

New 'Eyes' for Nondestructive Testing Lab

You look at a lot of film in Sandia's Nondestructive Testing Laboratory.

The film density of radiographs is directly related to the density of the material through which the film was exposed — the more transparent the subject the greater the resultant film density. And film density is a factor in pinpointing the kind of internal defects for which you nondestructively test — minute cracks, casting flaws, poor connections, porosity of materials, improper potting, etc. For years, the expert (but variable and subjective) eyes of the radiographers have been used to interpret the density variations registered on the films.

Recently, the Nondestructive Testing Laboratory in Bldg. 860 added a capability — a new set of "eyes" that offer a different way of seeing inside a test item. The instrument is called an image analyzer, and its components were built to Sandia specifications by several suppliers.

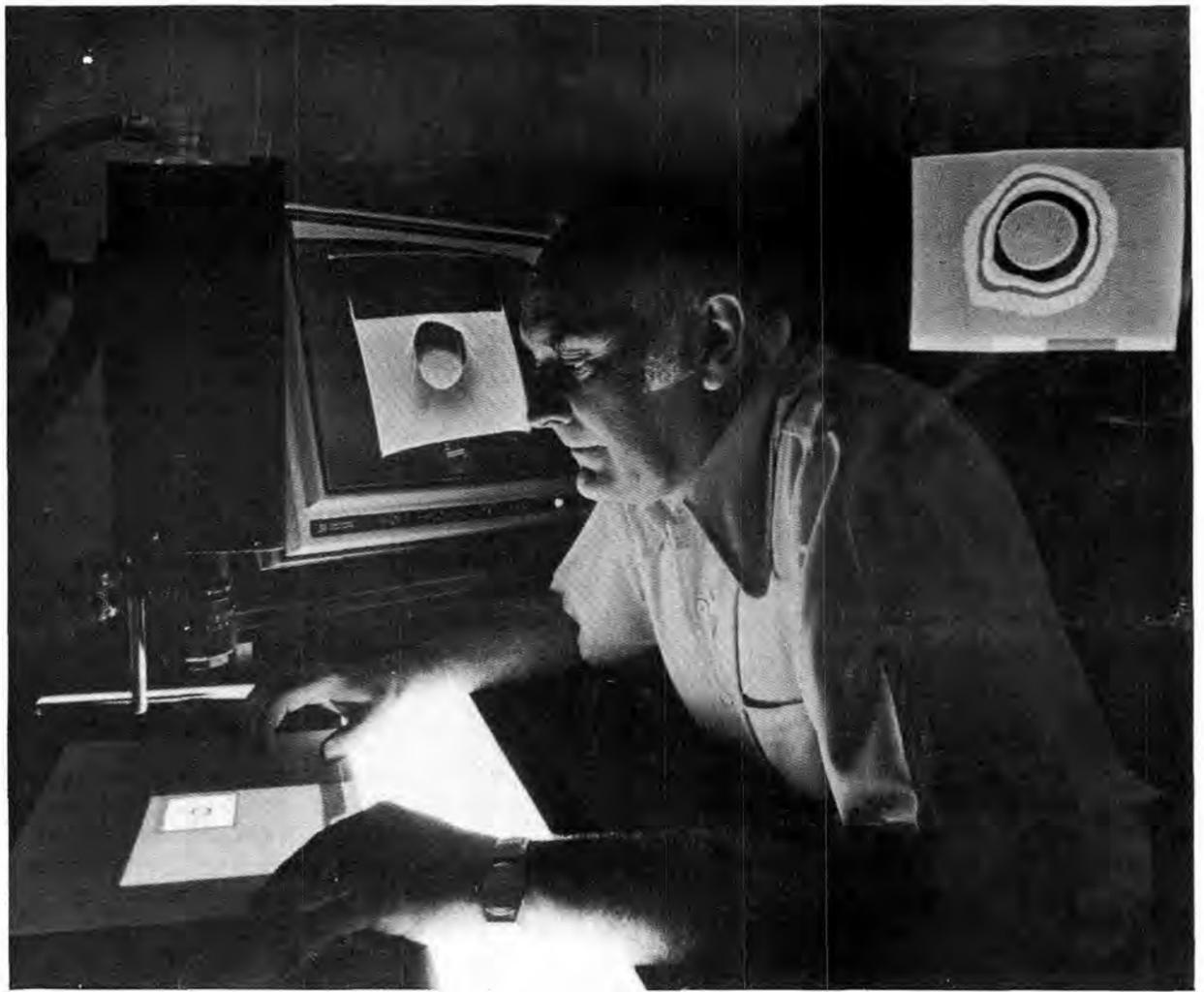
At first glance it looks like a couple of TV screens showing a wild psychedelic slide exhibit. Then Bill Mottern (9351) explains how he is manipulating the system, why he's doing it and what the display tells him.

In essence, radiographic film is scanned by a television camera which transmits the image into an image-analyzer control unit with multiple manual controls and numerous output options.

The signal is simultaneously transferred to a three-dimensional graphics screen and a pseudocolor television monitor.

Exposed photographic film is an analog medium — that is, it produces a smoothly continuous gradation of tone from black to white through an infinite scale of grays. On the color monitor of the image analyzer, this

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BILL MOTTERN (9351) demonstrates new image analyzer system in Nondestructive Testing laboratory. Photographic image of test item can be manipulated through a TV camera, a mini-mini computer, a three-dimensional graphics screen and a color TV monitor to gain desired information.

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

Splat!

Predicting Deformation with Eulerian Computer Codes

The study of ballistic penetration of armor plate is not new. But precise prediction of the degree of such penetration and kind of deformation of the plate was not possible until recently. A two-dimensional Eulerian hydrodynamic computer code, developed by Sam Thompson (5166), now can predict the effect of impact by high velocity projectiles with greater accuracy than heretofore possible.

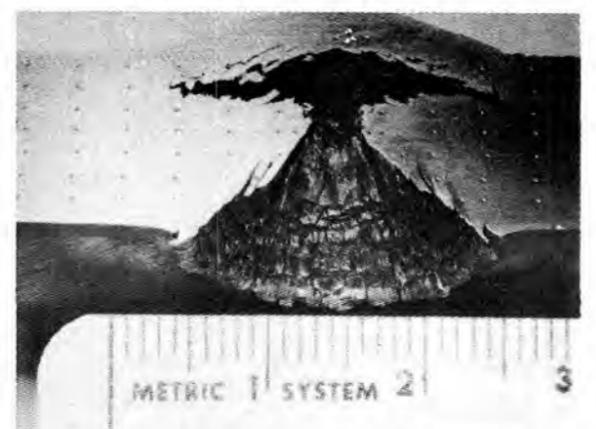
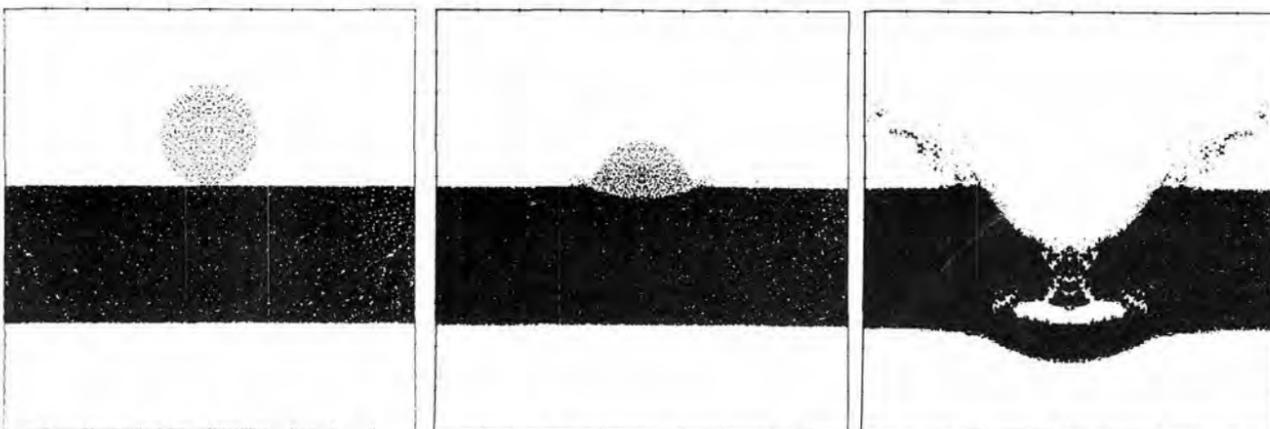
At 17,000 feet per second, even a small (3/8 inch diameter, 1/2 gram) nylon ball can make a real impression on a half-inch steel

plate. But how much and what kind? "That's what the code tells us," says Larry Buxton (5162) who worked with Sam on the problem. "We now can state that a high velocity, high deformation event can be adequately predicted. Ultimately, this should reduce the need for costly and very difficult experimentation."

The general purpose "hydrocode" (dubbed CSQ) numerically solves the coupled equations of motion and energy flow. Programs which can handle two-dimensional problems — such as cratering by explosives —

have existed for some time, but they lack the sophistication of CSQ. One major feature is the multiphase thermodynamic equations of state. This feature proved to be the key to solving the nylon ball/steel plate impact problem. A 130 kbar polymorphic phase change, typical of iron, was cranked into the code. "Calculations made with and without the phase transition lead to quite different fracture behavior," says Larry, "and no other code has this capability. The conical spall region seen in the experimental sample is

(Continued on Page Two)



SIMULATED DEFORMATION of steel plate by nylon ball. Series, drawn by computer, shows ball entering and deforming plate at impact time, and 1 and 18 microseconds later.

ACTUAL DEFORMATION of steel plate by nylon ball. The ball was vaporized by the impact.



Supervisory Appointment

GEROLD YONAS to manager, Plasma and Electron Beam Physics Research Department 5240, effective July 1.

Gerold joined the Laboratories in April last year as supervisor of the newly-created electron beam physics division. Before coming to Sandia he had headed the electron beam research department for Physics International Co. in San Leandro, Calif.

He received a BS degree in engineering physics from Cornell University in 1962, and was awarded a PhD in engineering science, with a minor in physics, from the California Institute of Technology in 1966. He is a member of Tau Beta Phi, Sigma Xi, and the American Physical Society. His leisure time activities include playing the clarinet, jogging, photography and working in the yard.

He and his wife Jane have a six-year-old daughter Jill and live at 1416 Catron SE.

Recreation Notes

FUN & GAMES

Lillian Mancuso (3321), tournament chairman for the Sandia Golf Association (Women), announced the results of the recent Los Alamos tournament: Low gross winner was Molly Ellis (4712) with Rosalie Crawford (1) runner-up. Rose Hainlen (ret.) won the low net event and Ann Michele (7500) was runner-up. Dora Montoya (1542) was the low gross winner in the "Mini" 9-Hole tournament.

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&
in livermore lorena schneider does all

Sandia Reaffirms Support Of Guard, Reserve Forces

President Morgan Sparks recently reaffirmed Sandia's recognition of the nation's need for strong Guard and Reserve forces by signing a Statement of Support for the Guard and Reserve. The Statement, formulated by the National Committee for Employer Support of the Guard and Reserve, is a pledge whereby employers agree to encourage the participation of their eligible employees in Guard and Reserve programs.

In signing, Mr. Sparks specifically stated that:

1. Employee's job and career opportunities will not be limited or reduced because of their service in the Guard or Reserve; and
2. Employees will be granted leaves of absence for military training in the Guard or Reserve without sacrifice of vacation time.

Goal of the National Committee for Employer Support of the Guard and Reserve is to obtain the support of every employer in the United States, large and small, public and private, in facilitating employee participation in the Total Force role of the Guard and Reserve.

The committee was formed to help eliminate one of the reasons for the shortages of manpower in our Guard and Reserve units. Today, any shortages are critical because under the Total Force concept, with no draft, the Guard and Reserve provide immediate support to our national defense structure at a cost of approximately five percent of the defense budget.

The Statement of Support is a major part of the overall program the National Committee for Employer Support of the Guard and Reserve has instituted to improve relations between members of the reserve components and their employers to assure Guardsmen and Reservists the freedom and encouragement to maintain their two careers.

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'New Eyes'

scale of grays can be divided into eight discrete levels and each of these can be assigned an arbitrary color. Then you have a new kind of picture that can be more easily interpreted in many instances.

The color levels can be expanded or compressed as you search through the values of the film density for the desired information. The assigned values are digital (if black equals 1.000, then white is 0.000 and middle gray is 0.500). This allows quantitative analysis, particularly valuable in the analysis of the new composite materials when you want to know, for instance, the percentage of boron fibers in a boron-aluminum composite sample.

There are X and Y axis cursor lines on the color monitor screen which can be moved to pinpoint any spot on the image for digital readout. These electronically generated cursors also can be used to give you a density cross-section, vertical or inverted. Thus, the film containing the original image offers many bits and pieces of enhanced information which fit together in patterns that become obvious at a glance to a skilled radiographer. Similar enhancement methods can be applied to other nondestructive testing data displays such as thermographs from infrared scans.

"We used to have to wait days for this kind of information from our computer enhanced data displays," Bill Mottern says. "Now we can have it about as quickly as we can develop film. The image analyzer has become an extremely useful tool in the couple of months we've used it and we're continually finding new applications throughout the Nondestructive Testing Laboratory." • dg

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Computer Codes

predicted only when the transition is properly treated." In the series of pictures produced by the code, the cone material has fractured but has not yet fallen out because of a relatively low velocity.

The nylon ball/steel plate calculation consumed some 10 hours of computer time. In spite of the speed of the CDC 6600, the time is long because many factors — velocity, displacement, stress, temperature, etc. — that describe the behavior are slightly changed at each pass through a loop which advances the event through time. In this calculation, about 130,000 bits of information are continuously being updated.

"Since the code can crank out horrendous volumes of data while determining the response, good plotting packages are necessary," says Sam, "and we have them." Perhaps the most graphic are the slow motion movies that depict behavior over a period of time. Illustrations accompanying this article indicate only one of many types of problems that can be treated with the code in its present stage of development. Further refinements are being made to improve agreement with experimental data.

Both Sam and Larry are in the Solid Dynamics Research Department. • bh

Congratulations

Mr. and Mrs. Celedon Gabaldon (7631), a daughter, Laverne Rose, June 27.

Retiring



Bill Moffat (1242)

Retarded Glide Bomb Patented

Explorations into new methods of low altitude bomb delivery have led to a patent awarded to the AEC for a retarded glide bomb invented by Arnie Rivenes of Systems Development Division 8363.

The design reduces significantly the loading on the bomb at impact with the target, while still providing a capability for low level delivery. The technique is an alternate to the laydown method which involves the deployment of a parachute after bomb release from the aircraft to reduce the bomb's velocity before impact. However, the laydown delivery technique continues to impose considerable impact loading on the structural parts and components of the bomb.

Basically, the new concept is a method of flying the bomb to a higher, predetermined altitude after it has been released from the delivery aircraft and then deploying a large parachute to provide a low velocity descent and impact on the target. The lifting action is attained by opening a pair of wings on the bomb immediately after ejection from the aircraft. Drag forces from the wings and a small parachute deployed after release cause the bomb to slow down sufficiently so that as it glides upward it can safely separate from the delivery aircraft.

The lifting surfaces or wings on the bomb are unique in that in their retracted position they become a part of the bomb casing and shape. They are hinged in such a way that when rotated into position they assume an angle of attack to the air flow, causing a lifting force. Wind tunnel testing showed that "drooping" one wing relative to the other caused a rolling force. This characteristic can be used as the means for controlling the bomb trajectory.

Arnie says the development work was especially exciting because not only did it involve a totally new concept but allowed experimenting with both "flying bomb" models and full-scale units. "We began with one-fourth scale models, using simple foam shapes with sheet metal wings and tail surfaces glued or wired on," he explains.

"The model needed fairly high launch velocity so the most economical way was to launch from a speeding pickup truck," continues Arnie. "We decided the best place

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LEAP (Livermore Employees Assistance Plan) chairman Bill McGuire (8431), center, and committee member Carl Schoenfelder (8313), right, accept a certificate of merit from the American Cancer Society on behalf of Livermore employees who contribute to the national health organization through the Labs' annual LEAP program. Making the presentation is John Conrad, chairman of the Livermore/Amador Valley Chapter and member of the board of directors of the Alameda County Unit of the Cancer Society. The award expresses "appreciation for helping to save lives from cancer."

for these tests was the parade grounds located at nearby Camp Parks. I'll never forget the operator of the truck roaring down the field to reach 60 miles an hour for launch conditions, and then after launch having to slam on the brakes to avoid running off the end of the field. The models flew and it got us started on the project." • Is

Livermore Credit Union Meets July 26

Annual meeting of the Livermore members of the Sandia Laboratory Federal Credit Union will be held Thursday, July 26 at the Sunol Country Club beginning at 7:30 p.m.

A small gift will be presented at the door to those attending. At the conclusion of the meeting, a drawing will be held for a color television set to be given to the holder of the Lucky number. Refreshments will be served after the meeting.

Take Note

Bob Ware (8161) has been elected vice president of the national Society for the Preservation and Appreciation of Antique Motor Fire Apparatus in America. Comprised of 12 regional chapters, the organization is devoted to the preservation, restoration, and operation of fire service apparatus and equipment. Bob is past president of the California chapter, and has been active in sponsoring motorized contests at local firemen's musters.

* * * *

Marlin Pound (8214) won his flight 7-0 to take a first place trophy in the annual table tennis tournament sponsored by the LLL Recreation Association. Open to both LLL and Sandia employees, 32 men competed in four flights on a round-robin basis.



INVENTOR Arnie Rivenes (8363), center, displays a scale model of retarded glide bomb with Don Baumann (8434), right, who was responsible for the design layouts of the wings (shown in extended position) and actuator mechanism and "Ollie" Olivotti (8153) who worked on the fabrication and assembly of the test vehicles.

Charles Barncord Heads UCF Budget Committee

Charles (Barney) Barncord, director of Design Information Center 7600, is going into his second year as chairman of the United Community Fund's Budget Committee. He has been a member of the committee for six years. It is one of the most responsible jobs in the city's entire social and welfare service programs. The budget committee's prime responsibility is to see that contributors to UCF get their money's worth in terms of services provided.

"We like to think," Barney says, "that the people of Albuquerque who donate to UCF actually receive a dollar and ten cents of value for every dollar contributed."

The reason for this, he continues, is because of the hundreds of volunteers who freely give their time and effort to the operation of the 32 agencies which operate with UCF funds.

"Ours is a great system, the American system," Barney says, "we are a generous people and we take care of our own — those who are in trouble and need help. A government welfare system which provided the services of our volunteer agencies would cost the taxpayer twice as much. I can't prove that. It's just a gut feeling. Volunteers who do the job are dedicated. They work for nothing and they do an outstanding job because they care. They have their rules and regulations but red tape doesn't exist. If a person needs help, UCF volunteers and staff find a way to provide that help."

As a member of the budget committee, Barney can speak with authority. Members become knowledgeable about every detail of the operation of the UCF agencies. An expense sheet means much more than an accounting of funds spent. Members know what those dollars mean in terms of assistance provided, therapy given, counseling, recreation, child care and emergency relief.

Currently the budget committee is looking at the requests from the UCF agencies concerning needs for next year. Preliminary budgets are now being formulated. This information, combined with the UCF's campaign organization's estimate of the



R.S. KERN (4100) AND C.R. BARNCORD (7600) serve on the United Community Fund's budget committee. Barney is entering his second year as chairman.

economic health of the community plus the Community Council's survey of the city's needs weighed against state and federal programs, determines the goal for next year's UCF campaign.

The 1973 UCF campaign raised \$1,590,000, including \$304,000 pledged by Sandia Labs employees. With rising costs and increasing needs, next year's goal is bound to increase. After the drive in October, the budget committee begins its nitty-gritty work.

"There is never enough money for everything," Barney says. "We have to be realistic, we have to be humanitarians, and ultimately, we have to allocate the money." After a series of meetings (12 hour sessions for more than a week with representatives of each of the UCF agencies) the budget committee sends its recommendations to the UCF board of directors for approval.

"We cannot approve a deficit budget,"

Barney says, "and we have to examine very carefully the estimates of anticipated income of each agency. There are fees that each agency charges and there are private gifts to agencies which must be considered. We have to look at duplication of services and we have to know what state and federal programs provide. It is a trying time deciding the final budget."

Still, he admits, in spite of the hard work, the long hours, the tough decisions, there is tremendous personal satisfaction in doing the job.

"It is necessary," he says, "and important. If the people of Albuquerque are going to support the United Community Fund, they have to have assurance that their gift dollars are being spent well and wisely."

The mix of the membership of the budget committee is a cross section of government, industry, professional and concerned citizen representation. Twenty people serve on the committee. Each is assigned one or two agencies as his own responsibility. He becomes intimately knowledgeable about their operations, services and particularly finances. In addition to the budget committee time, the volunteer member spends time at "his" agency.

Bob Kern, Comptroller 4100, is one of the newer members of the budget committee. He has served since May 1972. His assignment is to work closely with the Red Cross and the National Council on Alcoholism.

"Albuquerque's UCF enjoys a high level of community support," he says. "This is gratifying, and it is a pleasure to work with the outstanding UCF administration and staff." •dg

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Tinier Tumbleweeds

Eeny, Meeny, Miny, Mow



PETE ORTIZ cuts a wide swath — about five feet or so. He's mowing the weeds in Area III as part of Division 7518's mesa maintenance program.

Blade the weeds. Lots of dust. Spray them. Not ecologically sound. So mow.

Find a surplus rotary mower (as Fred Brown, 9334, did); modify it (as Warren Arthur, 7518, did); and mow the weeds down (as Pete Ortiz, 7518, does).

Chuck Wells, supervisor of Remote Areas Maintenance Division 7518 and Herb Gentry, section supervisor, agree that the mower is a cheap way to get rid of weeds but leave enough cover to prevent erosion and dust.

The mower is basically a large economy size rotary lawn mower. It's pulled by a small standard farm tractor and is powered by the tractor's power take-off unit.

The mower has already proved itself at the laser facility; the tracking cameras now have a chance to follow the target without weeds interrupting their view.

"If the mower works out well in other areas, we'll try to locate another one or two," says Chuck. "And, next fall, the tumbleweeds blowing into Area I should be midgets." •bh

Gas Economy

Going Farther On Less



Gil Weaver plus light show difference between clean and dirty air cleaner. Dirty filter reduces gas mileage.

Is there one simple thing any car owner could do to get better mileage?"

Sure — check the air filter."

"But I do — and I change it every 12,000 miles like the manual says."

"But the manual doesn't tell you that you can drive from here to Amarillo through a sand storm, or follow a car closely on a dirt road for a while, and need a filter change even though the filter is relatively new. Shine a light through the paper folds of the filter and you can tell if the filter is dirty. If it is, there's less air getting to the engine, which means a richer mixture, which means less mileage."

Gil Weaver, head of Vehicle Maintenance Section 7554-2, knows his subject. Not counting special purpose vehicles such as fork lifts and the like, his group maintains some 460 sedans, carryalls, and pickups. Pick out one of them — say that '69 Chevy carryall, number 8992. Gil reaches into a vertical file, selects a fairly thick folder, and No. 8992's life history is there before you. "June 9, 1969, mileage 00003, left door sticks, return under warranty." Or "Feb. 7, 1973, mileage 56,112, replace tire right front, perform front end alignment."

Normal life of a vehicle is six years or 60,000 miles, (although there are a number of exceptions) after which it is sold through GSA at its lot on 12th St. N.W. Would-be buyers of the vehicle submit a spot bid, and the high bid gets it. You can't test drive the vehicle, so, in a sense, it's a pig in a poke. On the other hand, because of the regularity of maintenance, you do know that the car has led a pretty good life.

We asked Gill what kind of mileage the motor pool vehicles were getting. "Well, we tuned up that '73 Ford station wagon over there and kept pretty close track. It averaged nine and a half miles per gallon. Of course, that's and eight and it has air conditioning. I think we're getting about 12 with our half-ton pickups. They're mostly sixes. But none of them deliver what you'd call spectacular mileage."

No significant gas supply problems are anticipated for the Motor Pool. On the other

hand the Pool has recently urged customers to practice some simple gas economies while using vehicles or, better yet, walk. Usage of the special GSA blend runs about 26,000 gallons per month. The blend is a 90 or so octane, low-lead mixture. "No lead" was tried for a while, but valves and valve lifters began burning out at an alarming rate, and some lead was then reintroduced into the blend.

Emission controls have undoubtedly affected performance and, Gill notes, the higher operating temperatures occasioned by the controls reduce engine life. "Used to be engines ran around one-ninety degrees. Now they're up to two-forty, and the metal just wears out faster. You know, all those bike riders may have the right idea." • js



Emission control instrument, recently acquired, is checked by Ernie Marquez.



Pete Vigil gives sedan wash-wax treatment.

Mastercare Problems Discussed at Board Meeting

Newly-elected members of the board of directors of the Mastercare health plan are facing some tough decisions in coming months.

Higher-than-anticipated usage continues as a problem of Mastercare. The weekly dollar average claim for the first six months of operation is running approximately twice as much as for the same period a year ago under the Equitable Plan.

For the past four months participating physicians and hospitals have been paid 70 percent of their normal charges.

At a meeting of the board July 3, these problems and others were discussed. The shared responsibilities of the providers of the services and the plan participants were emphasized. The board plans an educational campaign to better inform participants of the nature and features of Mastercare.

The board issued this statement:

"Only by recognition of our responsibilities as well as an understanding of the service provider's role can we maximize plan effectiveness. Remember, it's our plan. Sandia Laboratories contributes \$38.58 per month to underwrite premiums of any of our three medical plans. The balance of premiums comes from employee payments."

Mastercare participants are urged to contact their board representatives with comments or suggestions. They are Don Bliss (7134), Sam Mancuso (4121), Carroll McCampbell (2310), Herb Pitts (4232) and Mary Quigley (3131).

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Take Note

Nick DeLollis (5513) has contributed a chapter for the recently published book, "Handbook of Adhesive Bonding." The chapter written by Nick is entitled "Adhesion Theory and Review." The book was edited by Charles V. Cable, late manager, Adhesives Division, High Strength Plastics Corporation, Chicago; and published by McGraw-Hill Book Company.

* * * *

Helen Henderson (4151) was recently voted Woman of the Year by the Albuquerque Charter Chapter, American Business Women's Association. She has been a member of the local chapter since 1967 and has held numerous offices; currently she is serving on the Board of Directors and filling the vacancy of treasurer. Helen will compete for the title of American Woman of the Year to be named at the national convention in October at Las Vegas, Nev. She has been at Sandia Labs for 20 years.

* * * *

And speaking of all those delays at the Base gates (because an alarm went off somewhere), Sandians will be edified by this recent item in the KAFB Bulletin: "Supervisors of alarmed areas are requested to assure that every employee who is authorized to open, close, or test alarm systems is thoroughly trained in the proper operation of the alarm system. Security Police are experiencing entirely too many false alarms due to improper operation of alarm systems. Each alarm activation not only creates a large expenditure of Security Police manpower resources, but also seriously interrupts the normal flow of business."

* * * *

For the fourth year, Gary Shepherd (2634)



GARY SHEPHERD (2634), helps a young member of the Neighborhood Drama Project with her costume for "Peter and the Wolf" which will be presented July 19-21 at 1020 Edith SE.

is directing the Neighborhood Drama Project for youngsters in the South Broadway area. The group will present "Peter and the Wolf" July 19-21.

"It's a great show," Gary says, "and should have tremendous appeal to kids — music, costumes, dance and animal characters. The cast's ages range from 10 to 16 and they've had a ball putting this show together."

Curtain time is 8 p.m. at the Baptist Neighborhood Center, 1020 Edith SE. Admission is free.

* * * *

Bob Garcia (4230), chairman of the ECP solicitation committee, reports that the Boys Club has enthusiastically taken up photography, and the Club's photography class is using an enlarger donated by Sandians. One need, though, is for cameras that the students can use. Do you have an old but usable camera kicking around? Why not bring it in to Bob — he's outside the Tech Area in Bldg. 832, west end, or you can call him on ext. 1200. (But remember *not* to bring the camera in the Tech Area — unless you enjoy security lectures.)

One Man's Family

What Is This Thing Called Success?

Jerry Fragua (7515), a Jemez Pueblo Indian and a janitor at Sandia for the past seven years, and his wife Rose were honored recently with the presentation of a unique award from the National Forensic League. The one-of-a-kind award was presented to the parents and not the children "for encouraging all six of their children to actively participate in student activities of speech and government."

All six of the Fragua children achieved remarkable records at Jemez Valley Schools. All achieved the degree of Excellence in the National Forensic League, all were active in student government (student council members, class presidents), were consistently on the honor roll, two were editors of the school newspaper, and the girls were cheerleaders and the boys lettered in school sports. All six were also delegates to Boys and Girls State and were elected to "Who's Who in American High Schools."

The oldest daughter Elizabeth is a speech therapy graduate student attending school in Oklahoma this summer. Laura is attending the University of Albuquerque on a scholarship majoring in sociology. The

youngest son David, the most recent graduate, will enter the U of A next fall. Two sons are draftsmen in Denver and another is a marine in California.

Jerry smiles and smiles and smiles.

"I never finished the eighth grade," he says.



JERRY FRAGUA (7515) displays a recent page from the Sandoval County Times Independent which details the remarkable accomplishments of his six children.



Bus Notes

After a week of operation, it appears that the Area III shuttle bus provided by the company is performing a needed service to people who ride busses or bike to work. Some 25 Sandians are riding the Gate 10-Area III shuttle daily.

A commuter bus out of Belen serving Adelino, Tome, and overflow from the Los Lunas bus began a two week trial period last Monday.

A bus from the mountain areas will begin soon.

Jim Graham (7146) is preparing a survey on bus interest of Sandians who live in west Albuquerque — north and south valleys and west of downtown. If you live there, you'll hear from him within the next week or so.

Speakers

H.D. Arlowe (9323), "A New Pulsed Power Strain-Gage System," National Instrumentation Symposium, May 21-23, Las Vegas, Nev.

W.D. Smith (5113), "Electrically-Controlled Secondary Phases in PLZT Ceramics," invited paper at Conference on Phase Transitions and Their Applications in Materials Science, May 23-25, Pennsylvania State Univ.

D.T. Weems (2514), "Proposed Electrostatic Sensitivity Development Tester," Evaluation of Electrostatic Hazards of Explosives, May 24-25, Picatinny Arsenal, Dover, N.J.

J. Lipkin and J.C. Swearingen (both 5165), "Subsequent Cross Yielding Behavior in an Aluminum Alloy After Cyclic Loading"; J.N. Johnson (5133), "Plastic Wave Velocities for Anisotropic Solids"; H.J. Sutherland (5163), "Wave Propagation in a Fiber Reinforced Material"; J.W. Nunziato (5131), "On One-Dimensional Shock Waves in Chemically Reacting Media," Canadian Congress of Applied Mechanics, May 28-June 1, Montreal.

J.C. Swearingen (5165), "Kinetics of Cyclic Hardening in Copper and Aluminum Single Crystals"; R.W. Rohde and T.V. Nordstrom (both 5531), "The Effect of Machine Stiffness on Stress Relaxation"; F.G. Yost (2431), "Unconstrained Growth of an Ellipsoidal Filament"; H.J. Rack (5532), "Improved Fatigue Resistance of 18 Ni (350) Maraging Steel Through

Thermomechanical Processing"; P.H. Holloway (2431), "Derivation of the Rate of Oxygen Chemisorption and the Rate of Initial Oxide Formation on Clean Nickel Surfaces," Spring Meeting of AIME, May 29-June 1, Univ. of Philadelphia.

I.J. Hall (1643), "One-Sided Tolerance Limits Based on Censored Samples"; R.R. Prairie (1643), "Teaching Statistics in the Education Program at Sandia"; R.G. Easterling (1643), "Comparison of the Fisher Randomization Test to the Normal Theory F-Test Under Experimental Randomization," "On The Power of the W-Test and Applications to Significance Testing"; M. Scott (2642) and W. Vandevender (5223), "The Calculation of Eigenvalues of Elliptic Partial Differential Equations via Dynamic Programming and Invariant Imbedding"; M. Scott (2642), "An Initial Value Method of Integral Operators - Kernels Depending on a Parameter"; R. Halbgewachs (2641), "PLEG - The Associated Legendre Functions $p_n^{(m)}(x)$ "; R. Jones (2642), "A Comparison of the Quadrature Routines NAC6 and QNC7"; C. Bailey (2642), invited address, "Attaining Portability of FORTRAN Programs"; F. Biggs (5223), "A Statistical Interpretation of the Use of Smoothing in Data Analysis"; B.L. Hulme (5122), "A Status Report on the Collocation Code COLODEI"; M.K. Gordon (UNM) and L. Shampine (5122), "Comparison of Performance and Features of Three Major Adams Codes"; H.A. Watts (2642), "SOSNLE - Solution of Simultaneous Nonlinear Equations," Numerical Analysis Special Interest Group Meeting, May 14-16, SLA.

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MISCELLANEOUS

- 3 LG. MEXICAN velvet oil paintings by artist Diaz; 10-gal. aquarium w/stand; 2 rose arbors; Spanish shield; lg. cast iron BBQ grill. Snidow, 298-6163.
- CHILD'S study desk, 26" high, & chair, hard maple, \$7; chrome plated music stand, \$4. Moyer, 255-8807.
- RANCH OAK BUNK BEDS, complete w/mattresses, \$75. Brown, 299-0315.
- .243 WINCHESTER RCBS reloading dies, never used, \$8. Taylor, 265-9387.
- REFRIGERATOR, Frigidaire, med. size, separate freezer, coppertone, \$100. Alcone, 264-6872.
- CLARINET, Selmer Signet wood, 3 yrs. old; beginners guitar. Aronson, 268-7109.
- ROYAL, port. typewriter, \$28. Hodyke, 268-5210.
- TAPE DECK, 4-track stereo w/3 tapes, \$5. Ristine, 298-8383.
- '70 12x70 MOBILE, 2-bdr., 2 full baths, carpeted, clean, skirted, \$5500. Burkhardt, 281-3335.
- ASSORTED SILVER PLATED serving pieces by Gorham, International, Reed & Barton, Wallace. Anastasio, 299-7012.
- KWIK raise-up camper, sleeps 2, stove, ice box, & water tank, \$425; elec. paint spray gun, \$25; dining table, \$40. Lackey, 898-5175.
- '72 MOBILE HOME, 14x60, 2 bdr., all appliances, extras, near Wyoming entrance to Base, adult park. McClure, 294-1912.
- 2 DANISH MODERN chairs w/turquoise cushions, \$30 ea. Smith, 299-6873.
- FREE PUPPIES, 4 wks. old, mixed breed, small. Rusty, 255-0568 or 294-1704.

- SPOTTING SCOPE, 15x-30x zoom, includes pan head tripod, never used, \$25. Womelsduff, 299-6269.
- COMPUTER CONSULTANTS STOCK, 90 cents share. Hiltunen, 6500 Cochiti Rd. SE, space 56.
- FURNITURE: Early American LR grouping: green/white sofa, green chair, ottoman, slip covers, vase, \$200. Dossey, 294-1167.
- PROJECTION SCREEN, 50x50 glass beaded w/folding stand, \$15. Hicks, 268-8640.
- VANITY SINK, 17x19 American Standard porcelain finished cast iron, w/faucets, \$10. Laskar, 299-1024.
- SHELTIE (Toy Collie), AKC, male, 18 mos., friendly; also 3-yr-old spayed, declawed long-haired female cat. Hickman, 298-3804.
- SEARS 22 cu. ft. chest freezer, \$150; 12'-6"x15' beige nylon carpet, \$25 w/pad. Welton, 299-8507.
- POLE VAULT POLES, Fiberglass, 14' (120-140 lbs.), \$10; 15' (130-150 lbs.), \$15. Owens, 256-0606 after 6.
- AIR CONDITIONER, refrig., 22,-000 BTU, \$100; boy's 20" bike, \$10. Kent, 256-1221.
- POWER lawn mower; movie camera; fishing boots; poodle clippers; 6' refrig; other misc. items. MacKay, 298-6541.
- BUNK BEDS w/4" foam mattresses. Buss, 298-1589.
- SANTA FE OPERA tickets, 2 seats, July 28 performance of Puccini's "La Boheme," left center row M, \$5.50 ea. Wright, 296-7670.
- PORTABLE DISHWASHER, white Kenmore, less than 1 yr. old, \$100. Tapp, 299-5705.
- FOLDING car top sleeper for stn. wgn., \$25. Coalson, 9801 Robin NE, 298-0061.
- RADIO CONTROLLED model airplane, F & M Quasar, 4 servos, Merco .61, spare airplane, \$200. Jacklin, 298-3046.
- 6' BAR, 4 stools, \$100; dbl. bed, box springs, mattress, dresser, \$75; gold sofa, chair & hassock, \$150. O'Neal, 255-9124.
- 30" TAPPAN elec. range w/eye level oven, \$50 or best offer.

- Campbell, 268-8445.
- CEMETERY LOTS, 6 choice spaces Sandia Memory Gardens, 5 excellent spaces near Mauseleum Sunset Memorial Park. Howard, 255-9489.
- FIVE 700 x 15 6-ply tires w/6-hole wheels & hub caps; will fit Blazer or 4-wd Chev. pickup, brand new. Gallegos, 298-6214 after 5.
- CAMPER, 8' Bell, half cab over, 115V lights, stove, sink, ice box, etc., \$750. Tucker, 877-1140.
- FRIGIDAIRE refrigerator, across top freezer, \$50. Cooper, 299-7157.
- POLAROID foldout countdown camera, never used, still in carton, similar to M420/30 but w/different flash attachment, \$35. Gilkes, 255-4189.

TRANSPORTATION

- '68 DODGE Polara, Calif. State Police car, reupholstered & painted. Prevender, 299-5253.
- 5-SPEED Stingray-type boy's bike. Fisher, 299-9235.
- 14' SEA KING 50HP outboard, 1,-000 lb. trailer, fully equipped, \$1095; 3 HP Sears outboard, \$85. Bradley, 298-2263.
- '72 FORD 1/2-ton pickup, AT, PS, Ranger cab, overload springs, 16,000 miles. Houghton, 1413 Guaymas NE, 299-3386.
- '69 TRAVELALL, new clutch & rear end, sell for book price. Church, 281-3853.
- '65 OLDS, \$450, will take trade. Traver, 294-2138.
- '72 CHEVROLET 3/4-ton pickup, 4-wd, low mileage. Causey, 299-0089.
- '69 VW BUG, radio, \$1000. Dickinson, 296-7726.
- '65 CORVAIR MONZA convert. Robinson, 296-2753.
- MOTORCYCLE: '68 Suzuki T200 scrambler, helmet, \$300. Boyd, 344-2542 after 12:30 p.m.
- '64 FORD Falcon; '64 Plymouth Valiant; '60 Ford 1/2-ton pickup; all for \$700 or will sell separately. West, 281-3460.
- '63 FORD pickup, \$650, new tires & paint, 6-cyl., 1/2-ton. Weaver, 265-4809.
- '65 FORD LTD, PS, PB, custom interior, \$625. Otero, 808 Muriel NE, 294-0060.

- HONDA TRAIL 90, '69 w/luggage rack, hi-low range trans., bumper carrier, \$200. Hansche, 296-1387.
- '66 CHEV. 3/4-ton pickup, camper special, 4-spd., V8 engine, extra gas tanks. Downing, 299-6945.
- GIRLS BIKE, 20" Sears, \$20. Oberst, 299-1224.
- '70 NOVA coupe, AC, V8, radio, low mileage, new tires & battery. Owens, 255-9257.
- '65 DODGE Dart stn. wgn., 3-spd. std., V8, Air, new tires, \$495; Raleigh 5-spd. bicycle, man's 21" frame, S/A hub, package rack, thornproofs. Lipkin, 296-1840.
- 14' BOAT, 35hp motor & trailer, heavy duty tilt trailer, windshield, boat cover, elec. start, skis, etc., \$625. Perryman, 247-8485.
- '70 7-PASSENGER VW bus, almost new tires, AM-FM w/dual speakers, extractor, complete service records, \$2300. Marchi, 299-3653.
- '68 T-BIRD, 4-dr., new belted tires, under book, \$1175/offer; '70 TS250cc Suzuki, 5-spd. trail, \$425/offer. Mortley, 299-7840.
- WRECKED '64 Chev. pickup, new shocks, new brake job, 4 new 4-ply tires, HD bumper, \$250. Gonzales, 242-1043.
- '70 DATSUN 240Z, AC, orange, 28,000 miles, one owner. Schroeder, 344-1011.
- YAMAHA 250 Enduro, \$410. Watterberg, 294-6759.
- BOY'S 26" bicycle, new thorn-proof tires & tubes, make offer. Brown, 296-1121.
- '72 PENTON 125 MX, fresh engine, superchargers, for serious motocrossers. Taylor, 898-6516 after 4.
- VW VAN, AC, vented propane heater. Stromberg, 255-6131.
- '70 PONTIAC Catalina 4-dr. HT, AT, PS, PB, factory air. Petty, 298-0856.

- \$150. Morgan, 256-7994.
- CEMENT MIXER w or wo/elec. motor. Leckman, 266-6354.
- JAPANESE swords & daggers; American & English old hunting knives & fancy daggers. Smitha, 266-9977.
- DOG HAIR CLIPPER w/attachments; clippers for cutting human hair not acceptable. Ristine, 298-8383.

FOR RENT

- FURNISHED DUPLEX, no pets, attached garage, utilities paid, \$150/mo., 605 San Pablo SE. Dodson, 255-0265.

REAL ESTATE

- 3-BDR., study, 1-3/4 baths, den w/fp, brick patio w/gas BBQ, 1470 sq. ft., cash to 5 1/4% loan or ref. Beckmann, 296-1829.
- 3-BDR., cathedral den, covered patio, heated garage, ready now, open daily, \$38,900 or reasonable offer, 1770 sq. ft. Lawrence, 8605 Horacio Pl. NE, 299-9118.
- MOUNTAIN HOME, 3-bdr., 1-3/4 baths, dbl. garage on 1/2 acre in Cedar Crest, \$27,000. Ridsdale, 281-3642.
- RUSTIC REAL ADOBE in Heights, 0.4 acre, 3-bdr., den, vigas, hw/floors, fp, rear access, separate garage, carport. Berglund, 255-3988.
- 4-BDR. Lori home, San Gabriel, corner, 2100 sq. ft., prof. landscaping, sprinklers, humidifier, 5 yrs. old, \$42,500. Lauger, 9801 Coda Pla., 296-3197.
- HOMESITES in Corrales, 1.4 acre view lots, underground utilities included. Forsythe, 299-2785 or Reed, 299-7425.

LOST AND FOUND

- LOST — Gold ring w/rose shape design, Rx photo sun glasses, brown leather card holder w/ID & credit cards, inlaid turquoise ring. LOST AND FOUND, Bldg. 832, tel. 264-3441.
- FOUND — Man's tri-focal glasses, clip-on sunglasses, 10-yr. award tie-tac. LOST AND FOUND, Bldg. 832, tel. 264-3441.

WANTED

- RUMMAGE for rummage sale by Chaparral Figure Skating Club. Call 298-5503 (bus. hrs.) 299-9033. 294-7169 or 266-6889 for pick up of items. Karnes.
- TRADE: 23" Admiral color set, needs repair, for sewing machine or guns; will sell.

Shrimp Peel Set July 21

HAPPY HOURS — Tonight, Club manager Jim Schultz will spread a fantastic Roman buffet, the Country Road will fiddle around, and Barbara Clark will provide a hot time in the main lounge. Friday, July 20 — Latin food is the buffet feature, Frank Chewiwie is set to make happy music and Yolanda Adent is holding the main lounge. Friday, July 27 — Oriental food for the buffet, the Prisoners loose on the bandstand and Denny Gallegos in the main lounge.

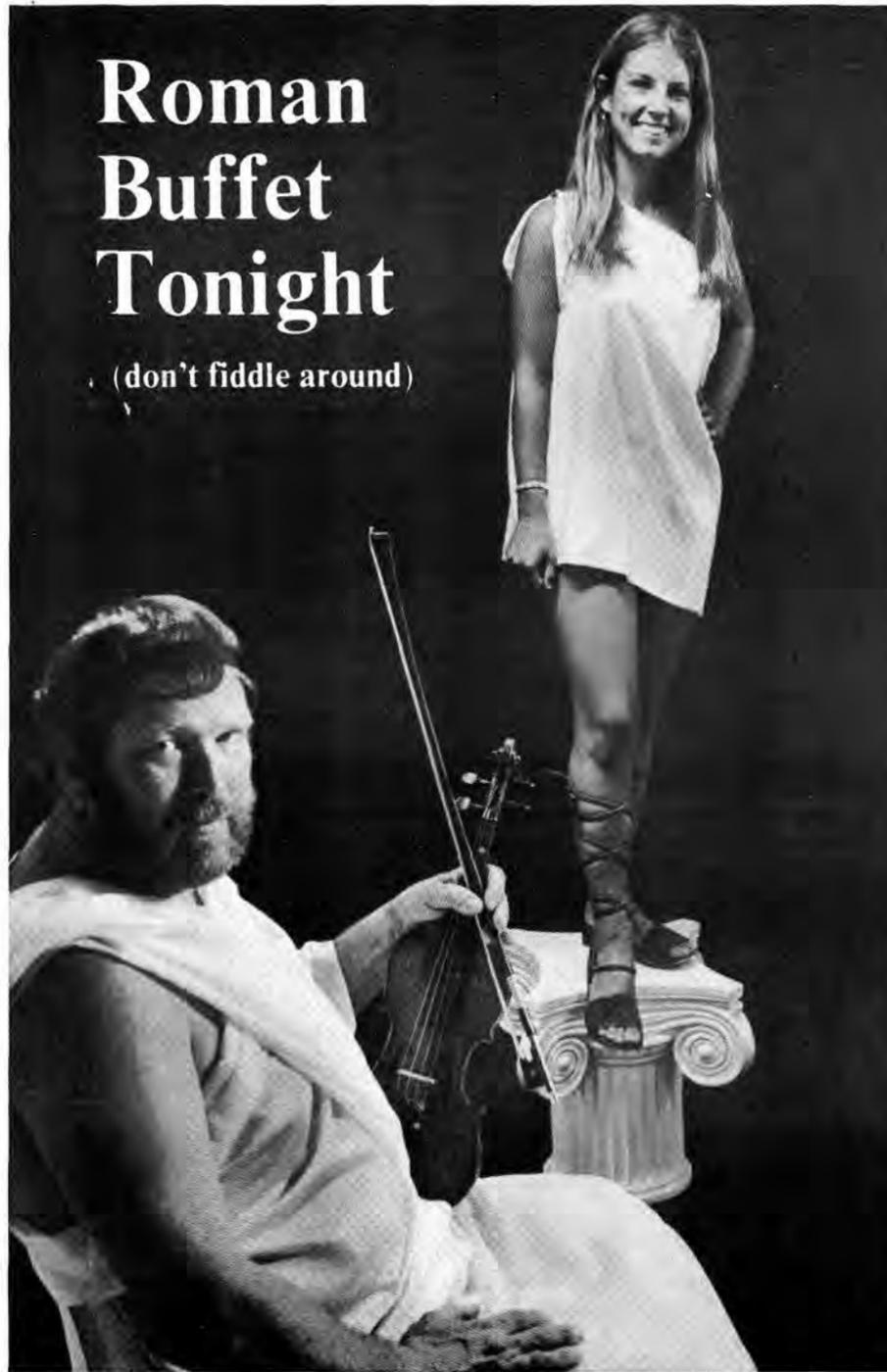
TOMORROW NIGHT is vaudeville night at the Club and the family should enjoy a magic show by a 16-year-old professional magician, The Great Gordini. Alec Guinness stars in "The Lavender Hill Mob," a hilarious comedy about robbing the Bank of England. Ten books of tickets to Uncle Cliff's Familyland will be given away as door prizes. Admission is free to members and families.

RESERVATIONS are due tomorrow for the Club's tremendous Shrimp Peel event set Saturday, July 21. In addition to all those large lovely shrimp, an array of salads and other goodies go with the dinner. It's set from 6:30 to 8:30 p.m. and then followed by dancing from 9 to midnight by Paul Plus II. All this goes for a mere \$3.95. (Have you priced shrimp lately?)

SOMETHING CALLED "Frozen Sun" will be wired into the bandstand for the kids to enjoy at the monthly Teen Go Go Tuesday, July 24, from 7:30 to 10:30 p.m. Member parents should pick up tickets (25 cents for member's kids, 50 cents for guests) from the Club office.

THE CINEMA SOCIETY will hold a Busby Berkley festival Wednesday evening, July 18. Ol' Busby invented the musical extravaganza film with lines of chorus girls and intricate choreography. Two of his best, "Gold Diggers of 1933" and "Forty Second Street," will be shown starting at 7:30 p.m. A Betty Boop cartoon is also scheduled. Admission is free to members.

TRAVEL NEWS — Bud Wheeler (4256), Club travel director, reports that the Mediterranean cruise set Oct. 14-29 is filled but he has secured about 30 seats on a second cruise, starting Oct. 29. This is the same deal as the first one — one week at a luxury hotel at Palma de Majorca and then a week cruising on the RHMS Queen Frederica. Prices start at \$699 depending on cabin choice. More information and sign-up forms are available at the Club office.



Elliot Harris (3153)

Kathy Pogna (AEC)

Events Calendar

July 13-15 — State Handball Tournament, Elks Club & UNM courts.
July 13-15 — "The Cocktail Party"; **July 19-22, 26-29** — "A Cry of Players," 8:30 p.m., Corrales Adobe Theater.
July 13-15, 19-22 — "Night Watch," 8 p.m., Old Town Studio.
July 14 — San Bonaventura Fiesta, Corn Dance, Cochiti Pueblo.
July 14 — N.M. Mt. Club, Santa Fe Baldy, Gulf Mart, 8 a.m.
July 14 — Santa Fe Opera, "La Boheme"; **July 13, 21, 25** — "The Marriage of Figaro"; **July 18, 20** — "The Merry Widow"; **July 27** — "Der Fliegende Hollander."
July 15 — N.M. Mt. Club, La Luz to Placitas, 15 miles, Eastdale, 5:30 a.m.
July 15 — KHFM Opera of the Week; "The Merry Widow"; **July 22** — "The Flying Dutchman," 6:40 p.m.
July 16 — Santa Fe Chamber Music Festival: Bartok's "Quintet for Piano and Strings," 8:15 p.m., Popejoy Hall.
July 16 — Lecture Under the Stars: Ted

DeGrazia, "The Man and His Works"; **July 23** — Peter McDonald, "American Indians Today," 8 p.m., North Mall, UNM.
July 21-22 — N.M. Mt. Club, back pack to Hermit Peak, call Bob Couch, 296-0908 by July 17.
July 22 — N.M. Mt. Club, Mt. Taylor, Lobo Statue, UNM, 7 a.m.
July 24-25 — Santa Ana Fiesta, San Felipe Pueblo; **July 25** — Santa Ana Fiesta, Acoma, Cochiti, Laguna and Santo Domingo Pueblos; **July 25-26** — Santa Ana Fiesta, Buffalo or Corn Dance and Rabbit Hunt, Santa Ana and Taos Pueblos.

Sympathy

To Celedon Gabaldon (7631) on the death of his infant son in Albuquerque, June 28.
 To Buford Egan (2341) on the death of his mother in Sacramento, Calif., July 2.
 To Charlie Eden (3148-1) on the death of his father in Albuquerque, June 24.

Present
for the future.



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