miles. Bloomquist, 821-3018.
 1940 BUICK Special, straight 8 engine, \$2950 OBO. Chavez, 831-9591.
 '80 SUZUKI GS450E motorcycle, 3300 miles, w/windshield, \$795. Lake, 294-1751.
 VESPA motorscooter, 125cc, one owner, 95 mpg, \$400. Ginn, 883-0004.

'82 KZ305CSR, 3400 miles, adult ridden, luggage rack, \$1000. Conrad, 298-2691.
 '83 HONDA CR80R, \$625; 1 set of 4 15" x 6½" 6-bolt wheels for Chev. 4-wd pickup, \$40. Brigham, 292-4399.
 BOAT, 2-passenger Folbot, collapses to fit into two carrying cases, \$250. Mendel, 265-3840.
 1960 ½-ton Ford truck body, \$150. Padilla, 877-2116.
 '75 HONDA CB550 Four super sport, Vetter fairing, luggage rack, new battery, \$7750 OBO; will trade for fishing or sailboat. Rozelle, 298-0396.
 '77 CHEVY MALIBU, new brakes & transmission, AM/FM radio/cassette, \$1600. Wilkinson, 281-3835.
 HUSQVARNA 360cc, street-legal dirt bike, extra tank, \$375. Kelsey, 292-4768.
 '76 PONTIAC VENTURA, 6-cyl, AT, AM-FM-cassette, steel radials, below book at \$2000. Morrison, 877-7425.
 '78 CHEVY IMPALA, AT, AC, PS, PB, AM/FM, tilt wheel, 4-dr sedan, 305 V8, \$2700. Taylor, 822-0637.
 '81 VW RABBIT diesel, 4-spd., AC, AM/FM/cassette, 2-dr-LS, 24,000 miles, \$3395. Schideler, 293-3235.
 '70 FORD MAVERICK, 170 engine, 3-spd manual, 25 mpg city, \$800. Roherty-Osmun, 293-8127.
 '83 BUICK Park Avenue 4-dr, diesel, 13,000 miles, \$12,250. Errett, 292-4885.
 '78 DODGE wagon, 51,000 miles, AC, auto, R & H, new tires, white w/green interior, \$2250. Gage, 293-1707.
 '80 MOTOGUZZI 1000SP, sport-touring model, new tire, battery paint, 7400 miles, \$2500. Weatherbee, 869-2849.
 '83 HONDA 1100 (V65 motorcycle), dealer serviced, asking \$3449. Ulibarri, 883-2848.
 '80 PINTO Runabout, AC, book \$3000, sell \$2695; see this weekend at 6107 Gisele. Schowers, 822-8494.
 '71 SCOUT for gold prospectors, 4 WD, dual tanks, engine-driven dry panner, water tank, tow bar, \$1795. Norris, 299-4717.
 '80 HONDA Prelude, sun roof, auto, air. Garcia, 296-6116 or 299-8778.
 '78 KAWASAKI KE100, dirt or street, helmet, manuals, \$325. Wengert, 294-5373.
 '72 CHEV station wagon, 4-dr, AT, AC, more. Pierce, 883-2719.
 '82 ISUZU pickup, deluxe, long bed, ¾ ton, AT, PB, AM-FM camper shell. Chandler, 299-5389.

REAL ESTATE

3-BDR., 2½ baths, FR, lg. LR, 2 dining areas, oversized M-bdr., lg. walk-in, dbl. garage. Tafoya, 296-8361.
 FAIR Plaza area, corner lot, 3-bdr., den, 1½ bath, pitched roof, hw floors, fp, dbl. car garage, terms negotiable. Gorman, 255-4431.

3-BDR., Angel Fire condominium, fully equipped, furnished, 1 block from ski lift, \$115K, terms. Edwards, 292-4700 after 5.
 14 x 80 NOBILITY MH, 1979, 3-bdr., 2 full baths. Ruybal, 821-7582.
 7¾% ASSUMABLE loan, \$452 payments, 3-bdr., 2 bath, fp, landscaped, garage, west side. Smith, 836-1676.
 1 ACRE with 12 x 65 MH, separate laundry room, tool shed & 8 fruit trees, \$36K, in Los Lunas. Sena, 865-7750.
 HOUSE in Rancho de Placitas, views west and mountains east, 2000 sq ft, 4-bdr, 2-bath, low utility bills, good TV reception, \$95,000. Nielson, 867-3968.
 4-HILLS HOME, 4-bdrm custom, large kitchen, lots of storage, many extras. \$107,900. Erickson, 296-0126.
 OPEN HOUSE, June 10, 1-5: 3-bdrm, large family room and den, storage garage with carport, 2228 El Navajo SW. Reich, 877-2846.

WANTED

CHILD'S sandbox, living room partition screen. Hanson, 296-7141.
 13" TIRE AND/ or wheel for travel trailer. Baxter, 344-7601.
 BROWN or green sofa bed in excellent condition. Pope, 255-6702.
 REAR BUMPER for Datsun pickup. Rozelle, 298-0396.
 CAMPER SHELL, LWB, fiberglass, reasonable. Vargas, 242-7097 after 5.
 CROQUET SET, used, not over \$10. Baker, 881-4939 (leave message).
 WESTERN SADDLE, lightweight. Walker, 281-9587 after 7.
 TO BORROW, solutions manual to "Physics — Part II" by Halliday and Resnick. Used in INTEC course PH709. Dandini, 296-4975.
 TEXAS INSTRUMENTS PC-100C printer w/paper rolls. Halsey, 294-4949.
 REEL-TO-REEL tape deck that plays well. Blackledge, 294-6030.

WORK WANTED

HOUSESITTING, pet care, references. Hamblett, 298-6052.
 YARD WORK, teenager working for soccer team travel expenses, references. Luke Atkins, 298-5762.
 LAWN MOWING and trimming, estimates. Greg Cook, 296-3064.
 HS senior wants baby sitting & lt. housework, preferably full time. Switendick, 884-0153.

SHARE-A-RIDE

RIO RANCHO van pool has full-time openings available, \$50/mo. Woodrum, 892-7771 or 892-7980.

LOST

Rx GLASSES in the vicinity of Bldg. 823 on 5/24/84. Keady, 298-5285.

Membership Drive Pool Party Sunday

TONIGHT at Happy Hour, prime rib tops the buffet, and you can get it two ways — with soup and salad bar, it's \$9.25, or without soup and salad, it's \$7.25. Entrees from the regular menu are also available. Karen Edwards instructs free country western dance lessons from 7:30 until 8:30. Western Flyer plays for dancing from 8:30 until 12:30. Happy Hour prices (very reasonable) are in effect from 4:30 until 8:30.

SUNDAY — Membership chairman Frank Biggs (7112) extends an invitation to anyone who works on KAFB to come to a pool party on Sunday, June 10, starting at 11 a.m. Festivities include a swimsuit fashion show at 1 p.m., 50-cent beer, and door prize drawings — two \$50 gift certificates from Gardenschwartz Sportz will be given away along with T-shirts and caps. Sandia and DOE employees are eligible for full membership, others for associate memberships. Either way, annual dues are \$60, which must be paid in advance (or a payroll deduction card signed). Anyone who joins the Club will receive four free drink tickets and a \$5 snack bar coupon. Buy a pool and patio ticket and save an additional \$5. Members are also eligible for prizes.

GOURMET DINING (Club 35) meets Tuesday, June 12. Last month, toward the end of the Club 35 evening, Chef Henry Perez checked the dining room and the crowd gave him a round of applause, an ovation. The meal was outstanding, and Hank promises to do it again. Here's the menu: shrimp in mustard sauce with corn bread rounds, chilled cream of watercress soup, mushroom and pinenut salad with raspberry vinegar dressing (cooked table-side), and your choice of medallions of veal in brown sauce with port and ginger or Beef Richelieu with Madeira sauce. Dessert is flaming baked Alaska followed by an after-dinner drink of your choice.

A wine taste starts the evening at 5:30. Jim Trost on piano and Rick Fairbanks on bass play very fine background music. The way it works is the first 35 couples who make reservations (call 265-6791) are the Club 35 members for the month. The dinner tab is \$35 per couple, which covers everything but the tip.

NEXT FRIDAY, June 15, sees a seafood spectacular buffet at Happy Hour. Monk fish, trout, perch, cod, snapper, blue fish, grouper, and halibut are among the goodies offered. They're served with various sauces, rice, baked or fried potatoes, and a vegetable du jour. The price is \$10.25 with soup and salad bar, \$8.25 without. The W.D.C. band plays for dancing.

ON SATURDAY, June 16, the children's pet show starts at 10 a.m. in the pool and patio area. It's for kids age 3 to 10 years and their pets — any kind, any style, any size. There'll be prizes and ribbons for the cutest, ugliest, fattest, shortest legs, best tricks, and best behaved in all categories. To enter, pick up an entry form from the Club office today. Fee is \$1, which is donated to the

Animal Humane Association. Member families only, please.

FATHER'S DAY CHAMPAGNE BRUNCH — it's the old man's day, and he deserves the best: brunch at the Coronado Club from 11 a.m. until 3 p.m. on Sunday, June 17. The menu includes baked whole halibut, baked ham with cherry sauce, steamship round of beef, Parisian potatoes, scrambled eggs, sausage, hash browns, green chile, assorted salads and desserts. The tab is \$9.25 for adults (champagne included), and \$4.75 for children under 12. For reservations, call 265-6791.

TRAVEL DIRECTOR Charlie Clendenin (2611) tells the LAB NEWS that the travel scene is changing. With the airfare competition and the airlines teaming up with resort facilities, an individual can do as well in obtaining special rates and deals as a group can to places such as Las Vegas and Hawaii — even Caribbean cruises. The Coronado Club travel committee will now function as an informed information center with literature, brochures, news on current travel specials, and feedback from Club travelers. The Club is arranging periodic travel programs with speakers, slides, and movies about exotic places.

In those cases where the Club can arrange the very best deal for a group and make significant savings for its members, it will continue to do so. The next Club-spon-

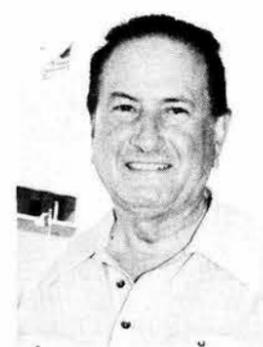
sored group trip is to Matzatlan Nov. 12-19. Through the years, the Club and Trans-Globe Travel have maintained very good relations with the luxury resort hotel Playa Mazatlan. The travel package — airfare, seven nights at the Playa (double occupancy), all U.S. and Mexican taxes, transfers, baggage handling, bell tips, and pool-side cocktail party — costs \$399, a very good deal indeed these days. Sign up at the Club office.

In the meantime, if you have an urge to travel anywhere, for instance to Dallas Sept. 15 for the Cowboys/Eagles game or again Dec. 8 for the Cowboys/Redskins battle, call Charlie or Betty Clendenin, 299-2071. They also have details on a Cumbrés and Toltec trip Oct. 6, and a Cozumel skindiver special Nov. 13-20.

Retiring



Jack Reynolds (3713)



Pat Quigley (7633)

Favorite Old Photo



MY FATHER (on the left) was a security guard at the IBM plant in Endicott, N.Y. (This picture was taken in 1944.) The plant was not secured by fences and, in fact, was in various locations all over town. Patrolling on horseback proved to be a sensible way to check all the buildings. IBM needed tight security because of the prevalence of industrial espionage. After using the horse patrols for a dozen or so years, the company replaced the horses with small foreign cars. I can remember how furious my Dad was when he lost his horse. It seems that he would dismount in front of one of the large warehouses, check out the building, and leave by the back door where his horse would be waiting. There was just no way to train the little car to do the same thing. — Arthur Sharpe (1245)