

Counter-Terrorist Training More Realistic With New Laser Engagement System

Protecting nuclear weapons and material is serious business. Terrorists believe *their* business is serious too.

Put those two facts together, and — if you're on the "good-guy" side — you reach a clear conclusion: Protectors of nuclear weapons should be sharp combat veterans; expecting the unexpected must be a way of life for them. And they have to react instantaneously to an event that may end — for better or worse — in a matter of seconds.

Combat readiness is no accident. Hardened military veterans are quick to point out that real combat experience is the best teacher — for those who live through it. However, many of the people defending our nuclear weapons installations today range from 18 to 25 years old — and have no combat experience.

So there's an all-important question: How do you build a group of combat-hardened troops when there's no war?

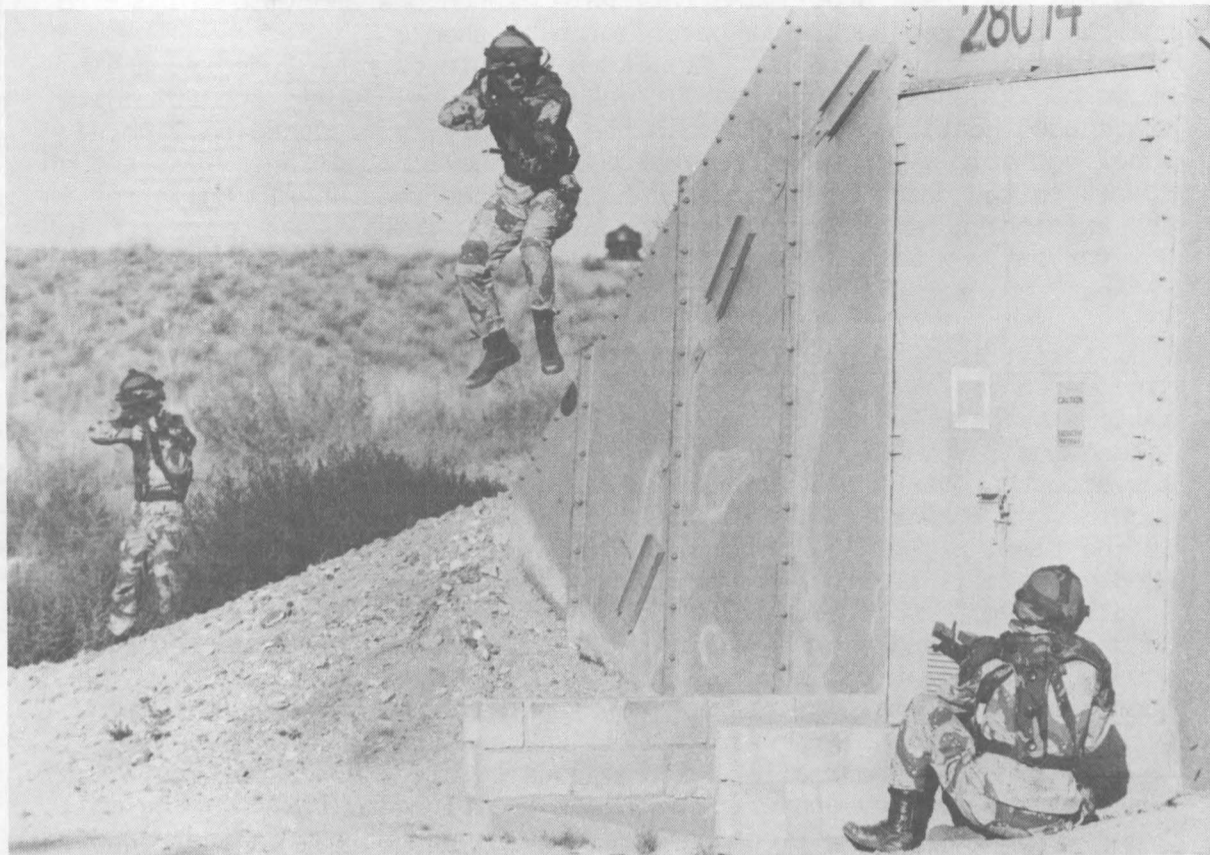
Recognizing the problem, the Department of Defense (DoD) requires force-on-force training at all locations where nuclear weapons are stored or deployed. Further, the training must include realistic exercises using an engagement simulation system and a trained aggressor (bad-guy) force.

'Experience Is the Key'

A microprocessor-based laser engagement system, TESS (Tactical Engagement Simulation System) — developed at Sandia during the last two years for the Defense Nuclear Agency (DNA) — is used for counter-terrorist training that provides participants combat experience without hazard. "That's important," points out engineering project leader Mike Moulton of Communication Systems Div. 5215, "because the basic goal of training exercises is to determine how well the defensive force did its job.

"It's often said that experience is the key to success in any real-world situation, from fighting a fire to flying a plane. Combat experience is no exception." (Besides his project-leader job, Mike also handles TESS technical interface between the Labs and DNA.)

For obvious reasons, weapons loaded with live



BUNKER DEFENDER Jim Kaiser holds off two attackers — Jeff Johnson (left) and Paul Justice (all 3435) — during a demonstration of TESS equipment at the NATO test site south of Area IV.

ammo aren't used in training exercises. Still, for the sake of realism, exercise "players" — both good guys and bad guys — carry weapons that fire blanks. But blanks, without some sort of hit-or-miss detec-

tion system, can't answer some basic questions at the end of the exercise: What mistakes were made, and how are they best corrected to ensure future suc-

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LAB NEWS

VOL. 41, NO. 1 SANDIA NATIONAL LABORATORIES JANUARY 13, 1989

Will Deliver Weyl Lecture in Leningrad

Michalske to Receive Premiere Award in Glass Science

Glass breaks. That much has been known since glass was invented some 90 centuries ago. Under stress, even the tiniest surface cracks and flaws can continue to grow and spread through the glass, eventually causing a large break. But how? And why?

Not much more was known in 1979, when Terry Michalske, now supervisor of Surface Science Div. 1134, began developing mathematical and chemical models to describe what happens — at the atomic level — when glass fractures.

True, researchers in the mid-60s had finally been able to make precise measurements showing that water makes a difference — specifically, that the stress needed to crack glass decreases as its expo-

sure to water increases. In other words, water aids glass cutters. But why?

As Terry developed his models, some of the answers to the question of *how* glass breaks began to emerge. More answers surfaced over the next ten years as he and his colleagues, Bruce Bunker (1846) and Stephen Freiman (National Bureau of Standards), continued to refine the models and focused on understanding — from an atomistic point of view — how water and other chemicals accelerate the growth of cracks in glass and other brittle materials.

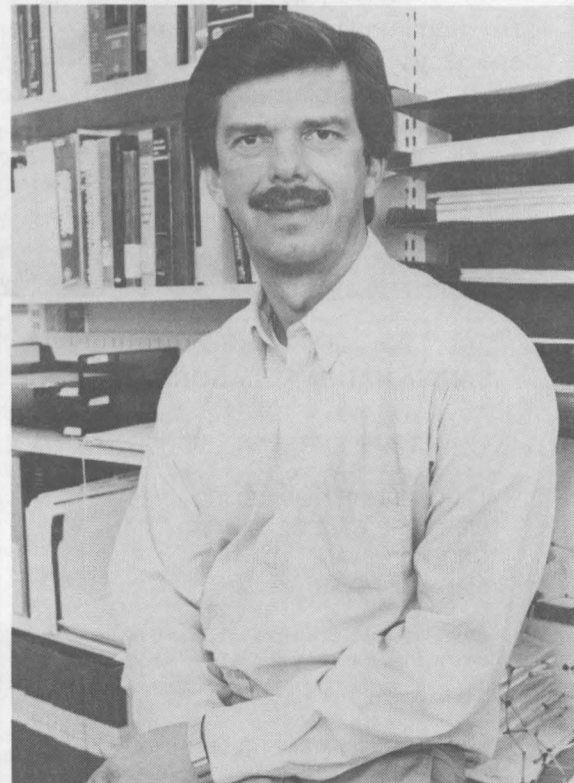
Now, Terry's work has earned him the Wolde-mar A. Weyl International Glass Science Award, a prestigious award established by Pennsylvania State University in collaboration with the International Commission on Glass. It recognizes young scientists whose work has shown "ingenuity, initiative, and innovative thinking."

The Award Committee's citation says Terry has demonstrated these outstanding qualities in his work and publications (more than 30 to date) by providing a "new, scientific basis for understanding and predicting the mechanical properties of glass in corrosive environments."

Terry is also a recipient of DOE's Materials Science Award (1985) and the American Ceramic Society's Ross Coffin Purdy Award (1987).

Formal presentation of the Weyl Award will be made at the 15th International Congress on Glass to be held in Leningrad, USSR, July 2-7. As part of

(Continued on Page Five)



DEVELOPMENT OF a new model for predicting the long-term reliability of silica glass has earned Terry Michalske (1134) the prestigious Woldemar A. Weyl International Glass Science Award. The award will be formally presented at the 15th International Congress on Glass to be held in Leningrad, USSR, July 2-7. Terry will deliver the Weyl Lecture at the Congress.

Executive Comment

I'm delighted by this recognition of Terry Michalske's work on fracturing glass. Over the last year and a half, I have been highlighting his work in my presentations to visitors to Sandia. It's an excellent example of the basic science we do to understand practical problems. He literally brought science to what previously was an art. External recognition of our research work by experts in the field is an important measure of its quality. My congratulations go out to Terry on this achievement.

— Venky Narayanamurti,
Vice-President of Research 1000

Antojitos

Memories of the Mid-70s -- Our recent series on Sandia's energy programs and their underlying rationale caused one anonymous reader to unearth this "feedback that never got published":

Energy is my shepherd. It maketh me gulp down my lunch from a brown bag; I shall not gripe. It maketh me bundle up in the frigidity of reduced heating and swelter in the torridity of reduced cooling; I shall not gripe. It maketh me carpool; I shall not gripe. Yea, though I walk in the shadows of darkened hallways and read Weekly Bulletins in the twilight candlepower of reduced lighting, I shall not gripe. However, it now maketh me wash my hands and my coffee cup in cold water -- and I am griping!

* * *

Adrift in an Electronic Oblivion -- It's always comforting to discover a fellow anti-answering-machine curmudgeon. I quote from an article by Jeff Hecht in New Scientist: "'Voice mail' is the latest telecommunications buzzword in the US. . . . What is voice mail? It is a system that can store incoming telephone messages, like an answering machine, or forward them to some other number at which you happen to be at the time. . . . All this sounds fine in theory. But what happens when voice mail starts replacing human secretaries? It used to be that a call to Professor Smith would be routed to his secretary if he wasn't in the office, and the secretary could tell you whether the professor was in the laboratory, out to lunch, or on a six-month field trip to Tasmania. Voice mail simply asks you to leave a message at the beep, with no indication of the professor's whereabouts."

As a fellow "journalist working to a deadline" in a company currently plagued by answering machines and plunging toward voice mail, I share Hecht's frustration that "callers never get any indication of the fate of their message." No, I don't expect a recorded message that says "Engineer Smith is on a six-month assignment in Amchitka, leaving her luxurious home at 123 Easy Street totally unguarded," but I would appreciate some idea of when Smith might get my message -- by noon? tomorrow? next month?

(Yes, I know it's only middle-tech, and I know it further burdens some already overburdened secretaries, but forwarding calls to a real human being has some real advantages.)

* * *

The Reports of My Death . . . -- Lots of our new hires awaiting their Q clearances have been known to say, "If it takes another six months, I'll just die." Few of them, I'm relieved to report, have made good the threat. But then there's Frank Hansen (6313). He'd been on-roll less than six months when his obituary was published in Eos, the newspaper of the American Geophysical Union, of which he's a member.

No, it wasn't for another Frank Hansen -- too many details of education, experience, and career for that. A friend of his phoned the AGU to report that Frank was alive and well -- which he is, by the way -- and was told that one of its inquiring reporters would check out the story and, if the facts warranted, print a retraction. That hasn't happened yet, but, of course, these things take time. ●BH

* * *

"I have long held the opinion that the amount of noise which anyone can bear undisturbed stands in inverse proportion to his mental capacity, and may therefore be regarded as a pretty fair measure of it. Noise is a torture to all intellectual people." --Arthur Schopenhauer

Take Note

DOE has challenged SNLA and KAFB employees to help improve Albuquerque's air quality by carpooling, riding the bus, bicycling, or walking to work Jan. 23-27. Information on this Challenge Week will be distributed to SNLA employees.

* * *

New Mexico Chapter of the American Vacuum Society will hold its 25th Annual Symposium on May 8-11 at the Holiday Inn Pyramid. The meeting includes sessions on surface science, electronic materials and processing, and applied surface science. Contributed original papers are solicited. Submit one-page abstracts to 1989 NMAVS Symposium Chairman Chuck Peden (1846), 4-1087; deadline is March 31.

A four-day program of short courses will be held in conjunction with the Symposium. Included are a four-day course on basic vacuum technology and a program of one- and two-day specialized courses. The National AVS Board of Directors will meet in Albuquerque during the Symposium, and a Topical Conference on Recommended Vacuum Practices will be held May 11-12, co-sponsored by the Vacuum Technology Division of the AVS.

* * *

Next meeting of the New Mexico Network for Women in Science and Engineering will be Jan. 18 at 6 p.m. at the home of Beth Sellers (DOE). The evening includes dinner (\$6) and a program sponsored by the National Endowment for the Humanities; VanAnn Moore will discuss the life of Susan Shelby Magoffin, the first American white woman to travel the Santa Fe Trail, and will perform a dramatization. Meetings are open to members and nonmembers. For more information and to make reservations, contact Donese Mayfield (9224) on 4-8811 or Beth Sellers (DOE) on 6-2102.

Sandia Colloquium

Thomas Deutsch from Massachusetts General Hospital will speak on "Lasers in Medicine" at the next Sandia Colloquium at 9 a.m. on Jan. 27 at the Technology Transfer Center. Jim Gerardo (1120) is the host. Call him on 4-3871 for more information.

The Albuquerque VAX Local User Group (LUG) promotes the exchange of information and ideas among those interested in Digital Equipment Corporation's VAX line of supermini computers. Next meeting: Feb. 16 from 1:30 to 3:30 p.m. at the Radisson Inn. For more information, call Wynona Sexson (6440) on 4-4358 or Cheryl Haaker (2644) on 6-6259.

* * *

The Albuquerque Convention and Visitors Bureau is asking area residents to "Invite Someone You Love to Albuquerque" in February. The Bureau's campaign showcases Albuquerque's performing and visual arts. Performances include violinist Itzhak Perlman and the New Mexico Symphony Orchestra, NMSO and Chorus along with the UNM Chamber Singers and the Albuquerque Boy Choir, and the Royal Philharmonic Orchestra of London; theatre performances of "Madame Butterfly," "The Mystery of Edwin Drood," Shakespeare's "Love's Labour's Lost," Woody Allen's "Play It Again, Sam," "You'll Love My Wife," and "When You Comin' Back Red Ryder"; and art shows and exhibits. Check the Events Calendar in future issues for specific dates, places, and times.

* * *

The Second Annual Travel Fair and Auction will be held Sunday at the Hilton Hotel; fair opens at 10 a.m., the auction at 4 p.m. Auction proceeds go to the Anderson-Abruzzo Balloon-Science Museum and the New Mexico Special Olympics. Auction items include tickets to London, the Bahamas, Disneyland, New Orleans, and other "dream-vacation" sites. Local trips include ski weekends in Tamarron, Inn of the Mountain Gods, and Quail Ridge, in addition to other packages. Tickets are \$2 and are available at the Que Pasa Recreation Center.



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Welcome

Albuquerque

Joe Aranda (3426)
Mark Biggs (3544)
Vicky Blackberg (3426)
Paul Graham (144)
Fred Jones (2648)
Richard Lucero (3426)
Kevin McMahon (3532)

Connecticut

Olin Bray (2825)

Indiana

Carol Phifer (1845)

Michigan

Michael Cuneo (1264)

A Matter of Fine-Tuning



Freezing strings on musical instruments cuts the need for tuning and brightens the sound, says physicist Jeffrey Levine of Applied Cryogenics Inc., Newton, Mass. Such strings, he quips, may be marketed under the name "Oppornockety." The motto: "Oppornockety only tunes once."

Lynn Asinof, Wall Street Journal

Joint Tritium Test Experiment Succeeds

Tritium may be easier to use in fusion reactors than previously believed. That's a major finding of a cooperative effort by researchers from Sandia Livermore, the Tokamak Fusion Test Reactor (TFTR) at Princeton, and the Joint European Torus (JET) in Culham, England.

In tests conducted at Sandia's Tritium Research Laboratory (TRL), members of Ken Wilson's Physical Research Div. 8347 played a key role in measuring the effects of tritium on the neutral beam insulators used in fusion reactors such as the Tokamak. (The insulators isolate the high voltage used to produce high-powered neutral beams that are shot into the fusion chamber, creating a controlled fusion reaction; see "Theory of Tokamak.")

Up to now, the insulators have been tested only with neutral beams composed of deuterium, the naturally occurring heavy hydrogen isotope. But a beam of tritium (a radioactive isotope of hydrogen) eventually will be required to increase the efficiency of the fusion reaction.

Sandia has worked since 1974 in the area of plasma material interactions for the magnetic fusion energy (MFE) program. Now that this tritium experiment has been concluded successfully, TFTR and JET can be more confident in using tritium in their fusion reactors. Both JET and TFTR plan to introduce tritium into their machines in 1992.

Unique Capability

"We have a unique capability here to conduct the kind of tests needed by Princeton and JET," says Ken. "In essence, the tests tell us whether we can take full advantage of the energy contained in tritium atoms in creating fusion events. The TFTR is fully committed to using tritium neutral beams as a way to 'break even' — obtain as much power out as power in — in magnetic fusion energy; JET is also considering tritium neutral beams. These tests provide confidence that a tritium neutral beam is a viable technique."

Rion Causey (8347), who worked closely with the TFTR and JET visitors, explains the nature of the TRL experiment: "One way of bringing energy into the Tokamak machines is through their neutral beams. Surrounding that beam is an insulator that has to hold off the accelerating voltage. Princeton supplied a high-voltage, low-current power supply device that could apply more than 100,000 volts to the insulators."

"We tested the insulators first in a vacuum, then with deuterium, and, finally, with tritium gas to obtain comparisons. To make the tests, we fabricated a specially designed chamber that could maintain a low vacuum and be plugged into the adjoining tritium supply manifold. The entire experiment was located in a high-ventilation hood and glove box to doubly contain the radioactive tritium gas."

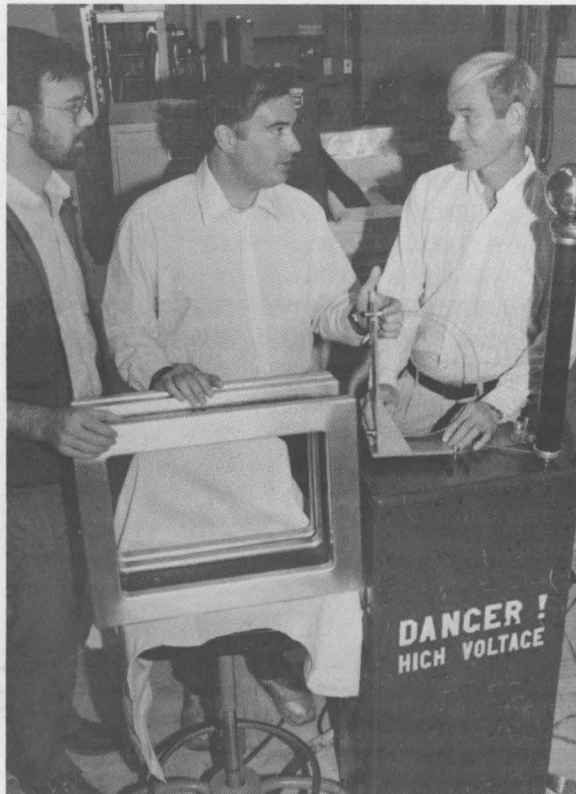
Those working on design and fabrication of the chamber included Wayne Chrisman, Ken Stewart, Art Van Hook (all 8347), Anthony De Sousa (8284-3), Ken St. Hilaire (8284-1), and Robert Arnot (8284). Providing support in the tritium work were Mark Mintz and Keith Kuhlengel (both 8286).

The insulators were tested to their maximum capabilities to be sure they wouldn't fail by high-voltage electrical breakdown (in effect, a short circuit). "Our results indicate no significant difference between insulators subjected to radioactive tritium and those subjected to deuterium," says Rion. "This good news will enable both TFTR and JET to proceed with the planned tritium neutral beams."

According to Larry Grisham, TFTR physicist visiting Sandia, tritium was not part of the original TFTR concept: "Originally, we planned that the beams would be composed only of deuterium. However, our early experiments showed that, if we fired only deuterium beams at the target plasma, we would rapidly come to have just a hot deuterium core. We would have gotten very few reactions. So, purely to maintain the right fuel mixture in the core of the plasma, we decided to make half the beams tritium and half deuterium."

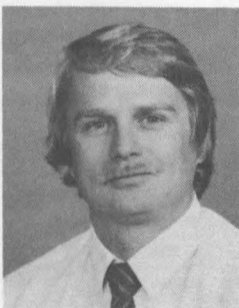
Because the beam lines weren't originally designed for tritium, the experimenters checked out every possible failure mode before actually running the final Tokamak phase with tritium. "We couldn't afford to discover that the insulators would have a problem with tritium when we started the final run of the TFTR — it would be too late to change them," Larry explains.

"We have had wonderful cooperation from the
(Continued on Page Four)



STANDING WITH THE TFTR insulator and high-voltage device are (from left) Tim Stevenson and Larry Grisham from Princeton and Rion Causey (8347).

Supervisory Appointments



CHARLES OIEN to supervisor of Advanced Systems II Division 8436, effective Dec. 16.

Chuck joined Sandia at Livermore in 1977 and first worked in the nondestructive testing group, researching nondestructive evaluation techniques (primarily, those involving radiation). From 1982 until his promotion, he performed Phase I and Phase II studies of concepts and feasibilities for such weapon programs as Navy nuclear depth bombs, earth and ice penetrator programs, and SRAM II.

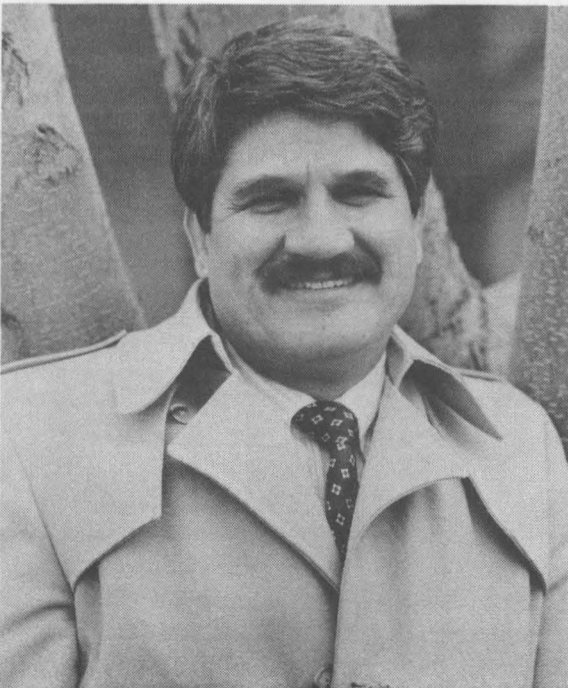
Chuck holds a BS and MS in nuclear engineering from Oregon State University.

He and his wife Carolyn live in Livermore. Chuck is active in the American Society for Non-destructive Testing. His outside activities include sailing, rock climbing, and tennis.

* * *

MICHAEL ROBLES to manager of Management Services and Human Resources Department 8520, effective Jan. 1.

After graduating from the Albuquerque Technical-Vocational Institute in data-processing technology, Mike joined Sandia Albuquerque in June 1969 as a



MIKE ROBLES (8520)

staff assistant, and worked as a programmer/analyst on payroll systems in the Payroll and Personnel Automated Systems Division. He was promoted to operations section supervisor in the Computer Operations Division in 1971.

In 1974, he became a Member of Laboratory Staff and moved to the production control section of the Computer Operations Division. While there, he helped implement new standards, production control policies, and procedures. He also worked in the Personnel Systems Design Division.

In 1980, Mike was promoted to supervisor of the Computer Operations Division; in 1982, he became head of the Office Systems Division. In January 1988, he was named supervisor of the Continuing Technical Education and Training Division.

His education includes a bachelor's degree in business from UNM through Sandia's Educational Aids Program, and a master's in business from the Highlands University branch in Albuquerque.

He and his wife Dolores have four children, two of whom are still at home. The family enjoys outdoor activities centered around their cabin in the mountains near Pecos, N.M.; they also like to travel in their camper. Other interests include jogging and dancing.

Mike, an Albuquerque native, is active in the Continuing Professional Development Division of the American Society of Engineering Education; he also belongs to the National Society for Performance and Instruction chapter in Albuquerque.

Welcome

California

Joanne Lombardi (8271), Pleasanton
William Minaudo (8272), Lathrop
James Berg (8452), Livermore
Gayle Probst (8522), Livermore

Kansas

John Williams (8142)

Maryland

Duane Johnson (8341)

New Jersey

Janine Esock (8522)

New Mexico

William Telfair (8531)

Washington

Alexandra Leo (8514)



Sympathy

To Lee Radosevich (DMTS, 8133) on the death of his mother in Livermore, Oct. 14.

To Craig DeShields (8513) on the death of his father in Belmont, Calif., Nov. 11.

To Tony Chavez (8284) on the death of his wife in San Jose, Nov. 11.

To Don Nissen (8313) on the death of his mother in Portland, Oreg., Nov. 16.

To Fran Rupley on the death of her father in Reno, Dec. 6.

PRESIDENT WELBER welcomed New Mexico's new US Representative Steve Schiff (left) to his first Sandia briefing as a congressman on Dec. 21. Several Labs officials explained Sandia's missions and current activities to Representative Schiff, First Congressional District.



Sympathy

To Joe Laval (3163) on the death of his father-in-law in San Francisco, Dec. 2.

To John Espinoza (5219) on the death of his mother in Las Cruces, Dec. 5.

To Edna Pederson (3321) and Irene Schulte (6330) on the death of their father in Albuquerque, Dec. 24.

To Barbara Saya (6512) on the death of her father in Valley, Nebr., Dec. 26.

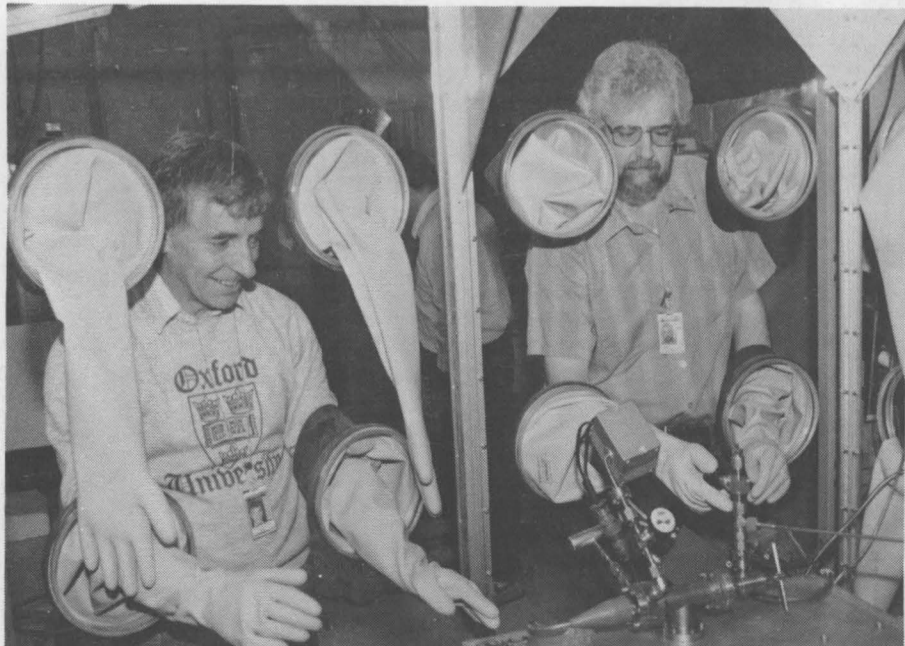
(Continued from Page Three)

Tritium Test

Sandia people here. They have built this chamber especially for these tests, which we couldn't have done at Princeton because we don't have a tritium-handling facility and won't have one until it is time to conduct the final deuterium-tritium phase of the experiment."

Representing JET at Sandia was Hans-Dieter Falter, a West German physicist who has worked on the project since 1980. Hans has been attached to the Neutral Beam Heating division at JET.

Sandia Livermore's MFE research is focused on such studies as tritium-material interactions, as well as on actual diagnostics of the existing fusion devices in England, at Princeton, and at General Atomics in San Diego. There are significant activities in magnetic fusion energy research at Sandia Albuquerque as well (a subject of a future LAB NEWS article). Dept. 6510 is working on the heat flux and engineering issues of plasma-interactive components; Dept. 1110 conducts accelerator-based analyses of materials exposed in the Tokamak to understand how the materials are evolving.



WORKING TOGETHER at the glove box that contains the insulator experiment are Hans-Dieter Falter (left) from JET and Wayne Chrisman (8347).

Congratulations

To Rita Bushmire (9144) and Herb Pitts (3100), married in Albuquerque, Nov. 5.

To Della (2170) Vigil and Charles (9113) Craft, a daughter, Kimberly Marie, Dec. 11.

To Denise and Matthew (2343) Sena, a son, Aaron Matthew, Dec. 19.

To Pat Zeiger (2821) and Jim Tempel (2631), married in Albuquerque, Dec. 28.

To Lan and Tan (5249) Thai, a daughter, Hanna Li, Jan. 2.

Fun & Games

Bowling — The first SANDOE Bowler-of-the-Year Tournament was held Dec. 11 at Holiday Bowl. Only 1987/1988 Bowler-of-the-Month winners were eligible to participate. Bowler-of-the-Year winners are: Scratch — Reggie Tibbetts (7815), 632; and Micki Archuleta, 565. Handicap — Curtis Domme (7811), 595 and 652; and Dora Gunckel (6400), 536 and 644.

* * *

Bird-Watching — Chuck Hundertmark (president, Rio Grande Bird Research, Inc.) will conduct a two-day bird identification class (field trip) on Jan. 28 and 29. The itinerary: Jan. 28 — depart Albuquerque at 7 a.m., hawk-watch on the eastern plains on the way to Roswell, take a quick afternoon tour of Bitter Lakes Refuge in Roswell (the evening is open); Jan. 29 — spend the morning on a more detailed tour of the Refuge, depart in time for a 6 p.m. arrival in Albuquerque. Trip cost is \$40 per person (includes transportation). Lodging has been arranged at the Leisure Inn in Roswell; cost is \$26 (plus tax)/single and \$29 (plus tax)/double, including breakfast at the Inn. For more information and to enroll, contact Stan Ford (SERP) on 4-8486.

* * *

Skiing — SERP has entered a second team in the NM Corporate Ski Cup. Openings are available. Contact Stan Ford (SERP) on 4-8486 for details.

Patch, Patch, Patch



A one-inch patch developed by Sola Research Laboratories, New York, tells people when they've had too much sun. Sold with the company's sunscreen lotions, the patch will adhere to a bathing suit or the skin. It turns red when it absorbs enough rays to cause a sunburn.

Lynn Asinof, Wall Street Journal

Theory of Tokamak

Scientists have been working on fusion possibilities since the '50s. The magnetic fusion device most likely to be able, someday, to create controlled fusion energy is known as a Tokamak (adapted from a Russian acronym meaning "toroidal chamber with magnetic field").

The challenge is to produce electricity through the controlled release of fusion energy. If the concept works, it may provide an inexhaustible source of power sometime in the 21st century.

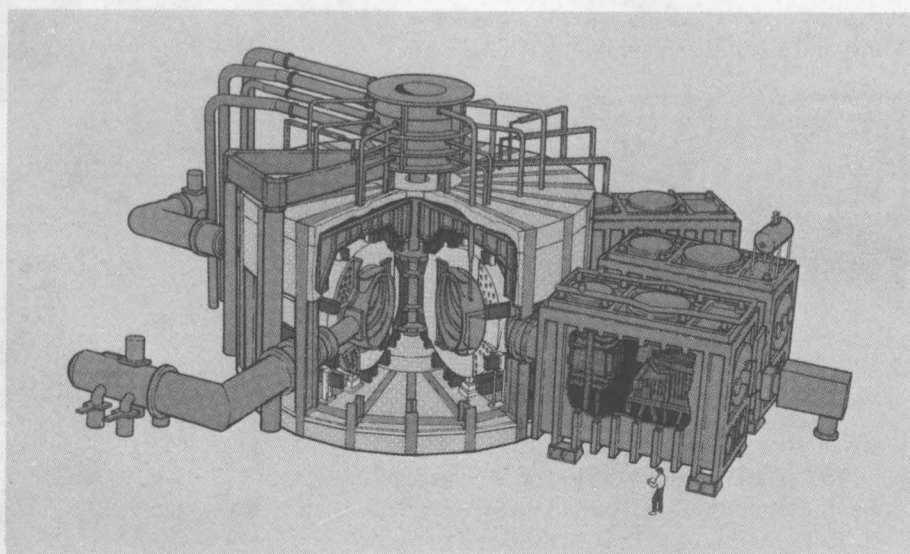
The most promising experiment so far uses deuterium and tritium reactions to create a very hot (millions of Kelvins) plasma inside the doughnut-shaped chamber. The plasma must be surrounded and contained by a specially designed magnetic field, because the extremely high temperatures would melt any solid material used to contain it.

The theory is to introduce a high-powered neutral beam into the device. The beam's deu-

terium and tritium atoms collide with the plasma ions and electrons, greatly increasing their temperatures and creating fusion reactions.

A charged particle beam could not pierce the extremely high magnetic fields inside the Tokamak, so it must be neutralized and made to penetrate by means of the neutral beam injector. The neutral beam is produced by an accelerator that strips the atoms of their electrons and then accelerates them to very high velocities by an applied voltage. The beam is allowed to flow through a gas to pick electrons back up, thus neutralizing it. It's during the acceleration process that the insulators mentioned in the main story serve their function.

Researchers hope eventually to build the power up so more energy is produced by the controlled fusion reaction than it takes to create the reaction — thus becoming a commercial power source.



CUTAWAY DRAWING shows (at right) the room containing the accelerator used to produce the high-powered neutral beams that are shot into the fusion chamber, or Tokamak (left). The insulators tested with tritium isolate the high-voltage beam the accelerator produces until it's inside the fusion chamber. (Figure courtesy of Princeton Plasma Physics Laboratory)

Reimbursable Program Grows Out of Basic Glass Research

Basic research into the mechanism of glass fracture conducted by Terry Michalske (supervisor, 1134) and his colleagues (see main story) has led to a new program, the AT&T Fiber Optics Study. It's a reimbursable program between Sandia and AT&T Bell Labs that exemplifies the type of interaction that can develop between DOE laboratories and US industry.

The long-term strength of glass is a critical issue to the Undersea Systems Laboratory at AT&T, because fiber strength controls the reliability of silica optical fibers used in transoceanic communications networks.

The AT&T Fiber Optics Study will enable

Sandia researchers to test their new model for glass fracture on a commercially important product (optical fibers) and provide AT&T a new method for predicting the useful life of its optical cables.

"The application of Sandia researchers' work to practical problems in industry is exactly the kind of payoff we and DOE's Office of Basic Energy Sciences like to see from basic research," says Fred Vook, Director of Solid State Sciences 1100. "And the experience Sandians gain in understanding the behavior of optical fibers will be valuable as the Labs integrate these fibers into future weapon systems."

(Continued from Page One)

Science Award

the award ceremony, Terry will deliver the Weyl Lecture at the Congress.

Why Glass Fractures

"Surprisingly," says Terry, "glass is intrinsically one of the strongest materials known." Flaw-free glass — under high-vacuum conditions — can withstand stress greater than two million pounds per square inch. But in actual use, glass is exposed to abrasives and chemicals (water is one of the most potent) that create small cracks and flaws on its surface. These flaws not only reduce the immediate strength of the glass, but can also spread through the glass, causing it to fail completely.

Water molecules — which are always present in the atmosphere unless precautions are taken to eliminate them — can enter the tip of a small crack where they react with silicon and oxygen to rupture the silicon-oxygen-silicon bonds that form glass. Once started, the reaction can propagate through the glass unless moisture is removed or stresses on the glass are reduced to an acceptable level. Even a small amount of moisture will reduce the strength of the glass by two-thirds. Other molecules also can weaken glass bonds and cause cracks to grow.

Cracks spread through glass at varying speeds. A fracture can be dramatic, notes Terry, as when an errant baseball crashes through a window. But many failures are preceded by the slow extension of pre-existing cracks. Some can grow during an incubation period and cause a catastrophic failure only when they reach a critical size: "Cracks in glass can grow at speeds of hundreds of metres per second — roughly half the speed of sound in glass — or as slowly as one-trillionth of an inch per hour." Incubation periods can be so brief as to seem instantane-

ous or can span as much as 10 years before the catastrophic failure occurs.

Rate of crack growth depends on the intensity of the stress and amount of water in the environment — water can accelerate the rate of crack growth more than a million times by attacking the structure of the glass at the very root of the crack. "We've always been able to predict the time of failure if we know how fast small surface flaws grow under stress," says Terry, "but current experimental techniques are not capable of measuring the very slow crack speeds." These are the critical measurements needed for predicting the useful lifetime of glass materials — without them, no predictions are possible.

What the Models Do

This is where the models developed by Terry and his colleagues come into their own. Through the

use of model chemical compounds (small clusters of silicon and oxygen atoms) that are tailored to simulate the physical characteristics of atomic bonds located at the tips of cracks, the models make it possible to study the behavior of silicon-oxygen-silicon bonds that form glass — and to predict the times of failures due to the growth of cracks.

Using the models, it is now possible to predict to within an order of magnitude the relative rates of crack growth in glass exposed to water or other chemicals — a considerable improvement over not being able to make any predictions at all. "We're now able to predict which chemicals will make slow cracks grow in glass and at what rates," says Terry.

Since the strength of glass is controlled by the growth of cracks that penetrate the material, knowledge gained from studies of crack propagation can be applied directly to real-world glass products such as fiber-optic cables, ceramic bone replacements, and various optical and electronic components.

Results of the studies also suggest several possibilities for controlling the strength of glass and other brittle materials. "Our discovery of the importance of molecular diffusion near the crack tip," explains Terry, "indicates that surface coatings might be designed to block the opening of the crack and restrict the passage of small molecules, such as water, that can attack the atomic bonds at the tip and chemically weaken glass. This could greatly increase the structural lifetime of glass products."

And Terry thinks the same thing should be true for ceramics: "Our work on crack growth in other solids leads us to believe that the general conclusions developed for glass can explain the strength behavior of a wide range of brittle materials."

Terry joined Sandia in 1981; his work has been funded by DOE's Office of Basic Energy Sciences.

●DR

To Honor Young Scientists

Glass Science Award: History

The Woldemar A. Weyl International Glass Science Award was established in 1976 by the Pennsylvania State University in collaboration with the International Commission on Glass as a memorial to Woldemar A. Weyl, who was Evan Pugh Research Professor in Physical Science and a member of the Penn State faculty from 1938 to his death in 1975. Prof. Weyl was known throughout the international community of glass scientists as an imaginative and innovative scholar and teacher, whose pioneering studies of colored glass formed the basis of later research into the constitution of glass.

Presented only once every three years, the award honors outstanding young scientists in the

field of glass science and provides the opportunity for them to present a special paper at one of the International Congresses on Glass.

Recipients are nominated by their colleagues, supervisors, or other appropriate persons, and final selection is made by a special committee appointed by the US delegates to the International Commission on Glass.

Terry Michalske (1134) is the first Sandian and the third American to receive the award (see main story). Previous award recipients: Peter Schults, Corning Glass Works, US (1977); Denis Ravaine, University of Grenoble, France (1980); Bruno Smets, Phillips, The Netherlands (1983); and George Scherrer, duPont, US (1986).



SECOND BEST IN THE COUNTRY — And Chris Isengard of Career Services for the Handicapped (left) is all smiles as he displays the plaque awarded for that designation. Career Services finished second in recent nationwide competition to identify the US's best vocational programs for people with disabilities. Looking on are (from left) Dennis Roth (V-P 3000), Mary Modrow (director of contract services at Career Services), and Ralph Bonner (3500). As Career Services' largest customer, Sandia will receive a copy of the plaque for display in Personnel Dept. 3530.

(Continued from Page One)

TESS

cess? In other words, what were the tactical strengths and weaknesses displayed during this deadly serious "game"?

TESS, like its predecessor, MILES (Multiple Integrated Laser Engagement System), consists of a blank-round-activated, eye-safe, laser transmitter attached to the weapon barrel — and a player-worn detector vest that responds to the laser beam. The laser transmitter, whose beam with its 1500 digital bits of information substitutes for a bullet, is activated with a combination of shock (from the blank round going off) and the muzzle flash's infrared signature.

Twenty-two vest detectors, strategically placed in a T-arrangement front and back, indicate whether or not a laser beam is on target; near-misses provoke a short series of beeps, while "kills" result in a continuous beeping sound and a flashing red light on top of the "victim's" head gear.

Not the 'Son of MILES'

"I've heard TESS called 'the son of MILES,'" says Matt Roach (5215), who has overall design and production responsibility for the TESS transmitter and detector-receiver systems. "But that's not really accurate. Though the two systems have a few things in common, they're very different in many respects."

MILES, developed by Xerox for the Army in the '70s, was designed for basic-training exercises lasting two or three days and involving 200 to 300 people.

"It serves its intended purpose very well," Matt says. "But MILES — even the version that Sandia modified for DOE courier training in the late '70s — doesn't fill the need for a system, adaptable to a variety of NATO security-force weapons, that can be used in fast-moving, counter-terrorist training exercises limited to just a few players.

"Current US Army MILES transmitters can't be used on the wide variety of small arms — pistols and certain types of machine guns — used by NATO nuclear-security forces," Matt continues. "TESS designs, on the other hand, can be mounted on all NATO weapons currently used in defense of nuclear sites."

"Laser-beam power of TESS transmitters varies, depending on the maximum effective weapon range," adds Mark Bishop (5215), who's had responsibility for TESS optics design and system field testing. "Therefore, though the transmitters are uniform in size, they're tailored to specific weapons."

TESS equipment is generally smaller and lighter than that of MILES. The TESS transmitter — slightly larger than a pack of king-size cigarettes — is about half the size of the MILES transmitter and weighs 24 ounces.

Another drawback of MILES (for use in counter-terrorist training) is its detector vest. The arrangement of its 12 detectors — 4 each on front, back, and head — makes it impossible to record center-of-mass "hits": those landing in the middle of the chest or back, which, in a real-bullet situation, would most

Taking Care of a Major Pitfall

Besides TESS's improved data-collection capabilities during counter-terrorist exercises (see main story), it takes care of a major pitfall of MILES — the older system's susceptibility to electromagnetic interference (EMI).

The '70s-vintage Army MILES can't be used around a radio transmitter of any kind; even 1-watt hand-held radios used by security and safety people on the scene upset the system.

When MILES was originally developed, it was assumed that because the system was digital, it would not be affected by EMI. The first large-scale MILES training exercise in 1979 proved how wrong assumptions can be: As tactical forces (after hours of maneuvering in the dark) approached a Hawk missile site, the site's radar system swept a radar beam across the oncoming troops — "killing" them all as a result of EMI produced by the radar transmitter.

"Making the TESS system EMI-resistant, as well as rugged and reliable, has been our goal," says Eloy Cota (5215), whose job is system fabrication. "The original MILES system would not stand up to more than two volts per metre of EMI. TESS equipment — following a multiyear analysis of EMI problems and some technical adjustments — will operate under much harsher EMI conditions: 100+ volts per metre, from a few kilohertz into the gigahertz range."

Tom Teague (2858), who has been responsible for drafting and detailed-design work (including EMI solutions) on TESS equipment, says the ultimate aim of the TESS program is to develop and field "an affordable, first-class system that's adaptable to the variety of weapons used by NATO security forces. And we're well along the road toward that goal."



JIM KAISER (left) and Jeff Johnson (both 3435) provide a close-up look at the front and back of the TESS detector vest. The vest's detectors, strategically placed in a T-arrangement, accurately record close-in "kills" during counter-terrorist training exercises. Small rectangular packages near the barrel end of Jim's M-60 and Jeff's M-16 are TESS laser transmitters.

certainly result in severe injury or death.

In contrast, the TESS vest, with its 22 detectors, provides better detector coverage on the side and back — and center-of-mass detectors in front to more accurately record close-in "kills."

The TESS vest's microprocessors also provide a number of new capabilities not previously available with MILES, according to Arlen Weishuhn and Paul Wayne (both 5215), who are responsible for microprocessor design and system software. A big MILES disadvantage is that exercise participants can continue to fire away, even though they take a "kill"

hit — certainly not the realistic scenario that DoD requires for counter-terrorist training. But a TESS RF (radio-frequency) alive-enable subsystem permits the vest's wearer to continue firing laser beams only if the vest has not been "killed." This feature also allows a "still-alive" player who has lost his/her weapon to pick up another and continue to fire — as in a real battle.

Reconstructing what happened during the exercise — valuable information for trainers — is not always possible with MILES. "MILES exercise evaluations are pretty much based on after-the-fact interviews with the players," says Paul. "You don't always get an accurate picture, because it's a highly competitive atmosphere; you hear statements afterward like 'I couldn't have been killed first — I shot him before he shot me.'"

TESS solves that problem, because vest microprocessors record and retain details of the last seven exercise events. Data retained include vest ID, which weapon was used to "shoot" a victim, whether the event was a kill or near-miss, the time, and whether the player shot was upright or prone.

'Smart' Hand Controller

After a TESS exercise, evaluators use a "smart" hand controller containing a small computer to extract the retained events from each vest. "The system doesn't let you get away with a thing," says Orville Howard (5215), who ran Sandia's MILES laser-training facility in the early '80s. Data collected by the hand controller are swiftly available — either in a hard-copy printout or on a small monitor that's part of the controller. The hand controller is then used to clear (reset) the vest for the next exercise.

Fabrication of the first 20 TESS prototypes, begun last June, was completed about Oct. 1. A week or so later, President Reagan and the National Security Council received a TESS briefing and demonstration — using two of the prototypes — at the White House. (Arlen Weishuhn assisted in the presentation outline and helped set up the equipment before the briefing.)

That same week, the remaining prototypes were used for a full-scale, force-on-force demonstration of the system at Ramstein Air Base (West Germany). The demonstration, a mock attack by aggressors on a storage bunker, was held in conjunction with the annual conference of the Joint Theater Surety Management Group; the exercise was observed by high-ranking military officers from all the NATO nuclear nations. Weapons provided by the Netherlands were included, to establish that TESS equipment will operate with light weapons used by NATO security forces.

On to Phase II

With Phase I (development of transmitters, player-worn systems, and mounts for NATO weapons) almost complete, the TESS program moves on to its second task: developing transmitters to simulate other weapons such as hand grenades. Phase II

(Continued on Next Page)

PRESIDENT REAGAN (left) and members of the National Security Council received a TESS briefing and demonstration last fall.



also includes developing sensors for vehicles and guard towers.

Phase III will involve developing miniature RF transceivers to transfer real-time data from the players to a central field processor housed in a suitcase. This Phase-III system will permit full analysis of tactical play in seconds instead of hours.

Div. 5215 supervisor Larry Stotts, who's been involved with laser simulation engagement programs since Sandia's original modification work on MILES, says, "TESS should bring a new sense of realism to nuclear-security exercises and will provide an accurate review afterward.

"We envision other TESS applications, as

well," adds Larry. "The system could also be useful for training Secret Service and State Department people responsible for VIP protection, FBI hostage-recovery teams, DoD special-operations people — or any group that must react quickly in an emergency." ●PW

'Tens of Thousands of Participants'

In on the Program From the Beginning

A long-time contributor to Sandia's safeguards and security programs — including MILES and TESS — is hanging up his S&S hat. After 30+ years at the Labs, Bob Wilde, manager of Safeguards and Security Services Dept. 3430, plans to retire at the end of January.

"Maybe we don't call TESS the 'son of MILES,' " says Larry Stotts (5215), "but you might call Bob the *father* of MILES — at least the Sandia version. He's been associated with the program as long as anyone has."

Bob joined the Nuclear Security Systems 5200 Directorate in 1975, shortly after the organization was established. His Security Forces Experimentation and Evaluation (SFEE) Division had responsibility for coming up with a total system for DOE that would ensure the safe transportation of nuclear material.

You Can't Model Attitude

"We investigated all aspects — vehicles, communications systems, courier readiness in an emergency, and so on," says Bob. "We tried to develop a computer model to analyze the security effectiveness of couriers. But we discovered you can't predict the behavior of people with a model; there are just too many variables — combat experience, physical fitness, attitude (try modeling *that!*), equipment.

"A parallel example is trying to model what's going to happen on a pro football field on any given Sunday. We have a wealth of statistical data on today's pro players and teams, but we still don't have a computer model that can tell a team what play to run next."

While Bob and his staff were searching for an answer to what he calls "the misunderstood

part of the equation," two division members — Bill Caskey (now 5267) and Jim Kaiser (now 3431 supervisor) — noticed a 1977 *Albuquerque Journal* article on the new Army MILES (Multiple Integrated Laser Engagement System) then under development by Xerox.

After a detailed investigation of the system, Sandia — with the Army's blessing — purchased the first 12 units off the production line and began working with DOE couriers to study its small-force training exercise capabilities.

Working Out the Kinks

"We had some kinks to work out," recalls Bob. "For instance, head sensors on original MILES equipment were mounted on helmets; since couriers didn't wear helmets, we came up with a change that put the sensors on a headband or on a cap. Also, we partially radiation-hardened the system and came up with a remote reset capability to improve training-exercise efficiency."

"I joined Bob's division in 1979," says Larry. "As I look back, I think you had to be certifiably crazy to join the project in its early days. Most engineering teams wait for good weather to conduct experiments and take data; in comparison, the MILES team — wearing night-vision goggles — spent many dark hours lying in the snow out in Madera Canyon to get data from a simulated terrorist attack on a DOE weapon convoy."

The division effort led to the establishment of a DOE-wide application of the SFEE concept and to an improved approach to securing weapon facilities in Europe. Working with the European Nuclear Security Command in 1983,

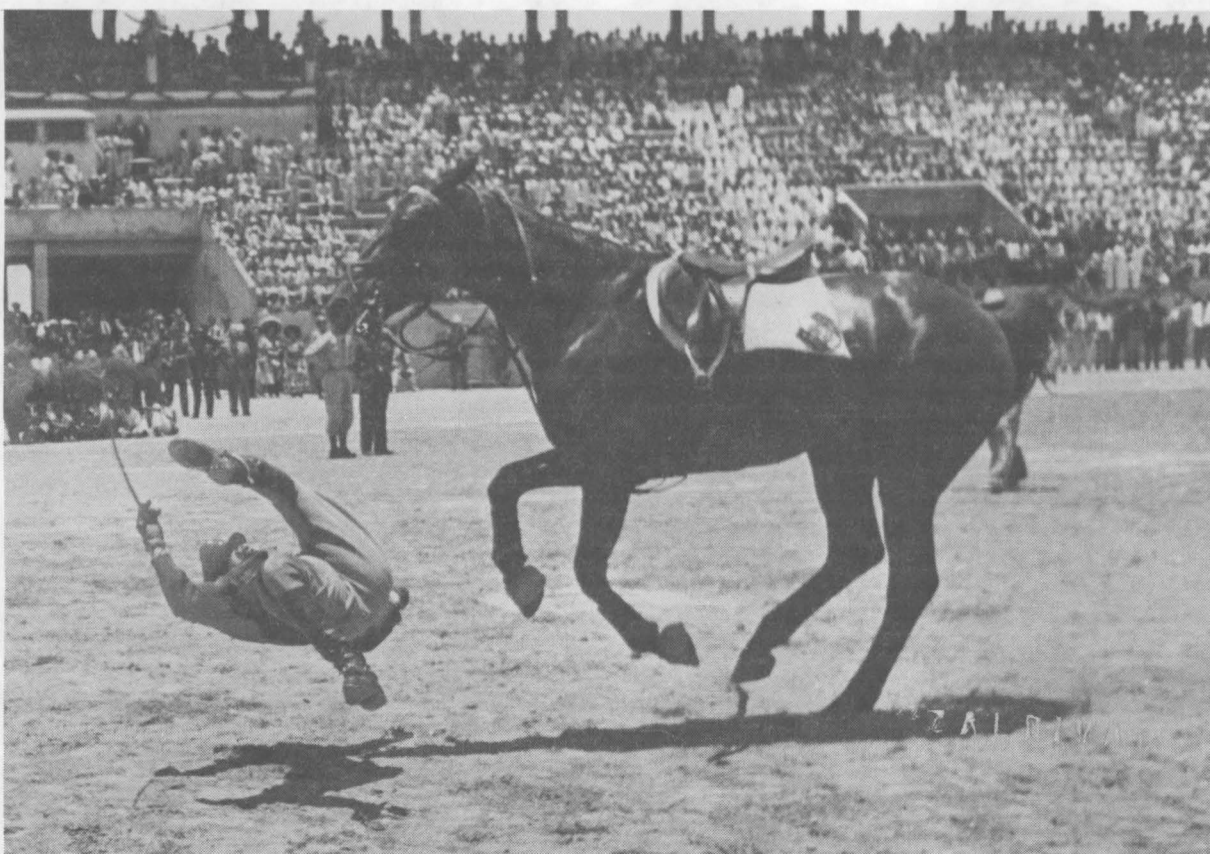


BOB WILDE (3430), who's been dubbed the "father of MILES," will retire Jan. 31 after more than 30 years of service.

Bob's division set up a three-month series of security tests involving NATO people at sites all over Europe. The participants' enthusiasm encouraged Sandia to begin work on the next-generation laser engagement system (TESS), which would improve the deficiencies of the original MILES equipment (see main story).

"The SFEE program has enabled realistic and safe simulation exercises for tens of thousands of participants," says Bob. "I'm very proud of that."

Favorite Old Photo



This photo shows Gen. Humberto Mariles of Mexico, the 1948 Olympic gold medal winner in the equestrian stadium jumping event — his team also won the gold medal. I first met Gen. Mariles in 1951 in Indiantown Gap, Pa., where his team was preparing for the 1952 Olympics and I was serving, for a time, as a groom for the first US civilian equestrian Olympic team. He was once known as "the world's finest horseman," but this photo, taken at the 1955 Pan-American Games in Mexico City, catches him at one of his less glorious moments — I don't think it would have been *his* favorite photo. In 1956, at his invitation, I spent almost a year training with his team in the Mexican method of jumping and sometimes riding out on exercises with him and the Mexican cavalry. I last saw him at the 1960 Olympics in Rome — he was a civilian then and attending the games only as a spectator. He said he "missed the glory" of his cavalry days and of participating in the games. General Mariles died in 1972. — Keith Creveling (ret.)

“Sandians Supporting Albuquerque Arts”: Sample Four Performances at Bargain Rates

If you want a treat for yourself and your family, or if you want to give a special gift, “Sandians Supporting Albuquerque Arts” has just the ticket — literally.

Call it S²A² for short. It’s a new program offering Sandians a chance for themselves and their families or guests to attend, at substantially reduced prices, four performing-arts events during 1989.

The events are one performance each by the New Mexico Symphony Orchestra (NMSO), the New Mexico Repertory Theatre, the Albuquerque Civic Light Opera Association, and the Southwest Ballet Company.

In the next few days, active and retired Sandians will receive membership information. Each membership, costing \$50, includes four tickets, one for each performance in the series. In addition, S²A² will present a noontime introduction in the TTC a few days before each performance, to help Sandians understand and enjoy what they’ll be seeing and hearing on stage.

Why is Sandia inaugurating S²A²? Herb Pitts, Director of Information and Communication Services 3100, explains: “S²A² demonstrates our support of the arts community and encourages Sandians to sample what’s available. We hope that increased exposure to the arts will lead to increased participation by our employees.”

To kick off S²A², the brass quintet of the NMSO, hosted by Irwin Welber, will present a concert in the TTC at noon on Tuesday, Jan. 24. The first of the regular noontime previews will be given March 7 by Neal Stulberg, Music Director of the NMSO. He will be hosted by Executive VP Orval Jones (who in his rare spare time is building a harpsichord).

The Best of Albuquerque

Karen Shane of Community Relations Div. 3163 coordinated development of S²A². Karen points out that while S²A² will benefit the arts by encouraging broader participation, the immediate benefit to Sandians is an opportunity to sample “the best of what’s going on in Albuquerque” at a bargain price.

Karen surveyed a number of Sandians before S²A² took its final form. Among them were Jim Rice (1270), who says, “I definitely thought it was a good idea to encourage the arts, and I’m particularly glad to see this kind of thing at Sandia. It will be interesting to have an expert come in ahead of time and explain what’s going on in the performance — espe-



SITTING IN at the harpsichord during an NMSO rehearsal is Dan Hartley, V-P of Energy Programs 6000.

cially in something like ballet.” (The ballet, by the way, will be “The Nutcracker,” which traditionally begins Albuquerque’s holiday season.)

Getting a Boost

Gary Shepherd (2614) calls S²A² “a wonderful thing for the Sandia community.” Gary regularly attends performances of three of the four organizations included in the 1989 series. Says Gary, “S²A² will introduce Sandians to a variety of things inexpensively. Over the last 15 years, the arts in Albuquerque have advanced substantially. It’s not a one-horse town.”

Other employees agree.

“It sounds like a fantastic program,” says Gila Caton (122).

“S²A² is important for people who just haven’t gotten jogged into doing anything about the opportunities in this city,” says Phil Thacher (DMTS, 7241). “It gives you a boost toward finding out what goes on in the Albuquerque arts.”

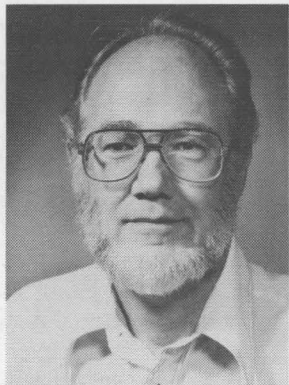
“It’s a good introduction to the arts in Albuquerque,” agrees David Judd (2645).

S²A² is planned as a continuing program. If you sample the 1989 events, you can do it again next year and get a taste of different performances in a new series.

But 1990 is still a long way off. For now, Karen wants you to know that the quicker you send her your check for 1989, the better your seats will be. So watch for the information you’ll soon get, including a reply card you can use to request your membership.

Illustrating the arts’ need for support are recent news reports of the Southwest Ballet Company’s financial problems. But what if an organization cannot present a performance that S²A² has promised? In that case, ticket-holders won’t be losers — S²A² will substitute a comparable performance by a different organization.

Retiring



Charles Clark (7223) 38



Stephen Chemistruck (2564) 37



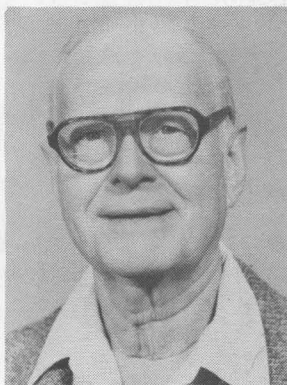
Bob Dawirs (9112) 37



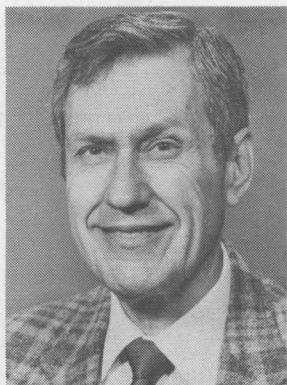
Jack Reed (7111) 40



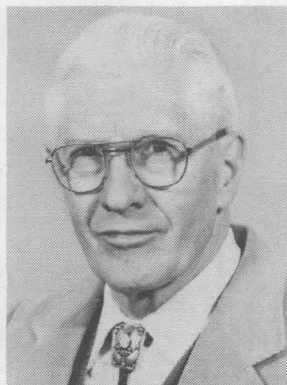
Bob Christopher (5154) 36



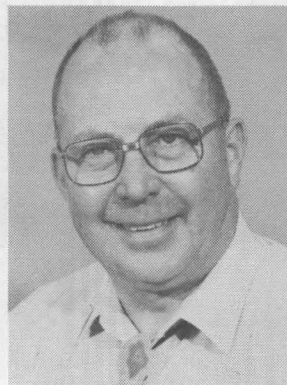
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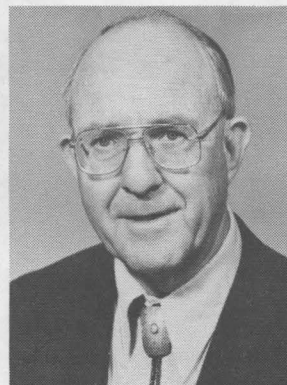
Everett Ard (7254) 38



Fred Stixrud (9234) 32



John Risse (5213) 32



Dale Young (2631) 36

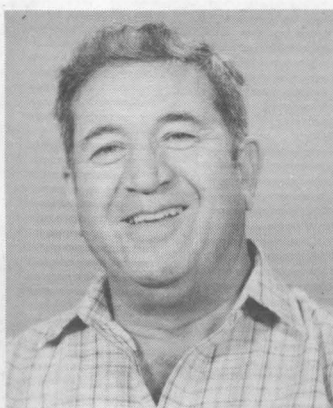


Claire Smith (7482) 20

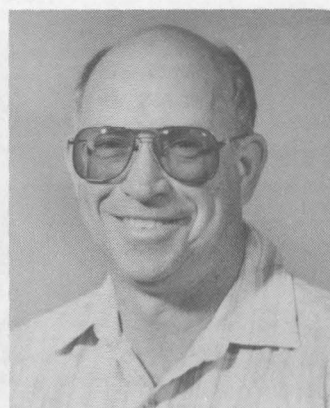
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LAB NEWS

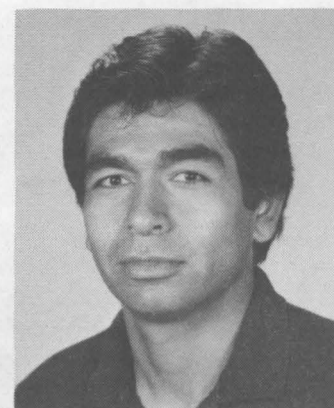
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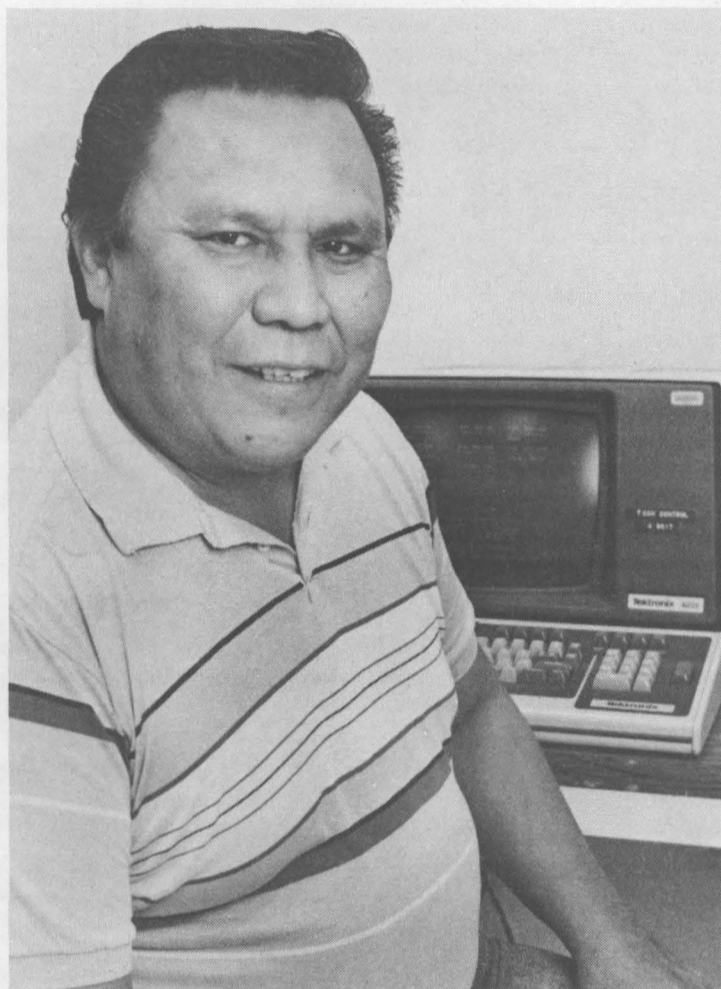
Jose Jaramillo (7482) 15



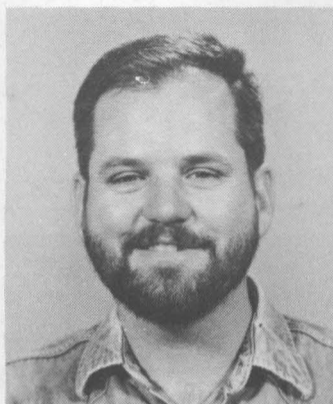
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Adam Sandoval (8284) 15



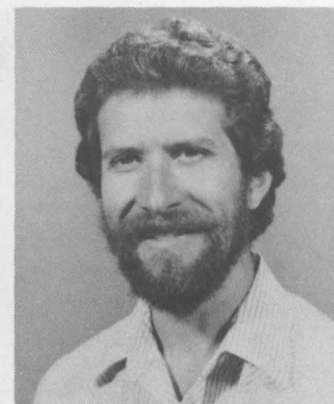
Herman Yazza (3424) 15



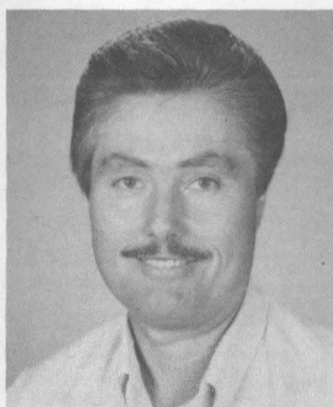
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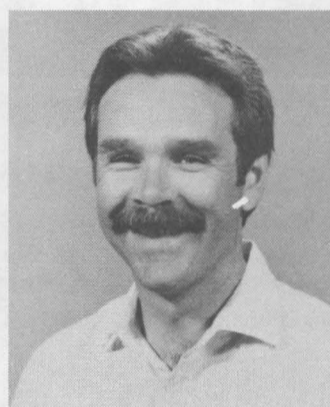
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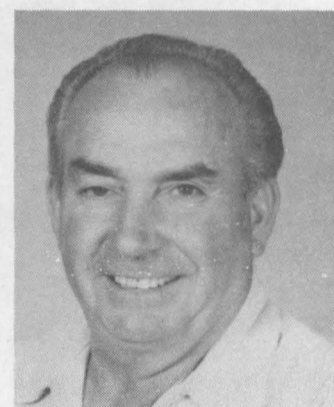
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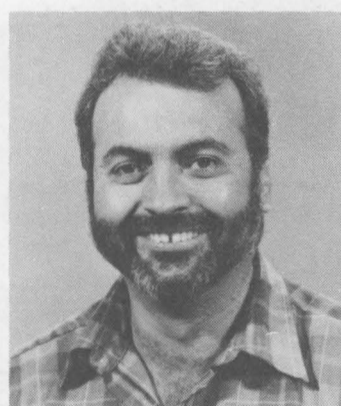
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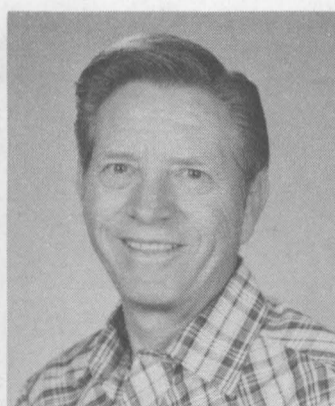
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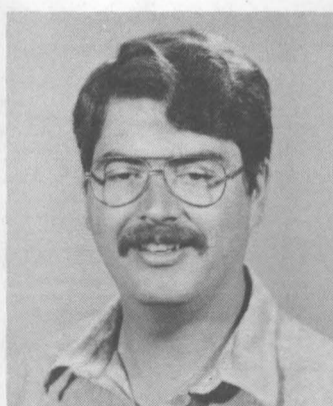
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Dan Baca (7813) 15



Al Harrison (8513) 30



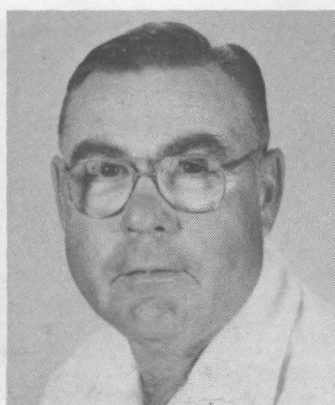
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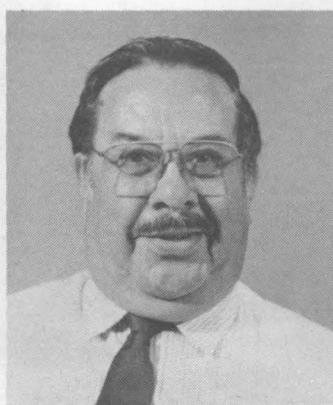
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Cliff Mendel (DMTS, 1253) 20



Don Gallagher (8532) 30



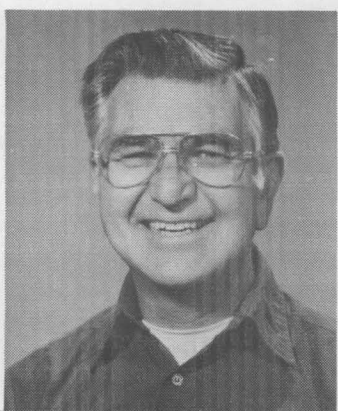
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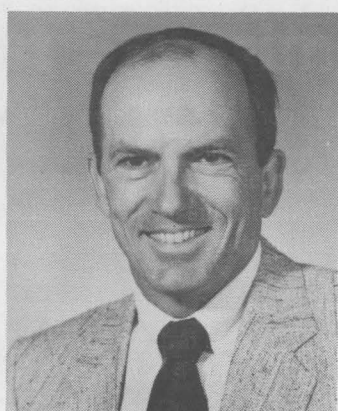
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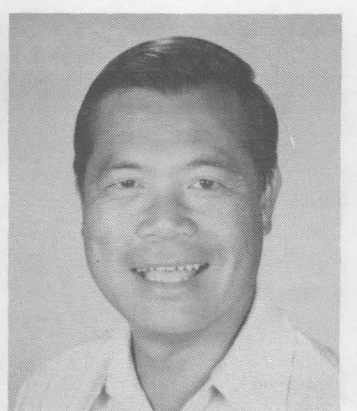
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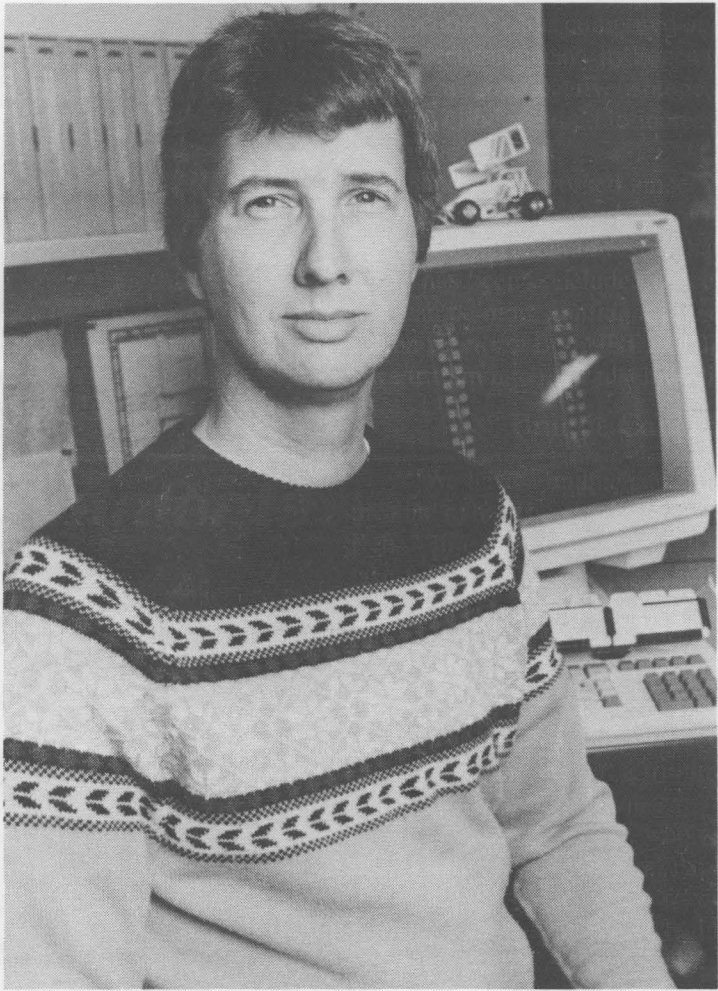
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Dan Hartley (6000) 20



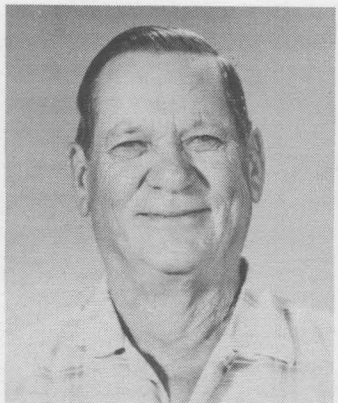
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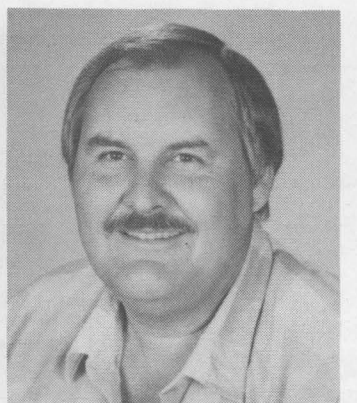
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Judy Hafner (8522) 25



Billy McConnell (7812) 40



Albert James (8532) 20



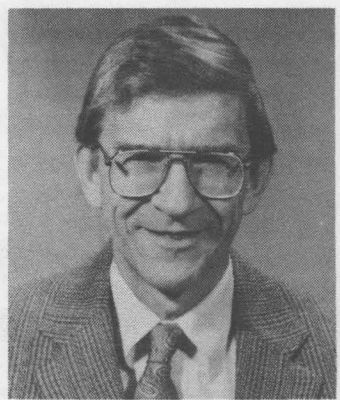
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Tom Bozone (7262) 35



Masako Williams (2631) 15



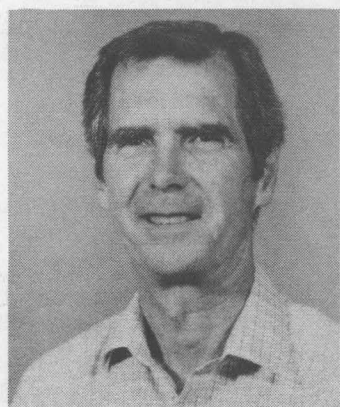
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Nick Magnani (2520) 20



Hazel Willyard (8535) 25



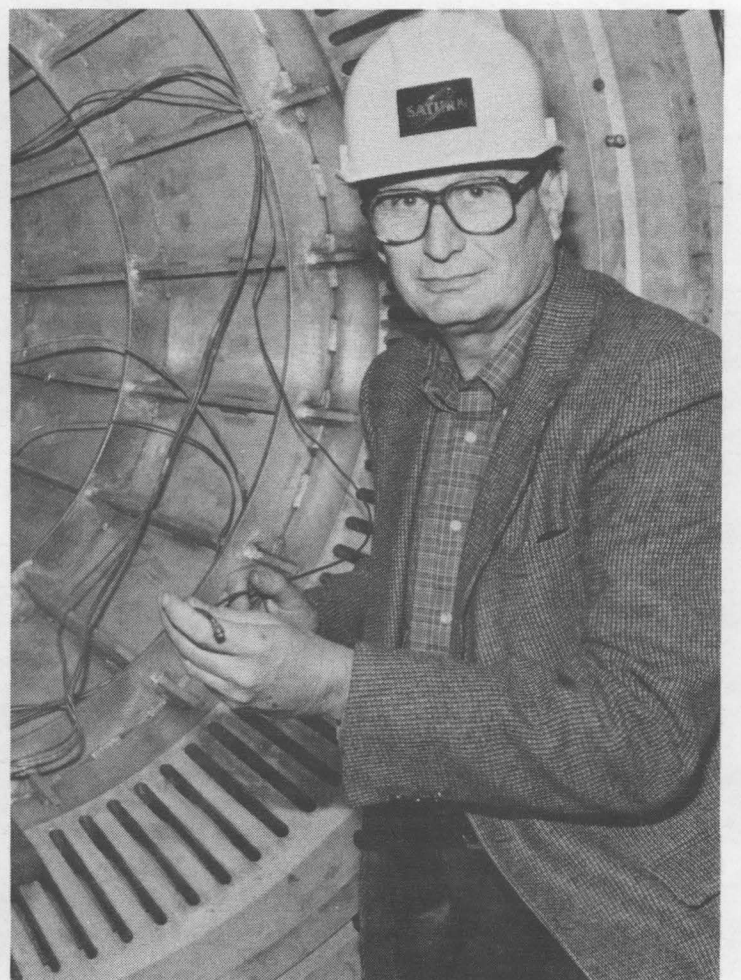
Charles Spencer (2561) 30



Howard Arris (7472) 15



Jim Wolcott (7213) 15



Allan Fine (3316) 35

How's Your Self-Esteem? Our #1 Mental Health Goal for 1989 +

By Arlene Price (3330)



Last year I introduced you to the idea of the importance of having a healthy level of self-esteem. I suggested that those who've got it seem to handle life's challenges a lot more effectively than those who don't. And those who've got it seem to set a lot higher goals for themselves than those who don't.

So what is it? Is it "conceit" and having a "big head"? Does it mean showing off and constantly telling everyone what a great person you are? Does it mean caring only about yourself at the expense of others?

No, it's not. But, I confess, self-esteem is not easy to define. Lots of people have tried, however, so let's take a look at some of the definitions.

Self-esteem is the way in which you evaluate yourself and your accomplishments. It has to do with how much respect you have for your achievements, especially in the eyes of those who are important to you (parents, teachers, professors, bosses, spouses, children, and whomever else you respect).

It's also been described as a condition that comes about when you see yourself as making sense. But the most famous definition is that it's the difference between your real self and your ideal self. In other words, you set certain standards for yourself that you try to live up to and that you strive for. And how you feel about yourself depends upon whether or not you believe you meet these ideals. The dis-

crepancy between your real and ideal self determines the degree to which you feel positive about yourself.

Throughout the ages, there has been a lot of debate about how much people should care about themselves. During some periods in history, people were taught not to love themselves but to sacrifice themselves for the good of others. The handsome Greek god Narcissus was said to have fallen in love with his own image when he saw it reflected in a pool of water. His type of love was considered to be immature, selfish, and self-centered; he was considered incapable of loving anyone but himself.

But in modern times, we've learned that many emotional ills involve low levels of self-esteem. Today, from the point of view of good mental health, we've learned that a significant degree of self-love is a necessity.

Where does self-esteem come from? Self-esteem develops through the accumulated social contacts and experiences you have with significant people in your life. Think of it as "learning about the self from the mirror of other people."

Although later experiences are certainly important in making you the kind of person you are, the formative years (including infancy) are the most important period of development. When you were a child, one of the main sources of unhappiness was to be belittled or ridiculed. It created feelings of pain and anxiety.

Over time, you learn that you experience similar pain and anxiety when you expect someone important to you to reject or criticize you. As a result, your ability to minimize loss of self-esteem and to

be able to maintain it at acceptable levels becomes vital to your sense of well-being. This is, of course, true for high- or low-self-esteem people, but for those with low self-esteem, it's tougher to accomplish.

That's why cultivating a healthy level of self-esteem is so important — it helps you gain confidence in your ability to achieve your goals, and it helps you feel good about yourself!

TLC Presentation

'Parenting Strategies: Truth or Fiction?'

To greet the new year, Medical's TLC Program is sponsoring a presentation by clinical psychologist Joseph Cardillo, who specializes in problems of children. His topic will be "Parenting Strategies: Truth or Fiction?" It deals with how to recognize unhealthy parenting attitudes and realistic (and unrealistic) expectations parents have of themselves.

"Sometimes parents worry way too much about their parenting skills," says Sandia's clinical psychologist, Arlene Price (3330). "They also tend to expect much too much of themselves. You and your spouse are welcome to join us to help you increase your self-esteem as parents!"

The talk is on Wednesday, Jan. 18, from noon to 12:45 p.m. in the Technology Transfer Center.

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

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3. Submit each ad in writing. No phone-ins.
4. Use 8 1/2 by 11-inch paper.
5. Use separate sheet for each ad category.
6. Type or print ads legibly; use only accepted abbreviations.
7. One ad per category per issue.
8. No more than two insertions of same "for sale" or "wanted" item.
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10. No commercial ads.
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12. Housing listed for sale is available for occupancy without regard to race, creed, color, or national origin.

MISCELLANEOUS

- KING-SIZE WATER BED, \$50; rattan couch, white & beige, \$75. Gregory, 897-0607.
- HOUSEHOLD SCRUBBER, electric, rotating, wet or dry brushes, rechargeable wall mount, Black & Decker, cost \$35, sell for \$15. Barr, 821-5870.
- MATTRESS, box spring, bed frame, \$50; bookcase, 4' x 4', \$25; bureau, 3-drawer, \$25; machinist toolbox, \$25. Rhoads, 298-6157.
- DOOR AND FRAME, 32" x 80", wood w/double glass panel, \$20; bathroom windows, 2' x 2', double glass, bronze frame, \$10/ea. Davie, 296-3950.
- COUCH, 2 cushions, white w/black wood trim, \$150. Marder, 291-8140.
- YAMAHA KEYBOARD, PSR-32, 61-key, 32 voices, 80 rhythms, PCM & stereo output, drummer, keyboard split, \$350. Pelzman, 828-1868 leave message.
- REFRIGERATOR, top freezer, Sears Coldspot, 19 cu. ft., harvest gold, \$125; truck rims, white spokes, fits

- 8-hole Chev. 10.25" x 16.5", 4 for \$75. Cotter, 897-1470.
- IBM PC/XT, 10MHz, 512K, clone, 360K floppy, 10mb hard disk, \$550; w/color monitor, \$700; Kawai K3 synthesizer, \$350. Kubas, 298-1557.
- KISO SUZUKI VIOLIN, 1/8-size, w/case, \$100. Akins, 867-3967.
- SLIDING WINDOWS, one 6' x 4', one 4' x 4', w/storm windows, \$45 OBO; refrigerated window AC, \$40. Peabody, 296-6239.
- GAS SNIFFER, continuously monitors carbon monoxide, natural gas, propane from wood stove or furnace, sounds alarm, \$20. Lagasse, 293-0385.
- COMMODORE 64 COMPUTER, printer, disk drive, Datasette, software, books, joy stick, \$330/all. Bear, 881-7128.
- SEAGATE HARD DRIVE for Tandy 1000, 20MB, w/Western Digital controller, 3 months old, \$250 OBO. Harris, 892-6281.
- WALTHER PP-32, trade OBO; B&D radial arm saw; Lyman reloading setup; Realistic remote VCR; Craftsman shop vacuum. Tolman, 266-6995.
- SCHWINN EXERCISE BIKE, speedometer, timer, spin wheel, \$200 OBO. Higgin, 296-7898 after 5:30.
- SOLID-STATE STEREO, Montgomery Ward Airline, made in Great Britain; Lawnplay croquet game. Wagner, 823-9323.
- CORVETTE PROTECTION: '84 and later, nose bra, dash protector, seat covers, car cover. Senglaub, 1-832-6371.
- SWIVEL ROCKING CHAIR, gold, \$50; assorted children's board games. Bonahoom, 296-4450.
- DINETTE SET, wood-grain table w/leaf and 4 chairs. Rodacy, 293-2668.
- DINING-ROOM FURNITURE: 42" x 66" oak table, 6 chairs, matching china hutch, \$1050; Simmons hide-a-bed, \$200; wingback chair, \$200. Connor, 293-7608.
- SIBERIAN HUSKIES, 2 months old, AKC-registered, parents on premises, white/black female, \$150, rare white male, \$200. Atkins, 260-1344.
- VITAMASTER EXERCISE CYCLE, w/speedometer and odometer, cost \$300, sell for \$150. Kaiser, 898-8439.

- BASKETBALL BACKBOARD and hoop, official size, \$20. Meyer-Hagen, 293-7339.
- STUDENT'S MUSICAL INSTRUMENTS: Armstrong flute, \$125; Yamaha clarinet, \$100. Bruniske, 897-4721.
- FULL-SIZE CELLO, new strings, w/case & bow, \$400; full-size cello case, \$30. Trellue, 292-7369.
- REFRIGERATOR/FREEZER, 12.3 and 3.9 cu. ft., Sears, avocado, \$125. Auerbach, 296-1489.
- WHEELS AND HUBS for '88 Chev. S-10, new; new rear window for S-10 and '87 Ford Ranger; new tire; 3 hanging lamps w/chain; Baldwin walnut piano. Freshour, 256-9168 after 5.
- DINING-ROOM TABLE, \$100 OBO; 4 wooden chairs, \$50 OBO. McCornack, 296-3936.
- BUNK BED, 2 bottom storage drawers, innerspring mattresses, \$75. Pucket, 298-6067.
- KITCHEN TABLE, butcher block, 48" round, w/2 extensions, 4 swivel chairs; imitation leather chair and ottoman. Valerio, 884-5400.
- QUEEN-SIZE WATER BED, converts to couch and work table, \$150; antique library desk, \$100. Hansche, 281-5623.
- UPRIGHT FREEZER, 16 cu. ft., Kelvinator, white, \$125. Cotter, 897-1470.
- SLALOM BOARD, 9'2", Westwind, single/double concave, 23" wide, 13" tail, woodies, double-insert footstraps w/pads, fin. Ritchey, 298-4311.
- CHILDREN'S SWING SET: 2 swings, glider, slide, etc., needs seats, you dismantle, \$25. Goetsch, 892-8366.
- COLOR PORTABLE TV, 25", w/entertainment center (oaks solids & veneers), 55" x 36" x 21", shelves for VCR+, \$300/both. Williams, 265-7960.
- GLASS-TOP TABLE and chairs, 36" x 60", \$125; '74 Ford Maverick owner's manual; truck rims; '60 1/2-ton Ford for parts, \$35; electric dipstick heater, \$3.50. Padilla, 877-2116.

TRANSPORTATION

ADULT-SIZE TRICYCLE, w/baskets on

- front and back, \$60. Gregory, 897-0607.
- '85 GMC CABALLERO, w/shell, 18.5K miles, \$7500. Palmer, 294-7656.
- '86 YAMAHA TRIALS/TRAIL MOTORCYCLE, took 2nd place state expert 1988, \$1200. Pryor, 884-3013 until 5 or 294-6980.
- '77 OLDS. 88, 2-dr., V-8, AC, AT, PS, cruise, AM/FM, 54K miles, one owner, \$1050. Flesner, 265-2136.
- '68 TRIUMPH SPITFIRE, 55K miles, hardtop, wire wheels, car cover, more, \$3000 OBO. Anderson, 281-5086.
- '75 FORD BRONCO, price negotiable. Reif, 299-2665.
- '78 JEEP CJ-7, 3-spd., 4-WD, 302 V-8, PB, PS, 2 tops, AM/FM cassette, \$3300. Potter, 299-6053.
- '79 PORSCHE 924, red, 5-spd., AC, sunroof, Australian sheepskin seat covers, \$7000 OBO. Jacobs, 275-8335 after 5.
- VENTURE SAILBOAT, 24', sleeps 4, boat, motor, and trailer, \$6500. Jakubczak, 892-6322.
- '84 BUICK REGAL, T-type, sunroof, PS, PB, AT, AM/FM cassette, leather seats, all options, \$5950. Bonahoom, 296-4450.
- 15-SPD. TOURING BICYCLE, Austrian Steyr-Daimler Puch, used 3 times, cost \$600, sell for \$400. Johnson, 898-8439.
- WOMAN'S 10-SPD. BICYCLE, Schwinn Varsity, \$95. Bruniske, 897-4721.
- '85 CORVETTE, 6.9K miles, black on graphite interior, loaded, \$20,500. Scott, 243-2393.
- '68 DODGE 4x4 DUMP TRUCK, \$2500; '70 Plymouth Barracuda, 6-cyl., AT, \$1500; '86 Kawasaki ZL-600, \$2200. Apodaca, 299-8515.
- '84 MAZDA RX-7 GSL-SE, cruise, AM/FM cassette, tinted PW, leather seats, sunroof. Brooks, 298-3294.
- '83 VW VANAGON, sunroof, extras, \$4900 OBO. Lachenmeyer, 268-7475.
- '79 JEEP WAGONEER, 4-WD, lock-out hubs, AT, AC, heavy-duty hitch, V-8. Whitley, 865-4390.
- BOY'S BICYCLE, Schwinn Predator, 20", w/basket, \$60. Koski, 822-1122.
- '87 DODGE RAIDER, 4x4, AC, PS, AM/FM tape, 5-spd., \$8400. Setch-

ell, 281-5600.
'79 VW RABBIT, 4-dr., AC, AM/FM, new tires, \$975 OBO. Garcia, 293-3937.

REAL ESTATE

- 4-BDR. HOME, 1900 sq. ft., 2 baths, new carpet, remodeled oak kitchen, Montgomery & Tramway area, \$115,000. Gibson, 298-9170.
- 2-BDR. MOBILE HOME, 2 baths, 2-vehicle covered drive, 2 storage sheds, in adult park, owner will finance. Hill, 275-7415 or 836-2752.
- 2-BDR. HOME, 1 bath, garage, utility room, LR, DR, NW valley, \$57,000 OBO. Duran, 345-5849.
- VACANT LAND, 2.2 acres, Placitas, cul-de-sac lot, Tierra Madre subdivision, full covenants, \$60,500 total. Bott, 823-2821.
- 4.85 ACRES, 1 mile east of N217, wooded, water & electricity accessible, partially fenced, views of Sandias and Estancia Valley. Schreiber, 281-3016.
- 3-BDR. HOUSE, 1-3/4 baths, LR, den, DR, stone FP, 1350 sq. ft., new roof, stucco, and heating, garage, jacuzzi, 1021 Indiana SE. Lopez, 255-5102.
- 2-BDR. MOBILE HOME, '79, 14' x 76', 2 baths, FP, storm windows, mini-blinds throughout, \$14,500. Hesch, 275-7630.
- 2-BDR. MOUNTAIN CABIN, 1 bath, LR/DR, FP, 1/2 acre, backs national forest, security and access year-round, \$70,000. Stevenson, 461-0405 between 5 and 9 p.m.
- 4-BDR. HOUSE, on 1 1/2 acres (4 1/2 more available), 2-story, passive solar, 2450 sq. ft., open plan, masonry construction, irrigable Tome area, will finance, \$125,000. Martinez, 865-6983.

WANTED

- CHILDREN'S CROSS-COUNTRY SKI EQUIPMENT. Boyes, 296-0654.
- US COINS AND COIN COLLECTIONS, hoards, etc., special interest is Standing Liberty quarters. Abbin, 296-7678.
- CROSS-COUNTRY SKIS, child's (age 6-7), boots, poles, clothes. Andersen, 294-8624.

Plan on Piscine Pleasure Tonight

THE FINEST FISH FROLIC in town's available tonight at the C-Club. Chef Henry's "catches of the week" for Seafood Night include lobster (\$13.95) and shrimp scampi (\$9.95). Afterward, it's melodious music by the Bourquet Brothers for your dancing pleasure. Dinner reservations recommended (265-6791).

FAMILY/VARIETY NIGHT tomorrow evening features pizza-by-the-slice and much more at the low-cost buffet served from 5 to 6 p.m. Then our old friends — Sleepy, Grumpy, Dopey, and the rest of the guys — appear on the big screen in the Disney classic, "Snow White and the Seven Dwarfs."

CAP OFF THE WEEKEND with brunch this Sunday. Served from 10 a.m. to 2 p.m., the magnificent menu includes pancakes, omelets, scrambled eggs, baked ham, hash browns, roast turkey, etc., etc. Cost is \$6.95 for adults and \$3.50 for kids ages 4 to 11. As usual, members receive a \$1 discount (\$2 maximum per family).

WHERE'S THE SNOW? Coronado Ski Club members wonder too; they'll discuss the problem at their meeting next Tuesday (Jan. 17). There's a social get-together at 7 p.m., followed by the 7:30 meeting featuring Sally George of Powder Horn Ski Resort (Grand Junction, Colo.). As usual, a few lucky CSCers will take home some fantastic door prizes.

MAIN LOUNGE EVENTS coming up this month include Comedy Video Night on Jan. 18 (videos start at 6 p.m.), Membership Night on Jan. 25 (flash the membership card and get a free drink), and Import Beer Night on Jan. 26 (your favorite import for \$1.25 from 4 to 8 p.m.). Of course, there's also the Big One: Super-Bowl Sunday on Jan. 22,

featuring football in the lounge and bingo in the ballroom.

IF AMBLING OFF TO ATHENS isn't on your schedule next week, the next best thing is showing up at Greek Night on Saturday, Jan. 21. Dinner at 6 p.m. (served by Greeks bearing gifts from the kitchen?) includes roast lamb with potatoes, chicken Riganato with rice pilaf, or baked fish with vegetables. With your entree, you get your choice of soup or salad, plus Greek-style green beans, rolls, and coffee or tea. The colorfully costumed Palamakia Dancers perform from 7:30 to 8, and then it's time for you to dance (8:30-11) to the mellow music of the Roland DeRose Orchestra. Togas aren't required, but reservations probably are — this event is usually SRO.

BINGO BUFFS get together again on Jan. 19 for another evening of fun and prizes. Card sales begin at 5:30 p.m., and the Early-Bird Game starts at 6:45. There's reasonably priced food available throughout the evening, so can the kitchen chores that night.

CHOW-LINE CHOICES at BBQ Night on Jan. 20 include ribs and chicken at \$7.95 a plate — an especially good deal when you subtract your member discount. Afterward, enjoy sagebrush-shuffle time with the Isleta Poor Boys.

ACES UP THEIR SLEEVES? Never. You can count on an honest deal when the T-Bird card sharks get together for fun and games (along with free refreshments and door prizes). Your next opportunity to join this retired — but unretiring — group is Thursday, Jan. 19. Action starts at 10 a.m.

Events Calendar

- Jan. 13-22 — "Drinking in America," modern comedy by Eric Bogosian; 8 p.m. Fri.-Sat., 6 p.m. Sun.; Vortex Theatre, 247-8600.
- Jan. 13-22 — "Roosters," New Mexico Repertory Theatre presentation of contemporary Hispanic play by Milcha Sanchez-Scott about a father-and-son battle for supremacy; call for time, KiMo Theatre, 243-4500.
- Jan. 14-15 — Albuquerque Comic Show, comic books and memorabilia; 10 a.m.-9 p.m. Sat., 10 a.m.-6 p.m. Sun.; Convention Center, 292-1374 or 768-4575.
- Jan. 16 — "Sonata to Serenade," concert by the Chamber Orchestra of Albuquerque; 8:15 p.m., St. John's United Methodist Church (2626 Arizona NE), 881-0844.
- Jan. 18 — "PDQ Bach," special comedy event, the New Mexico Symphony Orchestra w/guest Prof. Peter Schickele; 8:15 p.m., Popejoy Hall, 843-7657.
- Jan. 19 — "42nd Street," play presented by Concerts International; 8 p.m., Kiva Auditorium, 768-4575.
- Jan. 21-22 — "The Round-Eyed Rumpelstiltskin" by Bill Hayden, presented by the Albuquerque Children's Theatre; 1:30 & 3:30 p.m., Popejoy Hall, 888-3644.
- Jan. 22 — Fine Arts Music Series: the New Mexico Chords Barbershop Chorus; 4 p.m., First United Methodist Church (4th & Lead SW), 298-3355.
- Jan. 22 — Exhibit opening, "The Elusive Surface; Painting in Three Dimensions," by Laura Russell; 1-5 p.m. (2 p.m. discussion of work by artist), free admission day, Albuquerque Museum, 242-4600.
- Jan. 27 & 29 — "Madame Butterfly," drama of deception and human destruction in the name of love, presented by Opera Southwest; 8 p.m. Fri., 2 p.m. Sun.; KiMo Theatre, 243-0591.

More Dentists Join PDP

The following eight dentists in Albuquerque and two dentists in northern California have joined the Metropolitan Preferred Dental Program provider network since initial distribution of the Directory of Dentists:

Albuquerque

K. J. Armstrong, DDS
Gen/Fam Dentistry
5850 Eubank NE
Suite B-38
Albuquerque, NM 87111
(505) 275-3167

G. C. Clark, DDS
Gen/Fam Dentistry
3613 Rio Rancho Blvd.
Corrales, NM 87048
(505) 898-8011

R. L. Davison, DDS
Gen/Fam Dentistry
7520 Montgomery Bldg. E
Suite 4
Albuquerque, NM 87109
(505) 883-6111

R. J. Giannini, DDS
Gen/Fam Dentistry
6208 Montgomery NE
Suite A
Albuquerque, NM 87109
(505) 881-8488

R. E. Horn, DDS
Gen/Fam Dentistry
801 Encino Pl. NE
Medical Arts Square, Suite C-1
Albuquerque NM 87102
(505) 242-9781

V. A. Lopez, DDS
Prosthodontist
801 Encino Pl., Suite B-8
Albuquerque, NM 87102
(505) 243-4383

T.J. Lynch, DDS
Gen/Fam Dentistry
6208 Montgomery NE
Suite A
Albuquerque, NM 87109
(505) 881-5488

G. P. Maese, DDS
Gen/Fam Dentistry
3901 Georgia NE
Suite A-7
Albuquerque, NM 87110
(505) 888-3112

Northern California

K. Wong, DDS
Gen/Fam Dentistry
1776 Arnold Industrial Way
Suite A
Concord, CA 94520
(415) 676-5665

K. Wong - 2nd location:
38 Washington Ave.
Port Richmond, CA 94801
(415) 232-2328

B. K. Young, DDS
Gen/Fam Dentistry
3200 Mowry Ave.
Suite D
Fremont, CA 94538
(415) 797-0797



TOP GUNS SHOOT DOWN RHINOS to bag Sandia Flag-Football League championship. "Our nine-win, no-loss record this season supports the old adage that nice guys finish last," jokes team manager Phil Federico (9114, third from left, front row). Front row: Chuck Harjes, Larry Schneider (both 1252), Phil, Randy Harrison (2811). Second row: Jim Puissant (contractor employee), Jeff Rickey (2852), Tim Wiseley (contractor employee), Ron Simon (2341). Standing: Paul Yourick (3428) and Andy Seth (contractor employee). Not shown: Bruce Gunckel (3423), Brad Peyton (contractor employee), and Mark Baca.