

Fiber-Optic Spark Plug 'Sees' Inside Stock Engines

A spark plug fitted with fiber-optic "eyes" allows researchers at the Combustion Research Facility to probe combustion problems inside unmodified auto engines while they're running.

"It's the first time we've been able to make an optical measurement inside a production engine," says the inventor, Peter Witze (DMTS) of Combustion Applications Div. 8362.

The concept of a fiber-optic-instrumented spark plug occurred to Pete during discussions with Chrysler researchers in Detroit in early 1987. "They asked me whether it would be feasible to install windows in the cylinder walls of production engines and use LDV [laser-Doppler velocimetry] to determine probable causes of an industry-wide problem, rough idling," Pete recalls. "I told them windows would be expensive and difficult — after all, what you really want to know about is the fluid motion near the spark."

At the time, Pete was aware of some work by Spicher in Aachen, West Germany, involving optical fibers mounted through holes in cylinder walls, and he had himself worked with a fiber-optic detector that measured the light emitted during combustion of a window-equipped test engine.

"So I said, 'Maybe we could put optical fibers inside a spark plug.'"

What Pete had in mind was drilling holes vertically through the threaded metal housing of a spark plug and inserting optical fibers in them. Each of the fibers (similar to those you see in some decorative table lamps) would be tipped with a small lens so it would collect light from a portion of the cylinder during ignition of the fuel-air mixture. This light would be transmitted outside the engine where it would be analyzed. The plug would in no way affect the performance of the engine.

So, back in Livermore, Pete visited an auto parts store and picked up four spark plugs. "Cost me \$4.99 plus tax," says Pete. "Gotta turn in a voucher on that some time."

At the CRF, Pete, Eldon Porter (8362), Matthew Hall (a postdoctoral fellow supported by the Gas Research Institute, Chicago, Ill.), and visiting scientist Jim Wallace (University of Toronto professor) began the work necessary to convert a standard, off-the-shelf 14-mm (millimetre) spark plug into a useful research tool — essentially an unobtrusive, invisible observer of engine performance.

The Lotus and the Oven

Jim, for example, spent three months working on fiber-optic lens designs that would survive the combustion environment (see "Tough Place to Do Research" story). "He put prospective lens candidates into hypodermic tubing and baked them at 200°F in his apartment oven," Pete recalls. "None of them survived." (Later, the team realized that the oven test was an overtest — only the first inch or so of a spark plug gets really hot.)

"Eldon developed the instrumentation to measure the light that comes out through the optical fibers," says Mike Dyer, 8362 supervisor. "The very low light levels require the use of sensitive detectors — photomultiplier tubes — that measure the light. The electrical signal from each detector triggers a timing circuit that tells an on-line computer how many milliseconds elapse between creation of the spark [or ignition] and the arrival time of the flame at the measurement location."

The team decided that eight optical fibers would be needed to "see" the area of interest in the cylinder. So a ring of eight 1-mm (0.039 inch) holes was drilled in the spark plugs. Two-foot-long, 1-mm, fibers (tipped by lenses that provided a 23° viewing angle) were then fitted into each hole with their lenses flush with the bottom of the plugs.

After a local machine shop drilled the necessary holes, Matt installed optical fibers in them. He couldn't wait to try one out in the lab, so he took one home over the weekend and tried it in his Lotus. It was the plug's first test in a real car — and it sur-



UNDER THE HOOD are Eldon Porter (8362, left) and Peter Witze (DMTS, 8362). Pete headed the team of researchers that developed an optical-fiber-instrumented spark plug, the first device to permit optical measurements of combustion phenomena in an unmodified auto engine.

vived the heat and the pressure. Matt also worked with Pete in the lab to ensure that, in theory at least, the new device would work properly and provide the desired data.

In addition to his role as team leader, Pete has done the computer programming necessary to permit real-time data acquisition. And it was Pete and Matt

who first tested the entire system — plug, detectors, and computer — in a research engine.

The next step was to move to a production engine. "We wanted an engine with a modern 'fast-burn' combustion chamber, and the only one in the Motor Pool was a Reliant assigned to Security," says

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LAB NEWS

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MECHANICALLY STACKED CAKE marks Sandia's successful effort to set a new record for photovoltaic conversion efficiency — the fraction of the solar radiation hitting a solar cell that's converted into electricity. Virg Dugan (6200, right) and Dan Arvizu (6224, center) present the first piece to James Gee (also 6224), who assembled the new cell. "The blue and red icing on the cake denotes the two parts of the color spectrum absorbed by the top and bottom sub-cells of the new multijunction mechanically stacked cell," explained Virg. Two years ago, he promised a cake to Dan and his Photovoltaic Cell Research Division if they could build a cell that exceeded a 30 percent efficiency rate "It was a psychological barrier, the equivalent of a four-minute mile," said Virg. "They've hit 31 percent." Details in next issue.

Antojitos

Sandia's Longest-Service Employee -- and the last on-roll Sandian to have seen the Trinity A-bomb test on July 16, 1945 -- is retiring. Riding a draft deferment, Bill Thomas (7250A) joined the Manhattan Engineer District in Los Alamos as an 18-year-old civilian technician in September 1943. In February 1945, he was drafted into the Army -- and sent to Los Alamos. "Only missed two days of work," says Bill.

"I was sent to the Trinity site as an observer," he adds. "And I was to help evacuate personnel if necessary." The latter task was superfluous, it turned out, but Bill was an admirable observer: "We had a ringside seat. When the radio said, 'Lie down,' we hit the deck. The flash was brilliant, even though we had our hands over our eyes. Then the rocks danced around a bit. And then we heard the sound of the detonation and its reverberations. It was a memorable experience."

Thanks to a couple of terminations for schooling in the late 40s, Bill's effective Sandia service date is June 13, 1945. He joined the old "Road" organization (the code name for weapon production) in 1949 and has been involved in manufacturing development engineering and in quality assurance with that group and its successors ever since.

"If I had it to do over, I'd do just the same thing," says Bill.

* * *

Sandia Seniority List -- Bill's retiring, effective Oct. 3. But, in effect, he retired last Friday, thanks to some accrued vacation (yes, you could do that in *The Olden Days*). Bill's departure moves Howard Austin (7126), 3/4/46, into the top spot, which Bill has held since Ray Powell's retirement on Feb. 28, 1985. Howard is followed in the top ten by Ed Harley (6226), 6/10/46; G. C. Hollowwa (3411), 7/16/46; Jack Suttman (9122), 9/9/46; Ted Church (7290), 5/26/47; Jo Davis (7531), 7/10/47; Vernon Brewster (7137), 8/5/47; Bob Statler (7137), 9/2/47; Roy Crumley (3714), 9/9/47; and Fred Deiber (2852), 9/10/47.

* * *

On the Promulgation of a Solecism via phone-answering system:

"Hello," says the sultry voice. "You have reached the Sandia National Laboratories voice-messaging service. To leave a message for the person you are calling, please reenter the last five digits of their phone number." "Person" is singular; "their" is plural; that's a grammatical no-no.

But, as I told Ned Godshall (2523), whose sharp ears detected the error, it's not easy to avoid. Saying "the last five digits of his-or-her phone number" is awkward, saying "of his phone number" is sexist, and pluralizing it to "a message for the people you are calling" is inaccurate.

What to do? Over here, we'd probably write around it. Maybe "To leave a message, please reenter the last five digits of the phone number you just dialed." Yes, I'd leave out the "for the person you are calling" part. Would you want to leave a message for someone you weren't calling? It's a little too reminiscent of Lily Tomlin's telephone operator -- "Is this the party to which I am speaking?"

* * *

Above Issue Continued -- Ernest Hemingway once told an interviewer he had written the last page of *Farewell to Arms* 39 times. Asked what had him stumped, he replied: "Getting the words right." ●BH

* * *

El diablo lo que sabe es por viejo y no por diablo. (The devil knows what he knows because of his age, not because he's the devil.)

Jacobs Promoted To Director 5200



James Jacobs has been named director of Nuclear Security Systems 5200, effective Aug. 1.

"A new administration in Washington, coupled with reimbursable program initiatives, will make my new assignment challenging," Jake says.

Since joining Sandia in February 1959, Jake has worked with weapon, reentry vehicle, and aerospace power projects. In 1964, he was one of several Sandians given a leave of absence to help Bellcomm, Inc., work on systems development for the Apollo project.

Jake returned to the Labs in 1966 for an assignment in the Aerospace Nuclear Safety Department and later in the Space Isotope Power Department. He was promoted to supervisor of the Advanced Component Development Division in 1968, where he was involved in developing space power systems. After a four-year tour in Department 2320 doing guidance and control work, he transferred to Safeguards, where he was involved in advanced development of SST-type (Safe Secure Transport) technology. He transferred to the Security Systems Integration Division in 1976. Jake was program manager for the first high-tech security system implemented at Pantex.

In 1978, he was promoted to manager of Facilities Protection Department II -- eventually named Advanced Systems Department -- where his work was in nuclear security, advanced conventional weapons, and anti-terrorism. He also managed DOE's OSS (Office of Safeguards and Security) program, which was instrumental in upgrading security at many nuclear weapon sites in the US.

Jake earned BS and MS degrees in ME at the University of Nebraska -- his MS under Sandia's Educational Assistance Program (EAP). He worked toward a doctorate in applied math for two years at George Washington University. He's a member of the Army Science Board and the Institute of Nuclear Materials Management (INMM). In 1986, Jake received INMM's Distinguished Service Award for "his sustained outstanding leadership role in the development and implementation of advanced physical security systems for nuclear materials at facilities or in transit."

In his spare time, Jake enjoys carpentry and woodworking. He and his wife Dolores are doing most of the work themselves on a house they're building at Elephant Butte reservoir.

Jake and Dolores have two sons and live in the NE Heights.

Jokes in the Journals



Alexander Kohn, who teaches biochemistry & virology at Tel Aviv Univ. Medical School, says there is a surprising amount of humor, intentional and unintentional, in scientific pub'ns. Unintentional example from a library journal: "Limited Nutritional Value of Cannibalism." Intentional example from the *Journal of the American Psychological Ass'n*: "The Unsuccessful Self-Treatment of a Case of 'Writer's Block.'" Page following the title is blank.

PR Reporter

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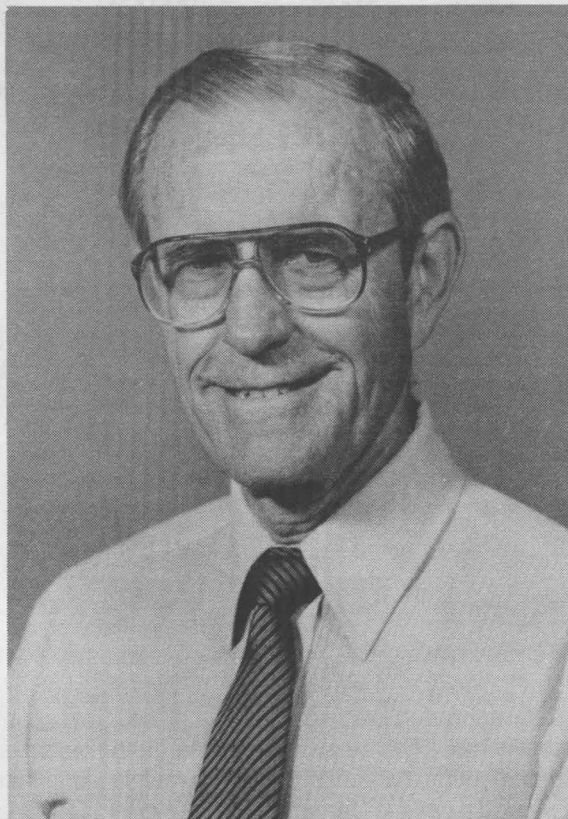
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RETIREE BILL THOMAS

International Science Fair Students Visit SNLL

Technical talks are nothing new at Sandia Livermore — unless, that is, the speakers are high school students. Five students (including one 14-year-old) made impressive technical presentations at Sandia Livermore the week of July 18. Each student had won a DOE Special Award in energy research at this year's International Science and Engineering Fair held in Knoxville, Tenn.

Helping judge the fair for the second year in a row was Dan Bozman (8153). "These are an elite group of kids," says Dan. "More than 700 students, who had already distinguished themselves in regional science fairs, participated in the international competition. The quality of the projects was top-notch."

The five DOE winners won one-week, all-expense-paid visits for themselves and their teachers to Sandia Livermore. The students and their teachers were matched with a Sandia or LLNL researcher in their specialty areas.

The five winning students were Philip Baltz (Fayetteville, Ark.), Khary Bridgewater (Saginaw, Mich.), David Dommett (Brisbane, Australia), Ariel Lacsamana (Manila, Philippines), and Clifford Wang (Vero Beach, Fla.).

Philip, who developed and tested a tubular solar-air heater, was accompanied by his physics teacher, William Merrifield. Philip used two vertical tube designs for his solar heater—one design with black epoxied quartz crystals for storage and the second design without. Philip was hosted by Nina Bergan (8364).

Tension on a Tow Line

Khary's project focused on how paints affect the resistance of ship hulls to water. Khary and his physics teacher, Daniel Sealey, were paired with host Rob Barlow (8351). In his project, Khary tested three different paints on 16 different ship models. To determine resistance, he measured tension on a tow line attached to the ship models.

David studied the greenhouse effect on plant life by exposing 15 varieties of plants to various levels of carbon dioxide and examining the effects. David grew 60 plants in an airtight enclosure and another 60 plants in an enclosure with three times the normal concentration of carbon dioxide. He found that increased levels of carbon dioxide affected not only the health of plants, but also how quickly they matured. David was accompanied by his father, a microbiologist, and was hosted by Joseph Shinn (LLNL).

Ariel developed an alternative source of electrical energy: a microbial fuel cell, with methylene



STUDENT SCIENCE FAIR WINNERS at Sandia Livermore for a week's visit are (from left) Philip Baltz, Khary Bridgewater, David Dommett, Clifford Wang, and Ariel Lacsamana. (Photo by JKetsdever/Valley Times)



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blue as a mediator. Ariel, who traveled with his biology and chemistry teacher, Marion Mallorca, was hosted by Emilio Garcia (LLNL). In his fuel cell, Ariel used two "compartments" with corresponding carbon electrodes. The anolyte solution consisted of a mixture of coconut water and sugar cane, methylene blue, and potassium phosphate buffer. Ariel thinks the fuel cell could help offset the energy shortage in the Philippines.

Clifford, who found different ways to enhance methane production from anaerobic digestion of red seaweed, and his biology teacher, Cheryl Domineau, spent time with Robert Taylor (LLNL). Clifford found that saltmarsh sediments were more effective in producing methane than freshwater sediments or anaerobic sewage sludge. Clifford also studied the use of different transition metals in the digesting material as well as different treatments before digestion.

The week began with a welcome by Peter Matern (8300), who strongly supported the students' visit to Sandia Livermore this year. During the week, the students and their teachers toured the FloWind Altamont windfarm, several laboratories at the Combustion Research Facility, the electron beam ion source (EBIS) experiment, computing center, physics labs, and tritium research laboratories. The stu-

dents made presentations "defending" their science fair projects, and they and their teachers attended a laboratory workshop with their respective hosts. They also saw several laboratories at LLNL. Gary Drummond (8301) coordinated the tours and events.

The week was not all work, though. Students toured Chinatown and the Exploratorium in San Francisco, and visited the Lawrence Hall of Science in Berkeley. There was also a cookout at Del Valle Park.

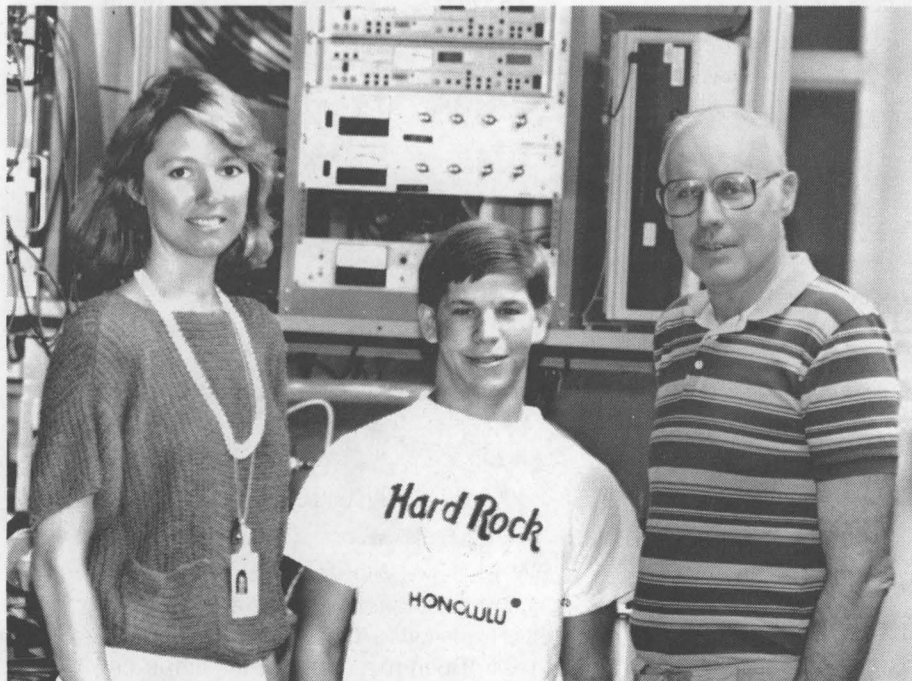
"This week was important," said Dan. "These five students represent the motivated kids of their generation. They will be asked to help solve the scientific problems of our future."

●MALley (8535)

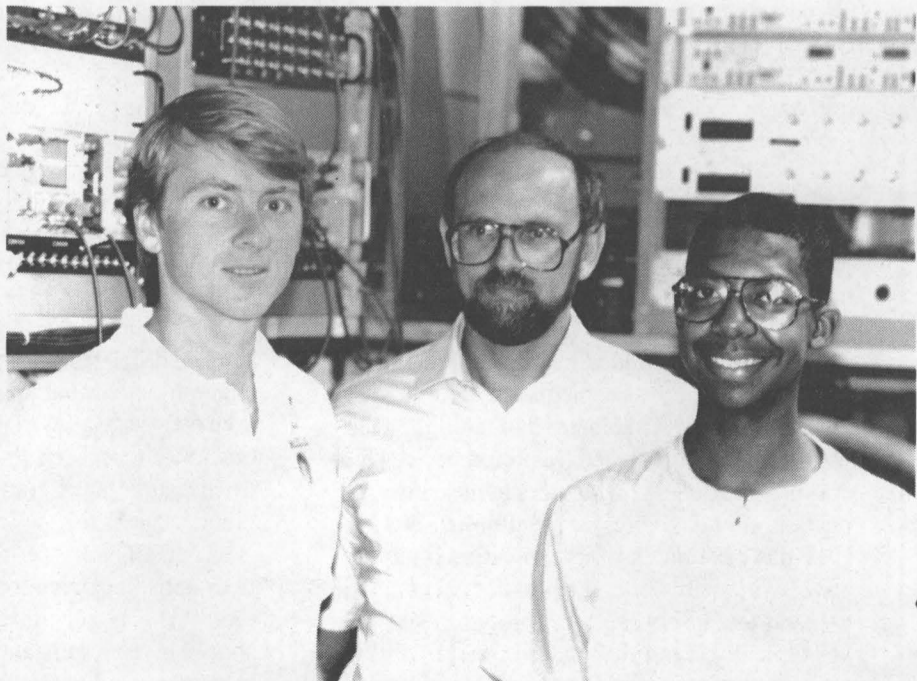


Congratulations

To Donna Edwards (8234) and Bryan Weber, married in Livermore, July 30.



SANDIA HOST Nina Bergan (8364) poses in the lab with Philip Baltz of Fayetteville, Ark., and his teacher, William Merrifield.



HOST Rob Barlow (8351), at left, with visiting teacher Daniel Sealey and Khary Bridgewater of Saginaw, Mich.



MATT HALL, a Gas Research Institute postdoctoral fellow, holds the prototype spark plug he helped develop for the research engine in foreground and for standard production engines.

(Continued from Page One)

Spark Plug

Pete. "So we traded vehicles with them one day, and ran some under-the-hood tests. I immediately called Chrysler with the results. Our contacts there confirmed that what we'd seen is just what we should have seen. The device worked!"

Tests Unmodified, Production Engines

Because the special plug was built using a standard spark plug, it can be used to test unmodified, production-model automotive engines. (In normal operation, the cylinders of an internal combustion engine fire one by one in a precise, recurring cycle.)

The efficiency of this process can vary greatly. The primary variables are the shape of the combus-

Marvin E. Gunn, Jr.
Energy Conversion and Utilization
Technologies Program, CE-12
US Department of Energy
Washington, DC 20585

Dear Marvin:

A year ago during SAE [Society of Automotive Engineers] week, Bill McLean, Pete Witze, and I spent a half day with Chrysler discussing the technical challenges in engine combustion research. Specifically, we discussed the industry-wide issue of rough idling in engines and debated whether the cause was fluid mechanics or fuel-air mixing. The consensus judgment was that the problem derives from the influence of cyclic variability of fluid mechanics on the early flame kernel development.

One approach to testing that idea is to perform LDV [laser-Doppler velocimetry] measurements inside their engine. That would require the installation of optical windows, which means that we could not presume that we had not affected the flow that we wanted to measure.

During the course of those discussions, Pete Witze [8362] came up with the idea of a fiber-optically instrumented spark plug that measures the rate of growth of the flame kernel. This approach offers the distinct advantage of being able to be installed in a production engine without modifying the geometry or operating conditions in any way. It represents the natural evolution of many of the diagnostic techniques we are pursuing under the ECUT Combustion Technology Program.

The plug has generated considerable interest within the auto industry. Chrysler has been keeping in close contact with our progress since the beginning. Complete sets of data and design details have been sent to the major US auto companies.

Sincerely,
T. Michal Dyer, Supervisor
Combustion Applications Div.

EXCERPTS FROM MIKE DYER'S (8362) LETTER to Marvin Gunn, DOE sponsor for the development of the new spark plug, describe its origin and interactions with the auto industry.

tion chamber and the chemistry of the air/fuel mixture. Getting good data out of a series of transient events such as a combustion cycle is difficult (see "Tough Place to Do Research"). The special spark plug offers a convenient way to measure the way in which the flame grows in the first moments follow-

ing ignition. The infant flame is called a kernel.

Using the specialized spark plugs connected to light-sensitive detectors (photomultiplier tubes), researchers are able to record the shape of the flame kernel. Each optical fiber transmits the light it "sees" from moment to moment to the separate detectors. The speed at which the flame grows in different directions can then be plotted with the help of a computer program.

Provides Variety of Data

"Measurements of this type are useful for comparing the effects on combustion of the many variables that can occur within the cylinder following ignition," notes Pete.

(Continued on Next Page)

Tough Place to Do Research

An automobile combustion chamber is a classic example of a tough place to do research:

- It's hot, typically 2500° C;
- The fuel-air mixture is exploded (ignited) several times a second, even when the motor is idling;
- Pressures vary from atmospheric or less to more than 50 atmospheres (depending on the position of the piston);
- Introducing measuring devices into a chamber changes the all-too-critical turbulent flow of the fuel-air mixture (much as determining the precise temperature of a thimbleful of hot water is impossible with an ice-cold thermometer);
- Although unobtrusive means to measure pressures within a chamber are common, it's often difficult to differentiate between causes and effects of pressure changes; also, because most of the suspected causes of cyclic variability (which results in rough idling) occur early — during the brief flame kernel development period — pressure measurements are an insensitive indicator of what is actually happening;
- Using high-speed Schlieren movie cameras or laser diagnostic devices to measure combustion characteristics is possible (in fact, the CRF has built much of its reputation on its creative work with laser diagnostics), but movie cameras and lasers can't see through steel walls; so, typically, carefully crafted quartz windows replace part of the steel — that's a technique useful only with research engines on lab test stands.

The new spark plug fitted with fiber-optic "eyes" (see main story) can take the heat and the pressures. In fact, measurements taken with the plug complement pressure measurements, which are more informative during the later stages of the burn.

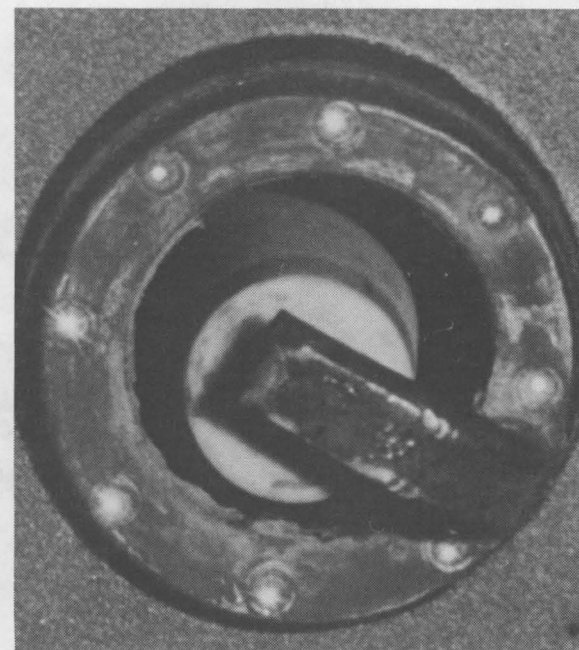
Doesn't Affect Turbulence

Without affecting the chamber's natural turbulence, the new plug measures the early flame development rate for individual cycles. The eight fiber optic "eyes" can measure the precise time between spark, on the one hand, and growth of the flame to a point in front of a fiber, on the other.

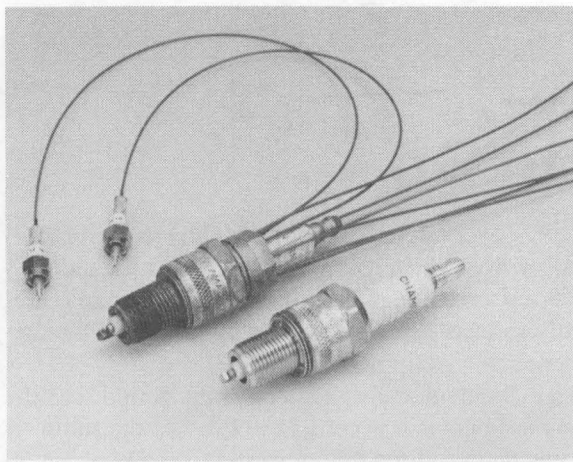
If it goes faster in one direction than another, then one "eye" will see it earlier than another. In that case, something is making it grow in one direction faster. According to inventor Pete Witze (DMTS, 8362), asymmetry is directly related to engine performance.

And inserting it in an engine is as easy as changing any other spark plug. "It's a simple, even elegant, way to look at some important combustion phenomena that no one has been able to measure in an unmodified production engine," says Pete.

Mike Dyer (8362 supervisor) believes the fiber-optic plug has a lot of potential as a research tool: "This is truly an exciting development that should give us substantial insight into the workings of production engines. No wonder automakers are optimistic about using it in their own engine research and development programs."



NEW PLUG'S WORKING END — Optical fibers tipped with tiny lenses show up as sparkling dots when light is transmitted through them in the reverse direction. Jim Boehmke (former Sandian) sliced a spark plug in half longitudinally, then did the preliminary sketch showing that Pete Witze's concept for instrumenting a spark plug could work.



PAIR OF PLUGS — The new optical probe (top) is a standard spark plug in which eight holes have been drilled through the threaded metal housing so 1-mm optical fibers can be inserted. The fibers — light guides that can transmit light with high efficiency — connect to light detectors that measure the amount of light produced during ignition and allow the light from this “flame kernel” to be precisely located in the cylinder.

(Continued from Preceding Page)

The measurement data can be processed, for example, to characterize the average displacement velocity and growth rate of the early flame, and then to relate these quantities with engine pressure measurements and gas velocities measured in the spark gap. The real-time data-acquisition system permits statistical analyses of the evolution of the flame.

The CRF team believes the special plug can help optimize engine designs and is cooperating with engine designers and researchers at Chrysler, Ford, and General Motors. All three automakers are now tracking the team’s progress on the fiber-optic spark plug. In fact, Chrysler engineers were out at the CRF early this week to provide an industry perspective on potential applications of the plug and to see the plug in operation firsthand.

Technology Interchange

“This project is an example of technology interchange,” says Mike. “We learn a lot about the practical side of the engine development business from our industry partners, and we hope that our optical diagnostics can help speed their own engine development activities.”

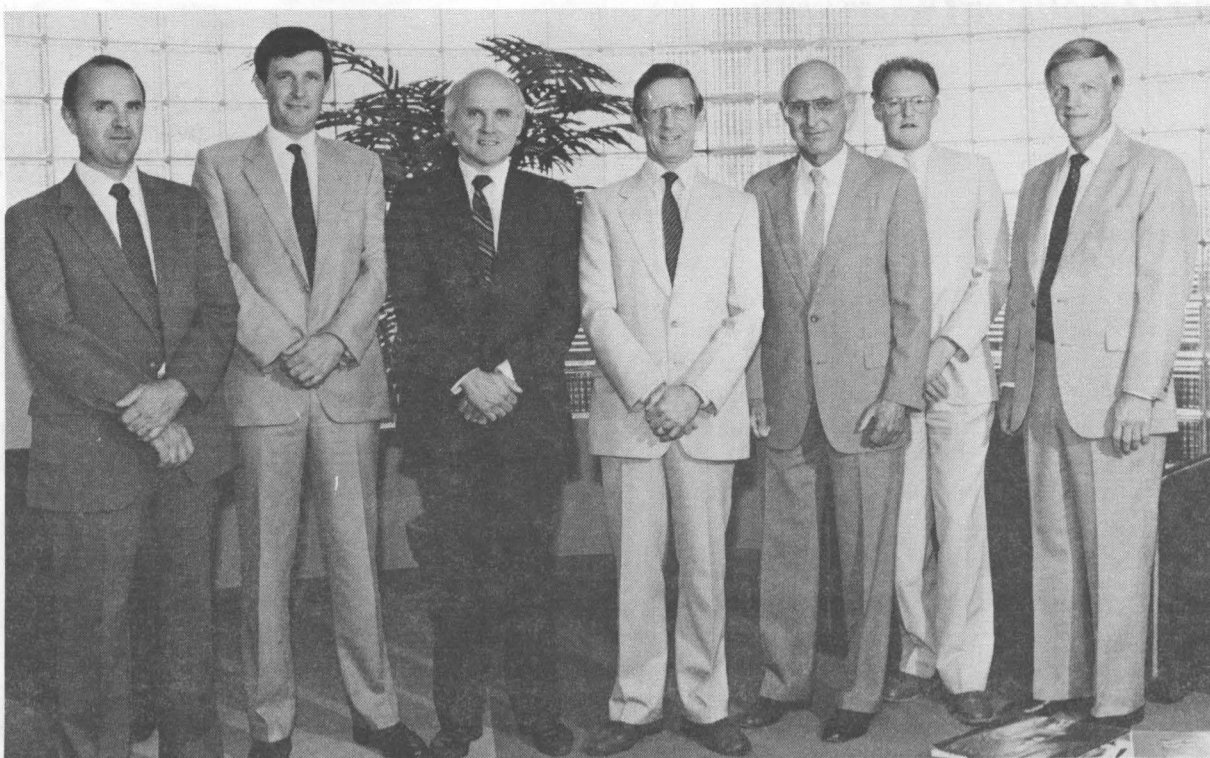
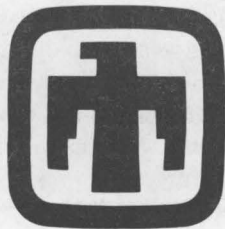
“We originally thought the plug would be most useful for studying the average firing characteristics within an individual engine cylinder, but we’ve altered that view now,” adds Pete. “We now believe it is equally important to examine and compare individual engine cycles. We are finding that the individual cycles are very different — that the flame grows in different directions from cycle to cycle. That may be a cause of rough idling.”

New ways to use the plug are currently under investigation. For example, Matt is using the fiber-optic plug to study lean combustion in natural-gas engines.

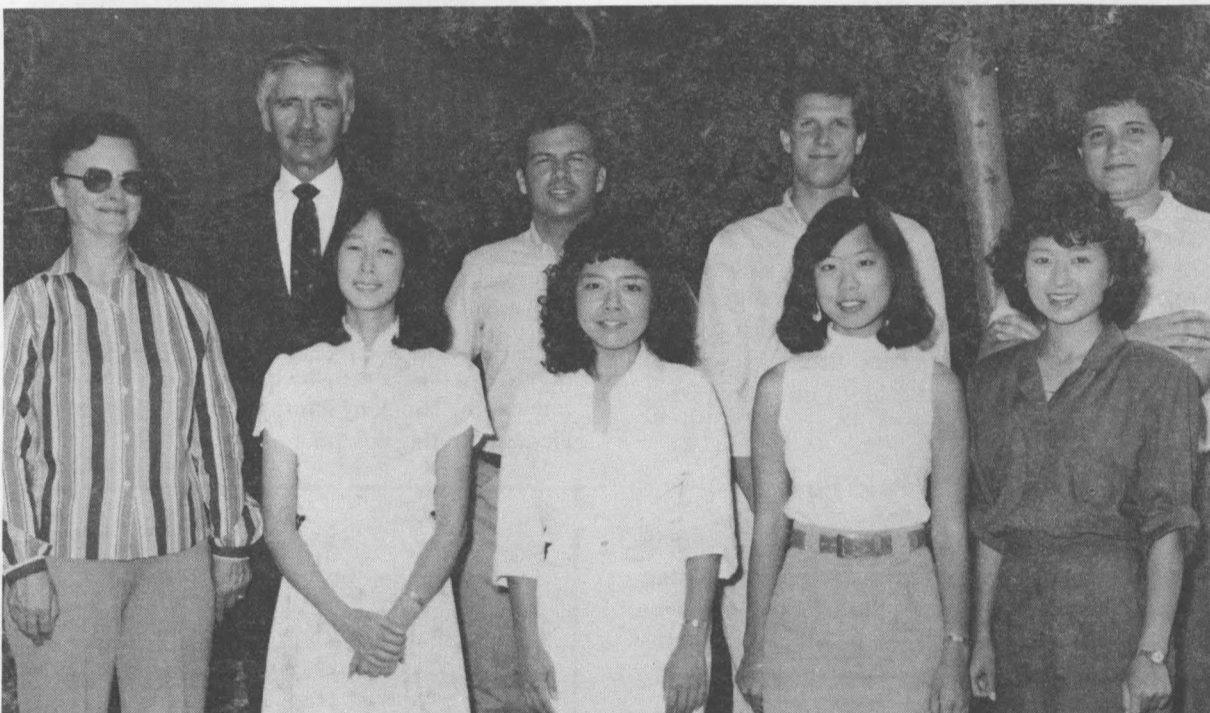
Pete will explain the development of the fiber-optic spark plug and its uses at the International Fuels and Lubricants Meeting of the Society of Automotive Engineers in Portland, Oreg., in October.

The plug was developed with funding from DOE’s Office of Conservation and Renewable Energy. Under that Office’s ECUT (Energy Conversion and Utilization Technologies) Program, Sandia has worked cooperatively with industry for the past 10 years to develop advanced techniques to measure, analyze, and understand engine combustion processes. Sandia is the lead laboratory for this program and serves as technical coordinator for applied research and interactions involving more than 20 industrial and university participants.

A patent application has been filed on the new plug. ●BH/LPerrine (3161)



LATE LAST MONTH, representatives of the United Kingdom, DOE/AL, and Sandia held another in a series of joint discussions. The meeting included an overview of UK activities in the nuclear and non-nuclear areas; an overview of Sandia programs by EVP Orval Jones (20); and briefings on non-nuclear programs by Max Newsom, manager of Advanced Projects Dept. 9120; and the status of the weapon system for the Trident I missile system by Everet Beckner, Vice-President of Defense Programs 5000. In photo, from left: Bruce Twining, DOE/AL Manager; Michael Steeden, Head, British Defence Staff, Washington; John Mabblerley, the UK’s Deputy Controller (Nuclear); Donald Spiers, Controller Establishments Research and Nuclear (CERN); President Irwin Welber; Paul Oliver, Private Secretary, CERN; and EVP Lee Bray (30).



THIS GROUP OF OYOC (One-Year-On-Campus) participants signed in at Sandia this spring. OYOC, an Affirmative Action program, enables outstanding minority students with BS degrees to earn their MSs in engineering or computer science during their first year at Sandia. After they work at the Labs this summer, participants will attend one of 17 OYOC-approved universities during the 1988-89 school year. Shown are (front row, from left): Ruth Brooks (3521, OYOC registrar); Wendy Amai (5267, Cornell); Margaret Meng (2344, Stanford); Sheila Motomatsu (9211, Berkeley); and Huong Tran (1265, U of Arizona). Back row: Ed Gullick (3521, OYOC administrator); Pete Rebeil (5249, Berkeley); Tim Urenda (2814, Purdue); and James DeAguerdo (5141, New Mexico State). Not pictured: Nadine Bandat (5268, Cal-Tech).



THE SANDIA SOCCER TEAM started out playing for the fun of it, then got down to hard work and practice, practice, practice. They went on to win both the Albuquerque Soccer League championship and the 1987-88 NM State Soccer League championship. The team’s overall city league record is 21 wins and 1 loss. They scored 16 goals and allowed only 1 during the state championship. Team members include: coach/ captain Ricardo Beraun (6332), Robert Baca (7541), Jorge Beraun (AFWL), Corey Cruz (DOE/AL), Peter Green (1813), Phil Kahle (2334), Steve Letourneau (7521), M. Omar (UNM), Ken Osburn (2826), Ramon Pacheco (7253), John Page (UNM), James Purvis (9015), Mark Rumsey (6225), Paul Schlavin (7843), and Bill Wampler (1112).

We've Come a Long Way — But There's Still a Long Way to Go

Trouble — right here in River City. That's the way Bob Peurifoy (VP Technical Support 7000) describes Sandia's projected energy use and its costs for this fiscal year.

"When we talk about energy costs at the Labs, we're talking big bucks," says Bob, whose organization (through Plant Engineering 7800) budgets for Labs utility bills.

Big bucks, indeed. Sandia spent a little more than one percent of its total budget — more than \$12 million — on energy needs (at SNLA, SNLL, and Tonopah Test Range) in FY87. Worse yet, costs in FY88 are expected to increase about 27 percent in Albuquerque alone.

"At SNLA, we saw a steady decline in energy use rates from FY73 — the year we learned that cheap energy's days were numbered — through FY86," Bob notes. "But we saw an increase in FY87 and project another, much larger one, in FY88. It looks like energy use will increase 24 percent this year, and costs even more — but at the same time, building space has increased only seven percent.

"The RHIC [Radiation-Hardened Integrated Circuit] lab came on line this year, and that accounts for most of the increase; RHIC is a big energy user because of atmospheric maintenance needs — appropriate temperature and humidity, for example — in the clean rooms," Bob continues.

"The problem of increased energy consumption is alarming, and we're working on it. We're looking for ways to cut back on energy use — to get back on track, so to speak. And we need help from employees to do that.

"Back in the crunch days of the 70s, Sandians came through with many energy-saving suggestions [see "The Bad Old Days"]. Now, with energy costs expected to go higher, we need that same kind of assistance. We still import a lot of oil; minimizing that dependence is important."

Utility Bills Paid First

"At Sandia, we pay the utility bills first — then channel money into programs," Bob says. "During this time of relatively flat budgets, there's a clear message: Conserving energy frees up funds for programmatic needs. So it's in the best interests of every Sandian to stay on the lookout for ways to cut back."

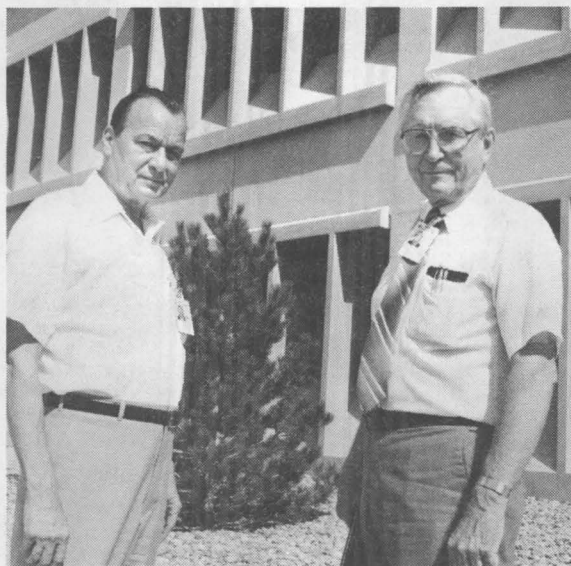
As of this month, there's a way to get energy-cutting suggestions to the right people. Energy hotlines — at both SNLA and SNLL — were recently established by Plant Engineering; employees can dial 6-4862 in Albuquerque or 4-2647 in Livermore with ideas on energy-saving operating procedures or equipment controls, or to report an energy-wasting situation that should be corrected.

"As we receive hotline calls, we'll evaluate the situations in question and get the ball rolling on ideas that appear to be dollar-saving winners," says Ward Hunnicutt (7800), who has overall responsibility for energy management at the Labs.

On-Peak Use Penalized

"Maybe employees aren't aware that sometimes a small adjustment — like scheduling an operation at a different time of day — can make a real difference in costs," Ward adds. "That's because we pay for electricity — our greatest utility cost — under a rate structure that penalizes on-peak use."

The rate structure, Ward explains, makes electricity more expensive at some times than others. Power costs more during on-peak hours — 8 a.m. to 8 p.m. Monday through Friday — than it does the rest of the time. On-peak usage (which determines costs for all of PNM's large commercial and industrial users) is monitored throughout the billing period to determine the 15-minute period during each month with the highest power-use rate (demand); total kilowatt demand during the on-peak period determines a separate charge on the monthly bill. Month-



ED HESS (contractor employee, left) and John Hall (7862) stand in front of Bldg. 891, whose passive solar design is typical of new, more energy-efficient buildings at the Labs.

ly readings from some 25 substation meters at SNLA determine the Labs' share of the total Kirtland AFB bill. (All of Kirtland is considered one billing entity by PNM, which currently supplies electricity to the Base.)

"Sandia's electricity bill reflects two things," says energy management specialist Ed Hess (contractor employee assigned to Div. 7862). "First, we pay for the *amount* of energy — the kilowatt hours — actually used during the billing period. Kilowatt hours used during the on-peak period cost significantly more — and nearly double in the summer — than those used during off-peak hours. That's because PNM's operating costs go up during high-demand periods; to meet the collective peak needs of its customers, the company has to use some of its less efficient generating equipment.

"Second, we pay for peak kilowatt demand — the *rate* at which energy is used during the month's 15-minute on-peak high. The demand charge generally reflects PNM's costs for building and owning generating equipment."

Temperatures can affect which period sees the highest demand, according to Ed. "In the summer, peak demand for a billing period typically occurs in mid-afternoon because of heavy air-conditioning loads," he says. "It follows, then, that switching an electricity-using experiment or other operation to the morning hours — if possible — would lessen the amount of peak-demand for billing purposes."

Little Things Mean a Lot

John Hall (7862), energy conservation coordinator for SNLA and TTR, points out that increased electricity use at the Labs this year is particularly distressing in light of the fact that DOE has set energy-reduction goals of 10 percent over a 10-year period (FY86 through FY95) for all its facilities. "SNLA's goal for that period is to lower building energy use rates from 653,000 Btu/sq. ft./year to below 588,000," says John. "To meet that goal, we need everyone's help — even in seemingly small ways. Turning off the lights or the PC when they're not in use may seem like little things, but little things mean a lot when you're looking at the collective effort of all Sandia employees."

(Use rate, as defined by DOE, is total energy consumed divided by the total square feet of building area occupied, expressed in thousands of Btu's — KBtu — per square foot used in a given time period. Therefore, even though energy consumption might increase during a year, the use rate could conceivably decrease if new energy-efficient buildings were occupied during that time.)

DOE energy-reporting categories include one
(Continued on Next Page)

The Bad Old Days

Long lines at the gas station — and talk of \$1-a-gallon gasoline. Skyrocketing costs for electricity. Ever more expensive home heating bills.

The energy crunch of the mid-70s made it painfully clear that the days of cheap energy on demand were to be no more. And Sandia, like other companies, felt the pinch.

"OPEC got everybody's attention real fast," says Bob Peurifoy (7000). "In no time flat, we learned a valuable lesson: Over-dependence on foreign fuel supplies was a crisis in the making."

Warding off the crisis became everybody's business. Perhaps for the first time, people began thinking about ways to use energy more efficiently and how to cut back on the use of electricity, natural gas, and gasoline.

All-Out Attack

In response to a 1973 request from President Nixon that federally funded organizations such as Sandia reduce their energy consumption by seven percent during FY74, the Labs launched an all-out attack on the problem. The campaign worked; even though floor space increased 1.5 percent in FY74, SNLA managed a 20.9 percent reduction in electricity use — from 92,276 to 73,022 megawatt hours (MWh) — during that same period. Overall reduction in energy consumed that year — including boiler plant fuel, electrical power, and gasoline — amounted to 12.1 percent.

Meeting the President's mandate and other energy-reduction goals in the 70s meant a host of new conservation measures. Among them:

shutting down air conditioning nights and weekends, and turning off redundant supply and exhaust fans; reducing lighting levels indoors and out; upgrading steam system traps and insulation; raising thermostat settings in summer (to 78 degrees) and lowering them in winter (to 65 degrees); shortening the lunch period to 30 minutes from one hour (so "people-comfort" systems — AC, heating, lights — could be turned off earlier at the end of the workday); reducing use of company vehicles; and promoting alternative transportation (car pools, van pools, buses, bicycles).

Other products of the times were annual shutdowns during the Christmas holidays and over the four-day Thanksgiving weekend. (Employees were required to use vacation days for the shutdowns in FY75; now, holidays are consolidated for the Christmas shutdown, and the day after Thanksgiving is often Energy Conservation Day.)

"Back then [the 70s], people shivered in their offices in the winter and perspired in the summer," Bob recalls. "But there was real team spirit, a 'grin-and-bear-it' attitude, about the whole thing. Employees came up with a raft of ideas — many submitted through the Feedback program — that resulted in significant energy-use reductions.

"To offset some of our current energy problems [see main story], we need that same can-do outlook. I urge all employees to use the new energy hotline when they're aware of actions that could save energy, and I ask supervisors to look over their areas with an eye toward conserving energy resources."

for consumption by buildings (heating, cooling, lighting, ventilation, etc.), the largest category; one for vehicle and equipment fuel use; and a third for what is called metered process. Metered process, as defined by DOE, describes a facility where specialized processes account for more than 80 percent of the building's energy consumption; this type of facility is not factored into the 10-year building energy use goal.

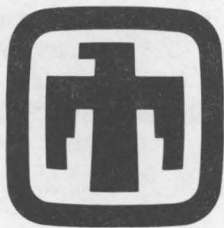
The RHIC lab falls into the metered process category, as will the Process Development Laboratory, slated for occupancy in FY89. At Livermore, the computer center is a metered process facility, according to energy conservation honcho Darrel Buettner (8511). (Under consideration are ways to meter the SNLA computer center so that it, too, would become a metered process facility.) These high-energy-use facilities have separate conservation goals set by DOE.

Energy-Efficient Buildings

Sandia is counting on energy-efficient new buildings to help meet the FY95 goal, according to John. "Reducing overall energy use rates by 10 percent won't be easy," he says. "However, all facilities built at the Labs since the late 70s meet a DOE requirement that new buildings be at least 45 percent more energy-efficient than pre-1975 buildings. In some cases, our new buildings have exceeded the 45-percent requirement by 10 or 12 percent." As new buildings come on line, John says, it's hoped that older, less energy-efficient buildings can be retired.

Energy-saving features of newer buildings include heavier insulation (both walls and roof), double-glazed windows, heating and air-conditioning equipment that meets stringent efficiency standards, and more efficient lighting. In Albuquerque, taking advantage of the abundant sunshine figures into the planning — through passive solar window design and placement, for example. (Bldgs. 823 and 891, among others, incorporate passive solar features.)

"Here in Albuquerque, Sandia covers a lot of territory," says Bob Peurifoy. "Our 470 buildings — of which 250 are permanent — cover about 3.5 million square feet of floor space on some 13,000 acres. Meeting our energy-conservation goals for the next six or seven years will be a real challenge — and we need help from every employee." ●PW



flex liback

Q. I think Sandia is inviting a lawsuit. The bicycle riders ride on sidewalks; they don't dismount and walk bicycles through the gates; they take the right-of-way over pedestrians and automobiles without regard for anyone's safety. If one of them hits me, I will empty his piggy bank — and I'll add Sandia as an accessory because there is no apparent attempt to control them. Security inspectors watch with no comment and even laugh when they endanger fellow employees who are on foot. Danger is greatest at Gate 4.

A. Like everyone else, bicycle riders are expected to obey all traffic regulations regardless of where they are cycling. Responsibility for compliance with all applicable regulations rests exclusively with the bicycle riders themselves. Sandia management expects that employees will comply with all corporate safety rules and applicable vehicular traffic regulations.

I have asked Security supervisors to personally review the situation at our gates during morning/evening rush periods and to enforce all applicable regulations. However, the real solution to bicycle/pedestrian interface problems is cooperation and courtesy on the part of both.

Jim Martin - 3400



Click-Clacking Cleats

Hillbilly Tap Dancers Kick Frustrations

Kind of like square dancing, kind of like tap dancing, clogging has kicked up some popularity with Sandians.

"It's nearly impossible to be gloomy around cloggers," says Dennis Huffman (2157). "There are hundreds of clog steps and dance routines. It's impossible to dwell on the frustrations of the day when you're busy clogging." Dennis clogs for the fun of it three or four times a week.

"Clogging can be whatever you make of it," says Dennis. "Buy a set of taps and put them on some comfortable old shoes, attend classes, and go to club workshops."

"It's a good aerobic exercise," says Terri Chiarella (3140), who clogs every Wednesday evening at the Double C workshop. Cloggers do a lot of pointing and flexing with their legs and feet to make the click-clack signature of clogging. Tapping sounds are made in time to music with a cadence of 120 to 160 beats per minute. The muscles of the legs, hips, buttocks, and abdomen get a workout.

"You don't need a partner to clog," says Hovey Corbin (7526), a member of Clogging Express, a group that puts on exhibitions. "And you don't need previous dancing skills. It's also a family activity. Everyone can do it, from kids to seniors. One group in the association is called the Golden Girls, and they're in their 80s."

Anyone interested in clogging is invited to attend the New Mexico Clogging Association's Third Annual Convention Aug. 20 at the 4-H Bldg. (1500 Menaul NW). Workshops are from 9 a.m. to 3:30 p.m. Clogging exhibitions will be held during a dance from 7 to 10 p.m.; spectators will be admitted free of charge. Other Sandia cloggers include Shirley Anderson (2813), Paul Beck (9211), Roque Feliciano, Jr. (1221), Virginia Hill (3152), Larry Lukens (2541), Delia Quintana (3732), Debee Risvold (9224), Gloria Williams (3722), and Mark Wilkins (5214).

For more information about clogging and its benefits, call Dennis on 4-7347.

Sympathy

To Frances Roelle (2600) on the death of her father and Donald Roelle (9234) on the death of his father-in-law in Albuquerque, July 18.

To Chris Erickson (6321) on the death of her father in Boston, July 23.

To Farrell Perdreauxville (9131) on the death of his wife in Albuquerque, July 25.

Congratulations

To Penny Webb and Steve Wagner (2858), married in Albuquerque, July 9.

To Juliana Garcia (7250) and Steve Letourneau (7521), married in Albuquerque, July 16.

To Elaine and Gary (3153) Chemistruck, a son, Peter, July 17.

To Veronica (7265) and Eddie Chavez-Soto, a son, Nicoles Daniel, July 31.

No Babies in the Woods, They



College savings start young, according to Beech-Nut Nutrition Corp. Some 58 percent of new parents who called the baby-food company's hotline [recently] already had started saving for their children's education. Average age of the babies: 6.7 months.

Wall Street Journal

Welcome

Albuquerque

Diane Behar (3741)
Kim Law (2853)
Duane Vermeire (2853)

Arizona

Howard Kimberly (5219)

Colorado

Ruth Kinney (2622)

Georgia

Dixon Patrick (5238)

Illinois

Johnny Spraggins (2858)

Kansas

Marcus Craig (2544)

New Jersey

Joseph Ehasz (5142)

New Mexico

Donald Ellis (7000)
John Kelly (3312)



STUDENTS, MENTORS, AND STUDENT SUPERVISORS participating in Sandia's Historically Black Colleges & Universities (HBCU) summer student program, sponsored by the Black Outreach Committee and EEO/AA, gathered recently for a day-long get-together to share information about their universities and colleges and to talk about their summer experience at Sandia. They were joined by 35 local Black high school students and 50 local Black community leaders. In left photo, HBCU coordinator Patricia Salisbury (left, 3510) is shown with HBU student Jesse Sims (6226) and faculty member Ira Graham (6220). Right photo shows (from left) mentor



Tom Henderson (2851), student Jocelyn Wright (6220), mentor Annie Webb (8281), and student supervisor Herb Sutherland (6225). Not pictured: students — Grady Moshay (5249), Melanie Burton (1140), LaTonya Boyd (1261), Vanessa Watkins (5249), Bernard Green (7254), Lisa Cruz (8361), William Pinnix (6514), Shalonda Embry (1245), Greg Barnes (2854), Arthur Watts (2854), Mark Martin (6226); faculty — Tom Whitney (6320), Vedula Murthy (6221), and William Pollard (6223). The HBCU program enables outstanding students and faculty members to work at Sandia during the summer in various scientific disciplines.

Take Note

Jack Hudson (2111), his wife, and son (a muscular dystrophy victim) will be featured on the 1988 Muscular Dystrophy Assn. annual Labor Day Weekend Telethon on TV Channel 13. Julia Gabaldon (3510) will mark her third year as MDA telethon cohost.

* * *

Sandia recently hosted a technology transfer workshop on the causes and prevention of melt/ water explosions — explosions that occur in the aluminum, paper, phosphorus, and other metals industries, and in nuclear power plants. A team of Sandians (Severe Accident Containment Response Div. 6427) supervised by Marshall Berman has been doing extensive research on such explosions since the mid-70s, when the Nuclear Regulatory Commission asked the Labs to study the phenomenon (often called "steam explosions") and its possible threat to nuclear reactors in the event of a core meltdown. As a result of that NRC research — and of increased emphasis on tech transfer — Sandia began a research program for the Aluminum Association in the fall of 1986 with the objective of improving safety for workers in the aluminum industry by gaining a better understanding of the key phenomena of melt/water explosions (see LAB NEWS, July 2, 1987).

Progress in understanding the influence of container surface properties on the triggering of the explosions was presented by Sandia at the workshop, which was attended by 40 representatives from major industries, universities, and other research laboratories. Research programs and results were also presented by representatives from Argonne National Laboratory, the University of Wisconsin, and McGill University.

Retirement Planning

Fred Lancaster of New York Life Insurance Co. presents another seminar on retirement planning on Aug. 17 at 5:15 p.m. at City Center (6400 Uptown Blvd. NE), Suite 590 West. If you plan to attend the session, call Fred on 883-5757.

Ethical and social effects of America's space program will be addressed at an interdisciplinary conference, "The New Wilderness," on Aug. 26 and 27 at UNM. The conference includes speeches, panels, and discussion groups covering a range of ideas and topics related to the space program. Apollo astronaut Frank Borman is a scheduled speaker. Registration is at 9 a.m. in the New Mexico Union Bldg. The conference is free and open to the public. Reg-



LAS AMIGAS BOWLING TEAM won the 1988 national championship in the 17th National Employee Services and Recreation Association tournament. This was the first time Sandia teams competed in the tournament — 328 teams participated nationally. Team members are (from left) Sally Frew (3523); Juanita Evans (6510); Lea Long, wife of Jerry (7111); Lin Ohrt, wife of Steve (1512); and Dora Gunckel (6400). Dora, secretary of the Sandia Bowling Association, invites all women interested in bowling to drop by the Coronado Club and join the Association, part of the Sandia Employees Recreation Program. "We play for fun and exercise, and everyone's welcome," she says.

istration forms are available at the LAB NEWS office in Bldg. 814, Rm. 1.

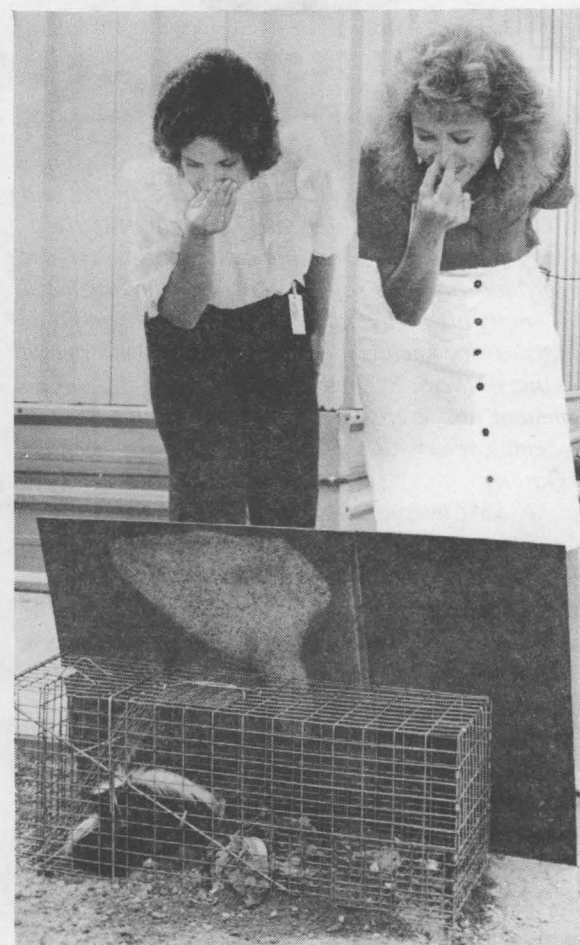
* * *

There are about one hundred 2' by 3' Sandia flags gathering dust in the LAB NEWS storeroom. Organizations that could use one (or more) of these Sandia-blue and white flags for company display (not for personal use) should stop by the LAB NEWS office in Bldg. 814.

* * *

If you're a balloon chaser, sign up for a spot on AT&T's balloon ground crews for the Albuquerque International Balloon Fiesta Oct. 1-9. Ten to fifteen volunteers are needed to help out on Fiesta weekends. For more information and to sign up, call Wanda Sanchez at AT&T in Albuquerque on 291-4588.

ABOUT AS CLOSE AS THEY WANTED TO GET, Wendy Falls (7525, left) and Kathleen Hovorka (7523) check out an uncleared visitor inside Tech Area I. Pepe le Pew, as he was (of course) known, created an occasional aromatic aura inside T-32 (a temporary building east of Bldg. 880) during his week-long stay under the building. After the pest-control brigade trapped him last week, the two secretaries bade him a tearful, or at least eye-watering, farewell as Pepe awaited all-expenses-paid transportation to the nearby mountains.



Sandia Hosts Statewide ITV Meeting

An ITV (instructional television) network capable of delivering high-quality education to and from every part of New Mexico — that's the goal of 76 people who gathered recently at Sandia for a meeting organized by Education and Training Dept. 3520.

Representing universities, labs, colleges, technical-vocational institutes, public schools, and industries throughout the state, they met to review the work of the ITV Task Group headed by Stan Love (2613) — and to plan future efforts.

State Senator Wendell Cosner (member of the legislature's Business, Economic Development, and Telecommunications Committee) and three members of the Commission on Higher Education, including John Finger (6252), also attended the meeting.

The meeting was hosted by Dick Schwoebel (1800), chairman of Sandia's University Education Program Committee (which reports to the Education Committee, headed by Everet Beckner, 5000.)

As early as the spring of 1985, Dick — and others — had envisioned a statewide ITV network. "It was clear at the outset of our ITV program," says Dick, "that the organization and expertise we were developing could be utilized on a statewide scale — that, in fact, the ITV concept could impact all levels of education in New Mexico in a cost-effective manner."

By the fall of that year, Maureen Baca (then 3521 supervisor, now 3510) had organized a small group of representatives from New Mexico's universities, labs, and businesses — potential ITV users and providers that became known as the ITV Working Group.

Sandia's Successful ITV

Also in the spring of 1985, Sandia's INTEC (IN-hours Technical Education Courses) program, coordinated by Dept. 3320 and ramrodded by Stan (then 3522), offered its first ITV course — a course on robotics beamed "live" from UNM. And a plan for greatly expanding the number of ITV courses was devised by the ITV Management Subcommittee chaired by Herman Mauney (7200).

By the spring of 1987, INTEC's calendar showed broadcasts of 23 courses — 18 from UNM and five from NTU (National Technical University, a group of 21 universities throughout the country); Sandia's ITV hardware had become a part of an interactive video system that included UNM and Los Alamos National Laboratory.

"Sandia's ITV experiment with UNM was clearly a success," recalls Dick. "It updated and modernized technical education at the labs and was providing convenient, cost-effective continued education for our staff, allowing them to take UNM courses without leaving the work site.

"Those of us in the ITV Working Group felt strongly that the human resources and ITV hardware developed for the link-up between Sandia and UNM had the potential for evolving into a statewide network of universities, laboratories, and industries —



DICK SCHWOEBEL (1800, center), chairman of Sandia's University Education Program Committee, hosted the Statewide ITV Meeting held recently at Sandia. Seventy-six representatives from schools, laboratories, and industries throughout the state attended the meeting organized by Education and Training Dept. 3520. Shown with Dick are Gary Tydings, director of Instructional Television at UNM, and Tom Cyrs, director of the Center for Educational Development at NMSU.

a network that could deliver efficient, high-quality education throughout the entire state."

To bring the vision of this statewide network a step closer to reality, the ITV Working Group last fall asked Stan to put together an ITV Task Group. Its mission would be to assess the needs of potential ITV users and providers throughout the state and to design a network to meet those needs.

Stan recruited Task Group members from all areas of the state.

"Fortunately, that wasn't too difficult," he says. "People generally are enthusiastic about the idea of a statewide ITV network."

Dividing the state into five geographical regions, Task Group members formed interview teams who visited a large sampling of industries, institutions, and associations in each region to survey their views about the potential uses of ITV in their areas.

"To get a true representative sampling of potential users in the state, we used a sampling plan devised by the New Mexico Department of Labor," notes Stan. "Our sample included 44 companies in Albuquerque, 77 companies in other cities, 24 trade and professional associations, and 23 post-secondary educational institutions.

"The interview teams used an excellent needs-assessment survey developed by Belinda Holley [3522]. It enabled them to come back from their interviews with hard data on the needs of potential users and on the educational institutions throughout the state capable of providing appropriate education and training courses. So, for the first time, we had solid information on which to base our design of an ITV network to link users and providers."

Poultry and Professionals

Most of the needs revealed by the interviews were not surprising: Public schools throughout the state would like to receive ITV courses they don't have access to now. Some schools would like to establish programs for people needing special training, such as those employed in the declining oil and gas industry who need to be retrained in other fields.

Many teachers and accountants living near the state's borders who now travel to cities such as El Paso, Phoenix, and Denver for certification courses would like to stay in New Mexico for their training. Holloman Air Force Base, White Sands Missile Range, and the National Aeronautics and Space Administration Test Facility (near Las Cruces) would like to have access to courses in technical and general education, skills training, and professional development.

But the interviewers also discovered some unusual needs. One was that of a Clovis businessman. He wants training courses in how to raise chickens — and in how to process and package them.

"That's not as odd as it sounds on the surface," says Stan. "He's starting a poultry-processing business that will eventually employ 3200 people. That's a lot of jobs — and a lot of people needing training."

A plant in another city, which employs several hundred people who make women's hosiery, is also interested in ITV training courses. Many of the employees are legal immigrants from Mexico with unique training needs. Besides training in electronics, computers, and secretarial and bookkeeping skills, they need general education courses such as reading, math, writing, and English as a second language.

"Many industries and businesses throughout the state are interested in short courses in trade skills, safety, and industry-specific subjects," says Stan. "They are particularly interested in having courses presented on-site [via ITV] because employees would spend less time away from the job. Management and supervisory training is also very high on their needs list."

Not Whether, But When?

"Overall, the responses to interviewers were overwhelmingly positive," Stan notes. "The usual response was not *whether* ITV, but *when*."

When? is a question Stan can't answer precisely yet.

"But the network is well on its way," he says. "The ITV Task Group's needs-assessment surveys have all been compiled and analyzed, and we've used the data to define the technical requirements of the network — both for the near term and for growth through 1995.

"We've turned our lists of technical requirements over to an Engineering Task Group headed by Fernan Bibeau, director of engineering at KOB-TV. Fernan knows every hill and microwave tower in the state and will do a good job. Don Morrow (3522) is helping out in that group, too. It's already at work identifying practical technologies for the network — with alternatives and estimated costs."

The Next Step

"The work of the ITV Task Group has considerably hastened the day when the entire state will be interconnected with instructional television," says Dick. "It has pointed the way to unifying and expanding the existing system so that it will serve more people in more ways in every part of the state.

"The current system — which already links the Labs, UNM, NMSU, and NM Institute of Mining and Technology through an optical-fiber network — will eventually make it possible for engineers at Sandia, Los Alamos, Honeywell, and Signetics to receive courses at their work sites from universities throughout the state.

"The ITV Working Group will be presenting the Task Group's results and recommendations — and those of the Engineering Task Group — before appropriate legislative committees later this year," continues Dick.

"We are optimistic that our presentations will be well received — and will bring a statewide ITV network another step closer to reality." ●DR

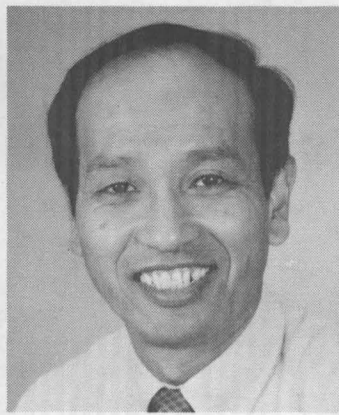


STATEWIDE ITV MEETING coordinator Ed Gullick (3521) chats with Stan Love (2613), chairman of the ITV Task Group, during a break in the day-long meeting.

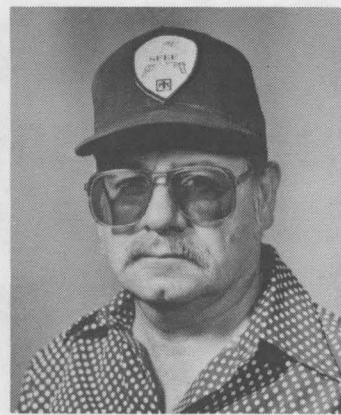
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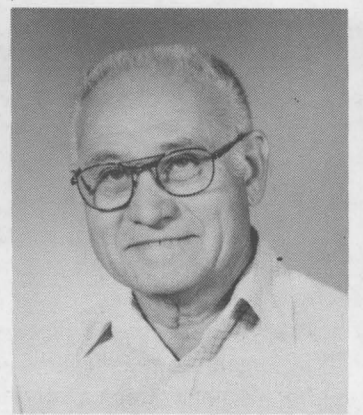
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Ray Ng (8445) 20



Leo Armijo (7818) 35



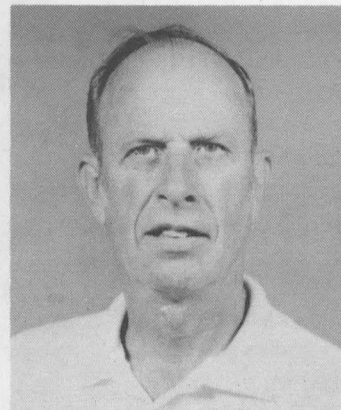
George Adkins (9143) 35



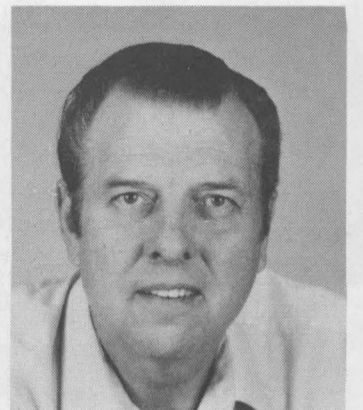
Chris Padilla (2831) 40



Mel LaGasca (8236) 20



Carl Sisson (1513) 30



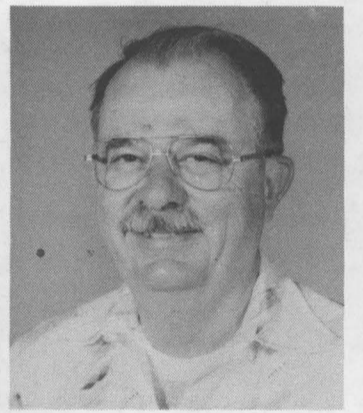
Jon Meeks (8354) 25



Bill Crawford (5122) 30



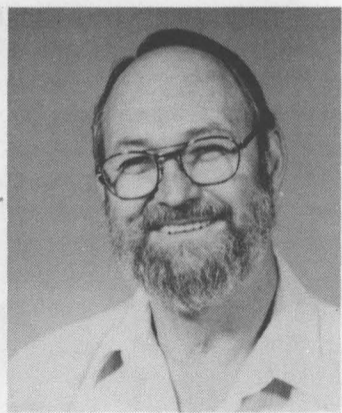
Jim Smith (8511) 30



Charles Sain (5154) 35



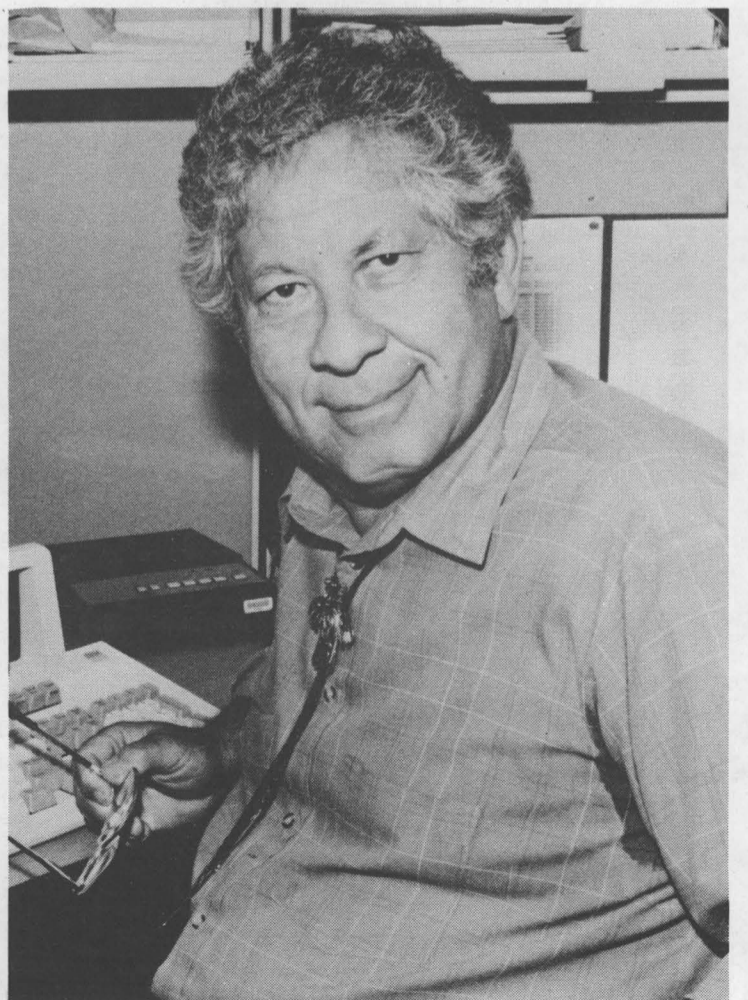
John Marion (8274) 30



Bob Morris (1124) 25



John Daniel (8535) 30



Bob Schowers (7213) 40



Charles Stockley (8281) 35



Jim Carrell (8445) 35



Jose Castillo (3423) 20

Fresh Fish Frolic: Feast on First-Rate Fare

PURE PISCINE PLEASURE is yours tonight on the patio. Manager Sal and the kitchen crew went fishing all week and brought back a treasure trove of delectable delights from the sea: shrimp, crab, lobster, trout, and shark. (They also made a movie — "Jaws XI.") Choose whichever one you like best, and team it up with both salad and pasta bars. Afterward, dance under the stars to the smooth sounds of the Roland DeRose band from 7 to 11 p.m.

BINGO FEVER: Everyone's got the disease, and the next chance for a cure is next Thursday (Aug. 18) when play resumes on the patio. Cards go on sale at 5:30 p.m., and the early-bird game starts at 6:45. Low-cost soup and sandwiches available throughout the evening — and some fabulous cash prizes and door prizes will go to a few lucky folks.

T-BIRD ROADRUNNER RVers take to the highway again Aug. 22-26; this time they're heading for Cochiti Lake. More info from wagon masters Duane Laymon (822-1749), Tom Brooks (344-5855), or Joe Shelby (299-4605).

Another Thunderbird contingent — those cunning and crafty card sharks — gets together for a gaming session on Aug. 25, starting at 10 a.m. Head dealer Jim McCutcheon's putting out an urgent call for pinochle and hearts players, so if either is your specialty, come out and join the fun. As usual, there are free refreshments and door prizes.

C-CLUB JUNIOR BOWLERS get organized for the Fall and Winter leagues at a meeting next Tuesday, Aug. 16, from 7 to 8 p.m. on the patio. Here's a chance for prospective members to learn more about

the upcoming season and to sign up; free popcorn and soft drinks are there for the asking. Members' children, ages 7 through high school — and of any skill level (beginner through advanced) — are welcome, says honcho Ciss Kelly. Give Ciss a call at 255-8011 for more info.

BEGINNING NEXT MONDAY (Aug. 15), renovation starts in the area housing the lunchtime serving line. Picking your way through the hard hats would be a trifle difficult, so there'll be no lunch line until the redecorating is complete — about Sept. 13. The *good* news is that the patio's Mexican buffet and snack bar are open during the middle of the day, so there's plenty of fine food available. Enter the patio through the pool entrance near the tennis courts.

BACK AT THE RANCH (no, we're not kidding) plays the shuffle-'n-stomp music next Friday night (Aug. 19) from 5 to 9 p.m. Beforehand, enjoy a mouth-watering Mexican buffet featuring goodies like burritos, enchiladas, carne adovada, and other traditional (New) Mexican dishes. Start the weekend right with your favorite libation (at special prices) during happy hour at the patio bar from 4:30 to 7.

CELEBRATE SUMMER SOON — it won't last forever, you know. Come out to the pool/patio area (open until 8 p.m.) any Wednesday evening this month for Family Night fun. The snack bar and grill are open, so you can kiss the kitchen chores goodbye for the evening. Regular admission rates: free for pool-pass holders, \$1.50 for members without passes, and \$2.50 for guests.

Fun & Games

Golf — SGA went to Four Hills Country Club on June 30 for a Skill Buster Golf Tournament. Format was two-man best ball. Winners were: A Flight — Ted Garcia (2632) and Joe Gonzales (2631); B Flight — Mike Eaton (5252) and Reynold Tamashiro (7412); and C Flight — Dick Chapman (6223) and George McClafin (3437).

The Mountain Classic Golf Tournament was held July 15 at the Los Alamos County Golf Course. Format was two-man total modified Stableford. Winners were: A Flight — Pres Herrington (9243) and Charles Salazar (7485); and B Flight — Don Robbins (2811) and Howard Cilke (9212).

In other SGA news, Robert Nelson (ret.) scored a hole-in-one on Hole 9 (185 yds.) at the Arroyo Del Oso Golf Course on May 16. Eli Perea (2543) won his flight (5th) in the Albuquerque City Championship held over the July 4 weekend at the Arroyo Del Oso Golf Course.

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Tennis — The Sandia Tennis Assn. (STA) and the Coronado Tennis Club (CTC) held a tournament June 25-26 at the Coronado Club. Netting wins in the finals were: Women's Singles — Shannon Longmire over Terry Martinez (1250); Women's Doubles — Terry Martinez and Helen Wilson over Judy Hansen (1420) and Pat Mefford (6442); Men's B Singles — Gerald Smith (2564) beat John Klauck; Men's B Doubles — Pat Fleming (9243) and Roy Palmer (2635) defeated David Sealey (154) and Mike Torneby (3426); Men's A Singles — Kevin Maloney (6412) beat Ralph Tissot (1822); and Men's A Doubles — Kevin Maloney and Tim Draelos (9242) over Ken Hanks (7866) and Mark Tucker (5246). Tim Draelos and Terry Martinez were tournament directors.

The next tournament will be held Sept. 3-5. Events include Men's and Women's Singles and Doubles and Mixed Doubles. For more information, call Steve Wagner (2858) on 4-6120.

Events Calendar

- Aug. 12-28 — "Santa Fe Sunshine," adult comedy by Preston Jones, examination of local New Mexico art scene and its colorful characters; 8 p.m. Fri.-Sat., 6 p.m. Sun.; Vortex Theatre, 247-8600.
- Aug. 12-31 — "Dinosaurs in Action," exhibit of four mechanical dinosaurs: adult and juvenile triceratops, brontosaurus, and tyrannosaurus; 10 a.m.-5 p.m., NM Museum of Natural History, 841-1374.
- Aug. 12-Sept. 18 — Exhibit, "Garo Z. Antreasian, A Retrospective"; 9 a.m.-4 p.m. Tues.-Fri., 5-9 p.m. Tues., 1-4 p.m. Sun. (reception and gallery talk by artist, Aug. 23, 5:30 p.m.); UNM Art Museum, 277-4001.
- Aug. 12-Oct. 10 — "Spectacular Vernacular," traditional desert architecture of West Africa and Southwest Asia, exhibit circulated by the Smithsonian Institution Traveling Exhibition Service; 9 a.m.-4 p.m. Mon.-Fri., 10 a.m.-4 p.m. Sat.; Maxwell Museum of Anthropology, 277-4404.
- Aug. 13 — Summerfest '88, Polish Night: food & entertainment; 5-10 p.m., Civic Plaza, 768-3490.
- Aug. 14 — Arts in the Parks: Third Annual Jazzfest, featuring Cunga Boogie, Jon Gagen and Hear & Now, Melodius Thump, and the Albuquerque Jazz Orchestra; 1-4 p.m., Roosevelt Park (Coal & Sycamore SE), free, 764-1525.
- Aug. 14 — Zoo Music: NM Jazz Workshop presents the Sofas and the John Clark Sextet; 1:30 p.m., Rio Grande Zoo, 848-1370.
- Aug. 15 — San Antonio Feast Day: Corn dances at Laguna and Zia Pueblos, 843-7270.
- Aug. 17 — Zoo Music: Bayou Seco, Cajun and Spanish music; 7:30 p.m., Rio Grande Zoo, 848-1370.
- Aug. 19-21 — Antique Show & Sale, antiques and collectibles from across the nation; 12-9 p.m. Fri., 12-8 p.m. Sat., 12-5 p.m. Sun.; Albuquerque Convention Center, 268-5122.
- Aug. 20 — Summerfest '88, German Night: food

- and entertainment; 5-10 p.m., Civic Plaza, 768-3490.
- Aug. 20-21 — Master Gardener Educational Fair: demonstrations, displays, lectures, and plant clinic; 10 a.m.-4 p.m., Albuquerque Garden Center (10120 Lomas NE), free, 296-6020.
- Aug. 21 — Arts in the Parks: outdoor pops concert, featuring Bayou Seco, Svirka, Albuquerque Philharmonia Orchestra, and Buster Willow; 4 p.m., Inez Park (Wisconsin & Cutler NE), free, 764-1525.
- Aug. 21 — Zoo Music: Cuicani, Latin American

- music (rescheduled from Aug. 3); 2 p.m., Rio Grande Zoo, 848-1370.
- Aug. 26 — Zoo Music: New Shtetl Band, Eastern European klezmer music; 7:30 p.m., Rio Grande Zoo, 848-1370.
- Aug. 26 — Crownpoint Rug Auction: 3-6:45 p.m. rug viewing, 7 p.m. auction; Crownpoint Elementary School, 786-5302.
- Aug. 26-31 — Ehecatl Aztec Dancers, "flyers" soar down and around 80-foot pole; 7 p.m. weekdays, 6 & 8 p.m. weekends & Labor Day; Indian Pueblo Cultural Center, 843-7270.



MOWING THE "GRASS" in outlying areas south of Area I takes care of a couple of problems, according to Chuck Wells, supervisor of Remote Areas Maintenance and Test Support Div. 7818. First, that perennial pest, the tumbleweed, doesn't grow in mowed areas; instead, native grasses and other desert flora take its place. Second, mowed grass growing on the shoulders of dirt roads eliminates the need for grading (to stop erosion). Here, Richard Garcia (7818) takes care of some vegetation beside the rocket sled track in Area III.