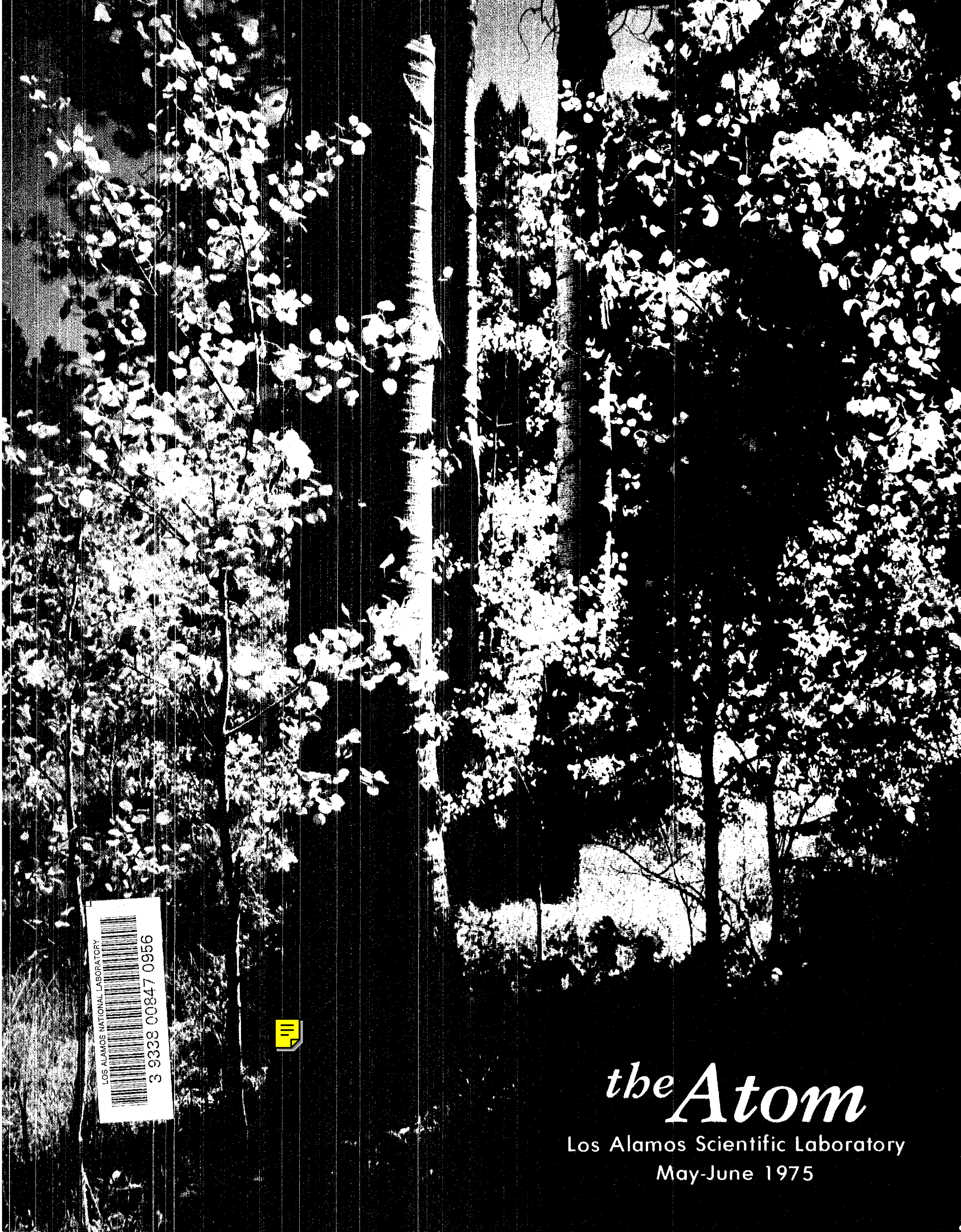

the Atom

Los Alamos Scientific Laboratory

May-June 1975

Volume 12 Number 3
May-June 1975

THE ATOM

Published bimonthly by the University of California, Los Alamos Scientific Laboratory, Office of Public Information, TA-3, West Jemez Road, Los Alamos, New Mexico 87544. Address mail to P.O. Box 1663, Los Alamos, New Mexico 87544. Second Class Postage Paid at Los Alamos, N.M.

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Office: D-442-B Administration Building. Telephone: 667-6102. Printed by the University of New Mexico Printing Plant, Albuquerque.

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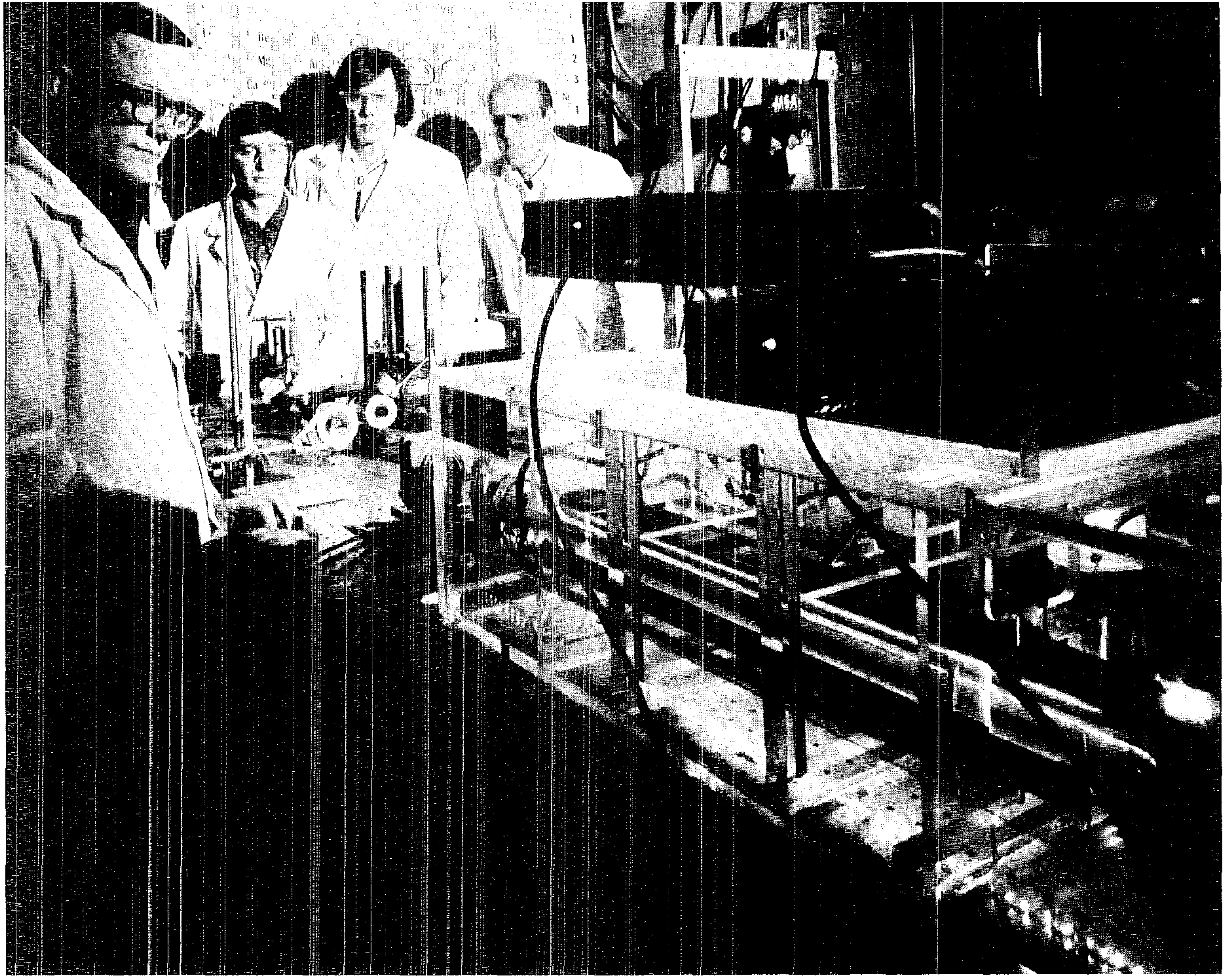
COVER

Winter's gone and the great outdoors beckons. From behind barracks-gray walls, Los Alamos Scientific Laboratory employees will migrate to scenes like this. Capturing the eternal magic of the Southwest is this cover photo of aspen trees in the Jemez Mountains taken by Bill Jack Rodgers, ISD-1.

Photographic judges also thought this picture captured the essence of New Mexico's beauty, for they gave it the Best of Show (Off-the-Job) Award at the 16th Annual Industrial Photographers of the Southwest Conference held May 15-18 in Alamogordo. The top award, Best of Show (On-the-Job) was presented to Jose "Mitzie" Ulibarri for his photograph, "Re-Bar," shown on the back cover.

LASL photographers brought home almost a clean sweep of prizes. Shown below are the winners, and their awards—20 of 22 given during the conference. Back row: Bob Martin, ISD-7, Off-the-Job color, 1st and 3rd; Off-the-Job black and white, 2nd. Gene Lamkin, L-2, On-the-Job color, 2nd, Technical Achievement, 1st and 3rd. Matt O'Keefe, ISD-7, Off-the-Job black and white, 3rd. Middle row: Julie Grilly, H-DO, Technical Achievement, 3rd. Fred Rick, ISD-7, Technical Achievement, 1st; "Oldie" 1st. Bob Stevens, ISD-7, "Oldie", 3rd. Front row: Jose "Mitzie" Ulibarri, ISD-7, On-the-Job color, 1st and 3rd; Best of Show and Photographer's Choice. Bill Jack Rodgers, On-the-Job black and white, 1st, 2nd, 3rd; Off-the-Job black and white, 1st; Off-the-Job color, 2nd; Best of Show, Off-the-Job. Lamkin and Rick shared first prize in Technical Achievement.



Recreating the historic moment when isotope separation by a single laser was accomplished in April are participants in the project shown here with the carbon dioxide laser used in the experiment. From left to right: John Lyman, L-3, John Rink, L-7, Paul Robinson, JUMPer project director, and Reed Jensen, L-3.

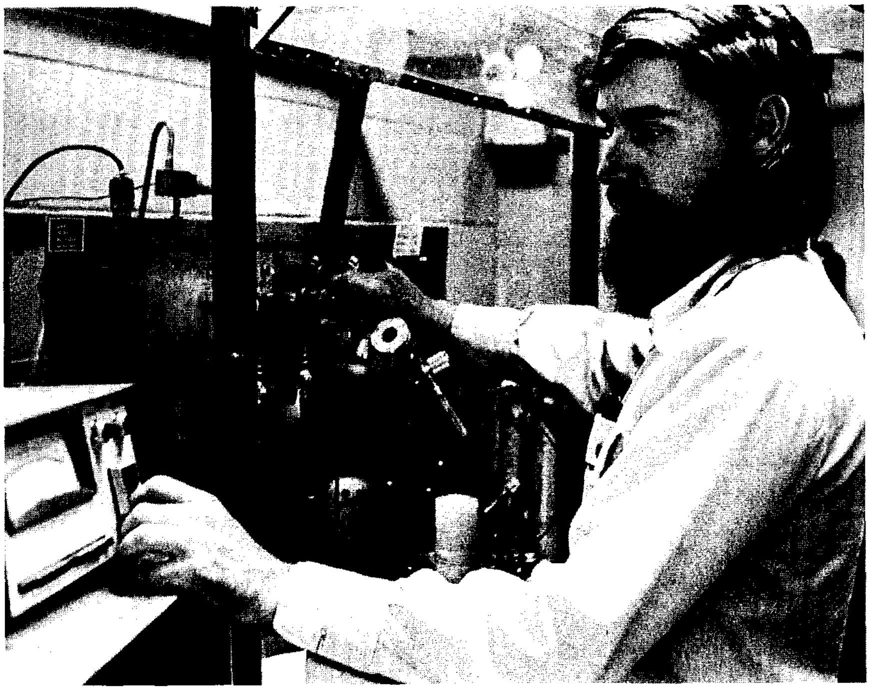
LASER ISOTOPE SEPARATION

On Saturday, April 5, a small group of Los Alamos Scientific Laboratory staff members and technicians watched intently as a carbon dioxide laser on a laboratory table flashed repeatedly, filling the room with brilliant light.

From time to time, a small brass cylinder, with windows at each end, was removed from its position in front of the laser and placed in a mass spectrometer. There a computer printed out measurements which were eagerly scanned by the men. With each measurement, the investigators smiled with satisfaction.

What was taking place was the separation of the isotopes boron 10 and 11 accomplished with a single laser.

A few days later, the U.S.S.R., long silent on the subject, announced it had accomplished the separation of sulfur isotopes by laser. The following Saturday, the LASL researchers per-



Above, Jerry Hudson, L-7, loads gas in a sample cell to be used in laser isotope separation experiments. Below, Paul Schell, L-8, adds notations to a printout of data obtained from a mass spectrometer 1000 times more sensitive than conventional instruments. The data so obtained are used to determine amounts of isotopes present before and after laser separation.

formed their second separation of isotopes with a single laser, removing sulfur-34 from sulfur hexafluoride gas. It was this accomplishment that was then made public.

The announcements from both countries of success in separating sulfur isotopes received prominent press coverage and comment. Among scientists and informed laymen, there was speculation that the same principle might be applicable to uranium. The 2 elements share certain chemical characteristics.

Both countries had long pursued independent paths of research toward the same goal, which holds revolutionary implications for future industrial and technological processes and bright promise for the peaceful use of nuclear energy.

As almost everyone knows, all atoms of a given element do not have identical nuclei. While all the nuclei of a given element will have the same number of protons, the number of neutrons in the nuclei will vary. It is this difference in the number of neutrons in the nuclei that characterizes the various isotopes of an element.

Because all isotopes of an element have nuclei with the same number of protons (and thus the same positive charge), all isotopes of an element have the same negatively charged electron shells. Since chemical reactions occur in the electron shells, it has long been known that attempts to separate isotopes by chemical means would be futile.

To obtain isotopes such as carbon-14, so valuable as tracers and for a multitude of research purposes, and uranium-235 for reactor fuel, scientists have relied on a physical difference between isotopes—atomic weight—to accomplish separation. The best known means of taking advantage of differences in atomic weight are magnetism and diffusion.

To use magnetism, ions of the element are accelerated through a magnetic field. All isotopic nuclei of the element have the same positive charge (because they have the same number of protons), but because they vary in their weights (because of differences in numbers of neutrons), their differing inertias cause them to take slightly different curved paths through the field.

To use diffusion, molecules containing the element (in gaseous form) are placed behind a membrane through which they can diffuse. Except at absolute zero temperature, all molecules

"Sulfur-34 is separable only with great difficulty under present techniques, with costs estimated at $1,000 per gram. Although total cost has not been projected for the laser method, the cost for electrical energy would be only 40 cents per gram."

move; in a gas, they are free to jump about like so many Mexican jumping beans.

Some of these molecules hit the membrane and penetrate through it to another chamber. Many simply bounce back into the original chamber. Lighter isotopes move slightly faster and penetrate the membrance in greater numbers than the more sluggish heavy isotopes. Repetitive "filtering" based on this principle builds up concentrations of lighter isotopes. In the case of uranium, the process must be repeated thousands of times to achieve meaningful enrichment.

But the almost explosive proliferation of lasers and the development of more powerful tunable types in recent years has suggested yet another approach based on a lesser known difference between isotopes: vibrational states.

Except at a temperature of absolute zero, molecules never rest placidly. Instead, they flex rhythmically, much as an arrangement of ball bearings linked by springs and floating in space might. This contraption would respond very readily to energy reaching it at a frequency that matched the frequency at which the gadget was already vibrating, but would respond poorly to the same amount of energy at a different frequency, such as a very quick blow or a prolonged, gentle "push."

With modern lasers, scientists perceived a new approach to isotope separation based on the observation that different isotopes of the same element vibrate at slightly different frequencies. A laser beam tuned precisely to the frequency of a desired isotope would excite mostly the atoms of the desired isotope while affecting the atoms of the "standard model" to a lesser extent.

For several years, it was presumed that to develop a process that could take advantage of these vibrational differences, a 2-photon system would be required. The first photon, from a laser tuned to the frequency of the desired isotope, would elevate the desired isotopic molecule to a vibrational excitation above that of the normal ground state. The second photon need not be tuned so precisely; in fact, it need not even emanate from a laser. It's function is simply to trigger a reaction which causes only the excited isotopic molecule to disassociate, or break apart.

And, in fact, just such an experiment demonstrating the feasibility of this approach was conducted at LASL in 1974. Steve Rockwood, L-8, and Sherman Rabideau, CNC-3, used a low-power carbon dioxide laser for the first-photon step and merely a filtered ultra violet flash lamp for the second-photon step to separate the isotopes of boron-10 and boron-11 from a boron trichloride molecule—an event that went unrecognized outside of the scientific community.

However, in earlier studies, the investigators had predicted that isotope separation could be accomplished by a barrage of photons from a single laser source hitting a molecule, each photon boosting that molecule another step up the vibrational energy "ladder." Upon reaching the top of the "ladder," it would disassociate. By tuning the laser to a precise frequency, many more of the desired isotopic molecules than the "standard" molecules would climb this ladder and break apart.

And, indeed, that is what was accomplished on April 5 with boron and April 12 with sulfur.

To make the separation process feasible, a second gas, acting as a scavenger, or reagent, is introduced in the chamber. Once separated, the isotopic atom would be inclined to reunite with other atoms in its old molecular "home." The scavenger provides a more attractive "home" for the separated isotopic atom, which enters into a new molecular arrangement with the scavenger. A new gas, different from the original gases in the chamber, is thus formed, which may then be separated easily by conventional means.

The significance for scientific research is immense. As an example, sulfur-34 is separable only with great difficulty under present techniques, with costs estimated at $1,000 per gram. Although total cost has not been projected for the laser method, the cost for electrical energy would be only 40 cents per gram.

On a laboratory scale, LASL researchers can enrich sulfur 3,300 per cent in half an hour, using 5,000 laser pulses to increase the ratio of sulfur-34 to the common sulfur-32 isotope from 0.044 to 1.5.

Since successfully separating sulfur-34, isotopes of chlorine, silicon, and carbon have also been separated at L-Division by the single-laser method, and the list appears destined to grow.

While L-Division has been the "home" for this investigation, it has also involved other divisions and groups, for this has been a major LASL research effort over a 4-year period under the code name of Project JUMPer. Heading the investigating team is Paul Robinson, associate L-Division leader, who recently created a stir in scientific circles with a presentation of a paper announcing the success of single laser isotope separation at the New York Academy of Science. Playing key roles in the program have been Reed Jensen, Ted Cotter, and Keith Boyer, all L-DO, Jack Aldridge, L-8, and Al Sullivan, L-6. The principal experimenters on the recent investigations were Steve Rockwood and John Lyman, both L-8, John Rink, L-7, D. F. Smith of the Oak Ridge Gaseous Diffusion Plant, aided by virtually a platoon of technicians who made the achievement possible.

"Robinson estimates that capital plant costs might be reduced from about $2.7 billion for present plants to about $30 million for a laser separation facility, or a savings of 99 percent."

The elegant simplicity of the method, and the vastly simplified description of the physics written here may give the misleading impression that this was a rather easy achievement. Nothing could be further from the truth. It required an intensive and sophisticated program drawing on resources throughout the Laboratory, and the development of tools with new capabilities. As an example, the JUMPer team in collaboration with their subcontractor at Lincoln Laboratory designed a laser spectrometer of 1,000 times greater sensitivity than conventional instruments. This helped investigators to zero in on absorption spectra of various isotopes, determining the precise frequency required for separation. Such an instrument represents valuable spinoff certain to find application in other research.

Any talk of laser isotope separation in today's nuclear world leads inevitably to speculation on the feasibility of applying the technique for uranium enrichment. This has been a fundamental goal of Project JUMPer and most of this work remains classified. All that Robinson will state publicly is that the problem of laser isotope separation for uranium is immensely more complex than merely setting a carbon dioxide laser on a bench and turning it on.

Yet, few at LASL and elsewhere in the scientific community doubt that laser separation of uranium and isotopes of other heavy elements will sooner or later become a reality.

If so, that would mark the beginning of a "whole new ball game" in nuclear power and interrelated fields of waste disposal and safety.

In respect to nuclear fuel, laser isotope separation may open the door to much simpler, more efficient and far less costly facilities for uranium enrichment, or the increasing of the ratio of fissile uranium-235 to non-fissile uranium-238 to levels where this enriched material becomes usable as reactor fuel. Robinson estimates that capital plant costs might be reduced from about $2.7 billion for present plants to about $30 million for a laser separation facility, or a savings of 99 per cent. Savings in electric power would be equally dramatic, Robinson says, again amounting to about 99 per cent. And because laser separation would be cost effective using lower-grade feed material than can be used economically at present, a savings of 25 per cent in feed material costs could be anticipated.

Laser isotope separation could also make a dramatic—and beneficial—impact on our nuclear fuel supply, according to Robinson. Tailings around the country, containing amounts of uranium-235 too small to justify reprocessing under present methods, might be reprocessed profitably using laser isotope separation. Robinson estimates that this could result in retrieving fuel equivalent to all the fuel consumed by today's nuclear plants in 8 years.

Such reprocessing could also yield fissile materials, other than uranium-235, that are useful in reactors. Waste could be taken directly from present reactors to laser isotope separation plants, from which would come other types of nuclear fuel usable by reactors of new design. In effect, a system of one type of reactor burning the waste of another could be established.

Taken together, the U.S. General Accounting Office estimates that these measures might produce nuclear fuel savings amounting to $81 billion by the year 2000.

Concurrent with the development of these new technologies for the better use of nuclear fuel, Robinson believes that those who address themselves to the problem of radioactive waste disposal may find their tasks simplified. For instance, radioactive wastes contain materials that retain significant radioactivity for 2 million years. The integrity of containers for underground or surface storage of wastes can be assured for 1,000 years with existent technology. Beyond that, the guarantee becomes less certain. Robinson believes that laser separation could be used to remove longer lived radioactive materials (these could be reintroduced into the new nuclear fuel cycles), leaving only short-lived products whose radioactivity would decay to harmless levels well within 1,000 years. There would be no detrimental consequences should a container fail after this period.

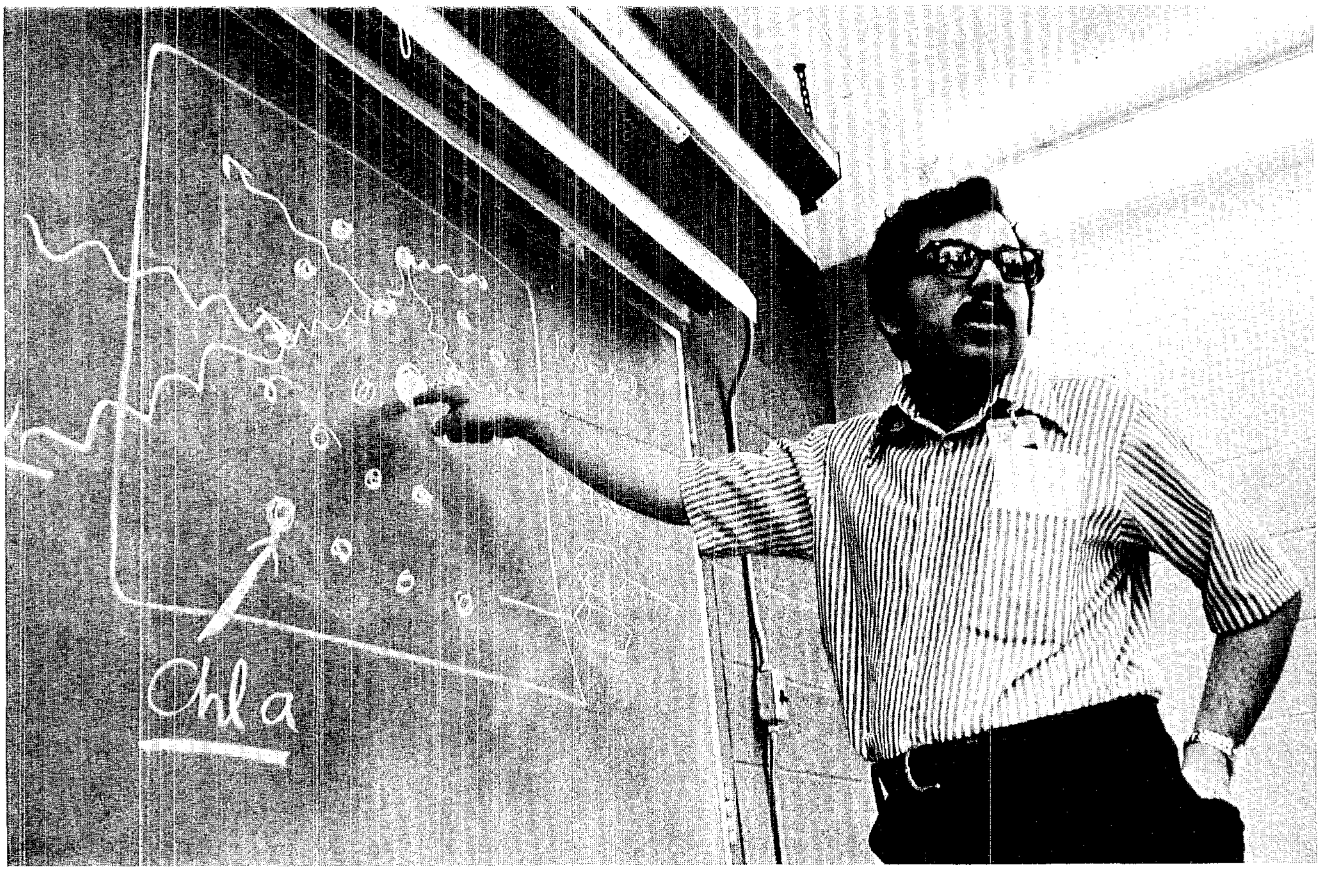
These are some of the potentially revolutionary implications of laser isotope separation. There will be others. As with all major scientific advances, new applications can be but dimly, if at all, perceived at the moment of birth. It seems all but certain that laser isotope separation will profoundly alter the nuclear energy industry of this country, if not the world, and in so doing affect all our lives.

New Light on Photosynthesis

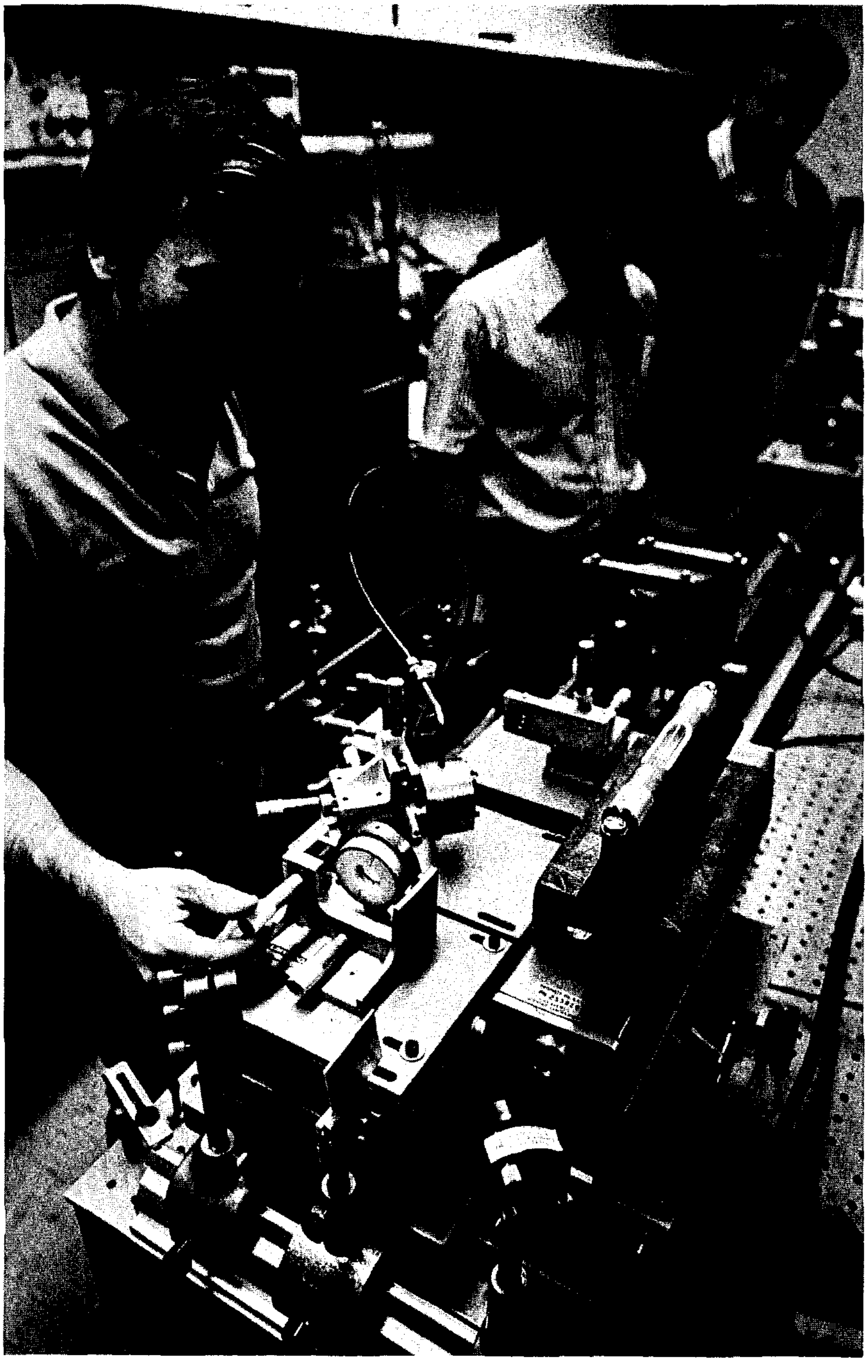
Stanley Shapiro, L-2, a principal investigator of photosynthesis using pulsed laser, here explains the process by which a submicroscopic photosynthetic unit captures light energy and transfers it to a reaction center.

If scientists were to be polled on the one mechanism indispensable to life on earth, chances are the balloting would be unanimous for photosynthesis. Photosynthesis is the intricate process by which plants utilize light energy to convert carbon dioxide and water into complex molecules. After a number of transformations, and after combining with nitrogen and other elements, these molecules become the carbohydrates, fats, and proteins which sustain all higher life.

In the process, huge quantities of carbon dioxide are removed from the atmosphere and oxygen added to it to perpetuate earth's life cycle. Russian-American biochemist Eugene Rabinowitch estimates that each year the green plants of earth combine 150 billion tons of carbon (from carbon dioxide) with 25 billion tons of hydrogen (from water) and replenish the atmosphere with 400 billion tons of oxygen. (Of this gigantic performance, the plants of the forests and fields account for only 10 per cent; 90 per cent is at-



Ron Hyer, Stanley Shapiro, and Tony Campillo, all L-2, set up a neodymium glass laser which directs a pulse at a target of vegetable matter. The reaction, measured in trillionths of a second, is recorded on a streak camera.



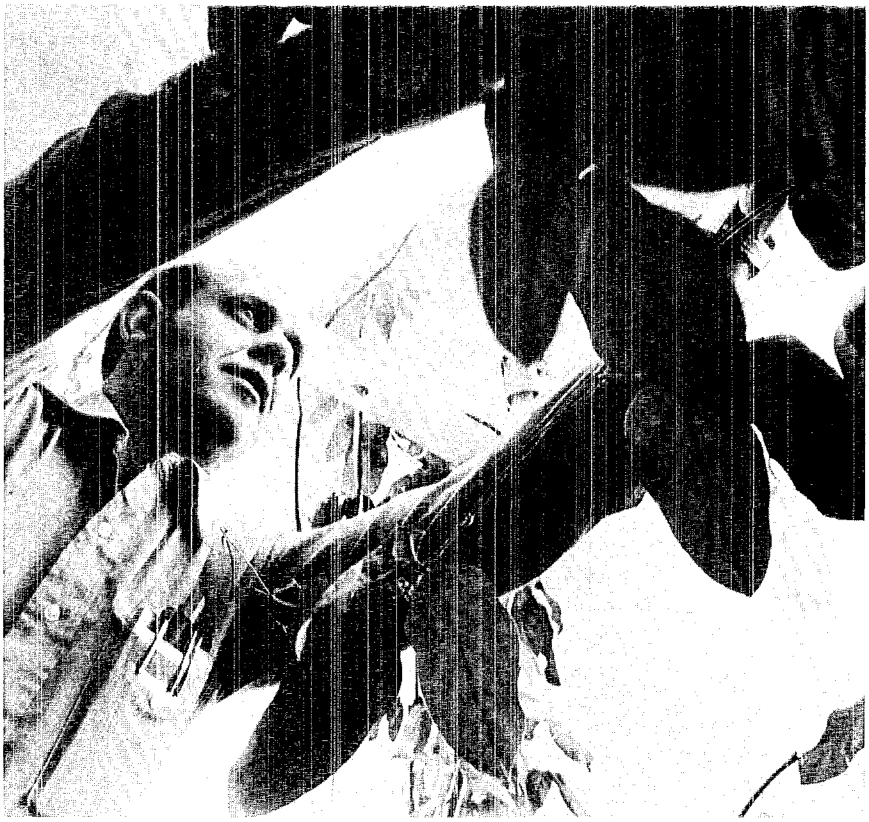
tributable to the one-celled plants and seaweed of the oceans, an interesting argument for those concerned with marine pollution.)

Because of its crucial role in life on earth, and because photosynthesis is a process of marvelous efficiency far exceeding man's own in separating hydrogen from oxygen, for instance, scientists have long sought to unravel the mysteries of photosynthesis. In recent years, thanks to the development of carbon-14 tracing methods and other modern techniques, the various steps in the process have become known, but the mystery at the very core of the mechanism—how light energy triggers the process and is transformed into energy usable by plants—remains.

The structure in which this process occurs is called a photosynthetic unit. It acts like a submicroscopic solar collector, but one so efficient that man's best efforts in collecting solar energy seem caveman primitive by comparison. Scientists have not yet determined the exact structure of the photosynthetic unit, but believe that it consists of about 300 molecules of chlorophyll and other organic molecules arranged around a protein reaction center.

The reaction center, containing 2 chlorophyll molecules, may act like a capacitor, receiving energy, storing it, and releasing it for synthesizing carbohydrates. (Among the many of its fascinating behavior characteristics is that an electrostatic field forms around the reaction center upon receiving an input of energy.)

The photosynthetic unit acts like a submicroscopic antenna farm with the chlorophyll molecules in it receiving photon "signals" and transferring them to a "receiver," or the reaction center. The energy may be transferred directly from the receiving molecule to the reaction center, or much more likely, arriving there via a chain reaction through any number of molecules. Remarkably, regardless of any one of the astronomical number of possible paths the energy may take, it always ends up in the reaction center, from



Victor Kollman, H-11, selects leaves from a jack bean plant for preparation as laser targets. Learning more about photosynthesis will contribute toward meeting his research goals, which include developing new algae strains as food sources.

which it is then transferred to other systems where the photosynthesis process is completed.

Such a complex mechanism would be difficult enough to study even if the reaction occurred within a convenient time span. But it doesn't. The initial process takes place in not millionths or even billionths of a second, but trillionths. Lack of equipment capable of examining events within this extremely brief time scale (light travels only 1/80th of an inch during a trillionth of a second) has barred investigators from deciphering this aspect of photosynthesis.

That is, scientists were barred until recently. With the development of pulsed lasers and extremely high-speed streak cameras, the hardware existed for studying biological phenomena occurring within a very short time scale. It took a need and innovative Los Alamos Scientific Laboratory personnel to put it all together.

The need arose in conjunction with investigations being conducted by Vic Kollman, H-11, whose experiments with plants include developing new strains of algae capable of phenomenal food production and other strains which could separate hydrogen from water inexpensively and abundantly. Beyond the manipulation of living organisms for these purposes, there lay the intriguing possibility of man's learning to duplicate these mechanisms with nonliving material in industrial processes. Probing the basic nature of photosynthesis is an essential step in this kind of research.

Stanley Shapiro and Tony Campillo, both L-2, were intrigued by the challenge and set up a system using a neodymium glass laser that would provide the brief pulse required: one measured in trillionths of a second, or picoseconds, so that measurements would not be obscured in time by reactions before or after the period under study.

In conducting measurements, Kollman provides targets—thin films of chlorophyll-rich plant matter mounted between glass disks. Shapiro and Campillo position one of these to receive a focused picosecond pulse from a neodymium glass laser. The laser pulse causes photosynthetic units in the target to fluoresce in a way that indicates the paths the energy takes to the reaction centers.

The photons released during this fluorescence strike a cathode in a streak camera, developed at LASL by Howard Sutphin, L-4, causing the release of electrons. These electrons are accelerated, focused, and swept as a streak across a phosphorescent screen, just as an electron beam sweeps across the face of a picture tube in a TV set. The characteristics of the line vary from point to point according to the number of electrons which have struck the screen. A photograph of this line provides a picture of events during the extremely brief time span involved.

Consulting with Kollman, Shapiro, and Campillo on interpretation of this streak photography is Walter Goad, T-10. As a result, the investigators now understand better how energy migrates within the photosynthetic unit to the reaction center. This fundamentally new knowledge has been published recently in scientific journals.

But the explorations continue in an ongoing project that has been named as one of LASL's New Initiatives Research Programs. The "task force" is beginning to study what happens after energy reaches the reaction center, and the geometry and mechanisms of the reaction center itself.

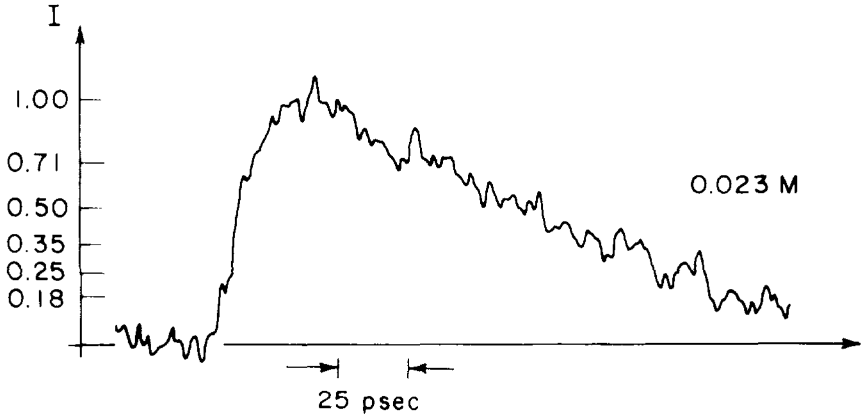
Ahead lie investigations of other biological mechanisms such as that of energy transfer within DNA molecules, the carriers of genetic codes. For this and other experiments, the technique may be modified by using 2 pulses in rapid succession. The first will excite the molecule. The second, or interrogation, pulse will probe the modification produced by the first. Streak photography will be used to learn new details of the DNA molecule structure.

"The system is readily adaptable to a number of biological experiments of this type," Shapiro says. "We anticipate a great deal more progress in understanding these fundamental mechanisms. To our knowledge, at LASL, we can look at these processes in greater detail than is possible elsewhere."

Aside from making significant contributions to the body of biological knowledge, the investigators find satisfaction in the program's interdisciplinary aspects. Although by no means unknown, joint ventures between biologists and physicists have not been all that common, either. However, as biologists venture deeper into fundamental processes taking place in ever diminishing dimensions of time and space, the tools and techniques of physics and the interpretations of theoretical physicists will find increasing application.

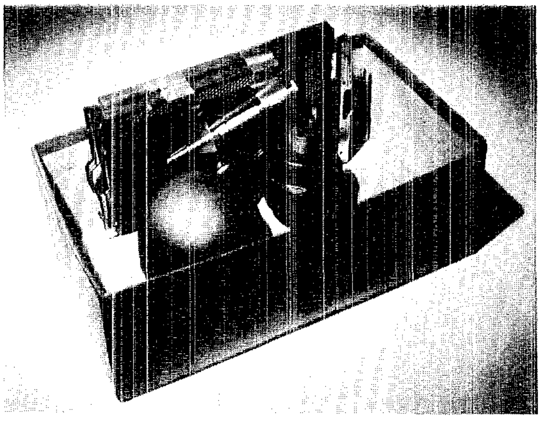
At LASL, where interdisciplinary research has always been a way of life, and with its superb facilities for both physical and biological research, projects such as this may become more the rule than the exception.

A portrait of photosynthesis—in this case of a variety of chlorophyll in a chloroform solution—is recorded as a "smear" of light showing reactions taking place in trillionths of a second. The image can then be "translated" as a graph as shown below.



Enigmatic images suggestive of abstract art are actually part of one of the first proton-scattering radiographs made at LAMPF. The dark edge line characteristic of the technique is not discernible because of marginal print quality and printing losses, but the white edge line is visible. "Dome" at left is depleted uranium; the rectangular shape is a uranium cylinder and the darker vertical "bar" is a uranium disk standing on edge—both within the dome.

A New Edge for Looking into Things



A shoe box was used to "mount" targets in front of x-ray film (within holder), including uranium scraps, a jeweler's screwdriver, and a chassis punch for making the radiograph at the top of this page.

In modern science, experiments are normally conducted with meticulous care and sophisticated equipment. Rarely is there the occasion to satisfy scientific curiosity in a simple, informal way.

But such an occasion did occur at the Los Alamos Scientific Laboratory last fall. As a result, a little-known, very new type of radiography, with characteristics differing in fundamental ways from radiographs made by x rays, may receive further, more systematic investigation later this year. It's called proton-scattering radiography, and it could give researchers of the future a new edge in looking at—and into—things.

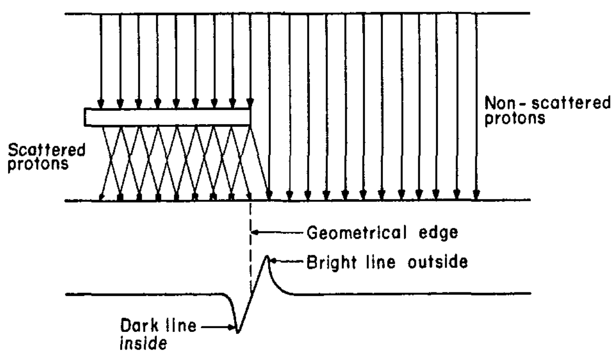
The first proton-scattering radiography was accomplished by D. West and A. C. Sherwood of the Atomic Energy Research Establishment at

Harwell, England, in 1973. Its most distinctive feature was in the way the edges of targets were not only clearly shown, but actually enhanced. West and Sherwood published the results of their research and explained the unusual edge effect.

At higher energies, in excess of 100 million electron volts, protons are highly penetrating. A few are absorbed, but most penetrate the target material, with many becoming scattered at low angles as they are repelled by the like positive charges of atomic nuclei.

The enhancement of edges in proton-scattering radiography is due to the material being examined exerting this low-angle scattering effect on the protons, while those protons passing through virtually empty space are not scattered. At the edge, some protons are scattered outward where they reinforce the unimpeded and larger number of protons flowing through empty space. The thin line where the flux is denser is recorded as a dark line on a film negative (and as a white line on the print).

The area directly under the edge, on the other hand, does not receive its "fair share" of scattered protons from the empty space beyond the edge. This is recorded as a white line on a film negative (and as a black line on the print).



The resultant image, while not as rich in tonal gradations as conventional x radiographs, is vastly superior in edge definition in many applications. With some materials it shows boundaries that x radiographs can show only poorly or not at all.

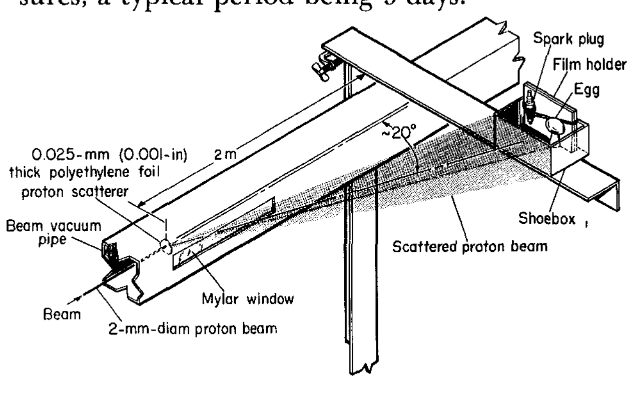
Among LASL staff members reading this report with interest was Jasper Jackson, P-11. After talking over the concept with Mike Moore, P-11 group leader, Rex Fluharty, P-11 assistant group leader, and staff members in other divisions with an interest in the subject, Jackson felt encouraged to test the new technique in a very elementary way. "We were curious to see the effect for ourselves and see how the images formed by various materials might differ. We thought the technique might find applications at LASL and could be rather easily developed with the proton source available at LAMPF," he says.

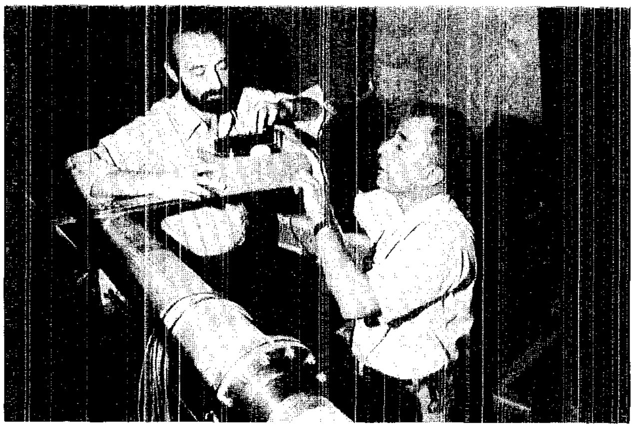
The targets collected for the project sounded more like a list for a scavenger hunt than for a physics demonstration: an egg, a chassis punch, a spark plug, scraps of depleted uranium, a rubber eraser, and an old shoe box. Yet, these objects were chosen to provide a wide range in densities and shapes to give a preview of what proton scattering radiography might be expected to do and not do.

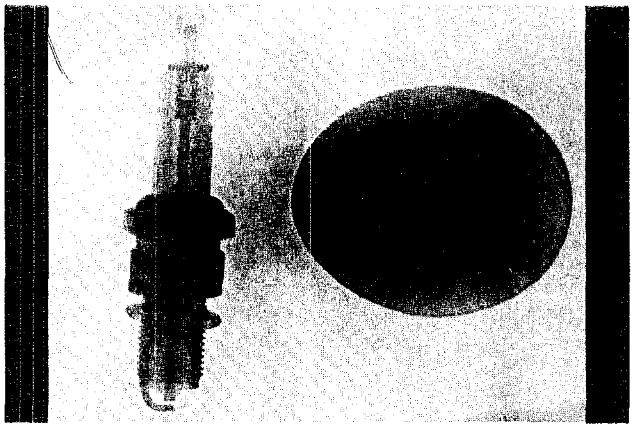
Like the targets themselves, the protons that irradiated them also had to be "scavenged." At the time, late in 1974, the accelerator at the Clinton P. Anderson Los Alamos Scientific Laboratory Meson Physics Facility (LAMPF) was the scene of frenzied activity as research teams from LASL and around the country hastened to complete their work before LAMPF was shut down on December 20, 1974, for maintenance and modification. Under the circumstances, Jackson's project could not be accommodated.

However, a group from Case Western Reserve University, including Rich Barrett, now T-2 but at the time a postdoctorate with the group, consented to Jackson's placing his project "piggyback" with their own. Their experiment entailed a scattering arrangement consisting of a polyethylene foil, 25 millimeters (mm) thick placed in the 2 mm-in-diameter LAMPF external proton beam line. Protons scattered to one side of the beam line entered their apparatus; protons scattered to the other side would otherwise be wasted. It was these protons that Jackson used.

The protons scattered from the beam, though high in energy (800 million electron volts), were few indeed. So anemic was the stream that only 1 proton passed through a square centimeter every second. To form even the faintest of images on film, Jackson had to make extremely long exposures, a typical period being 3 days.

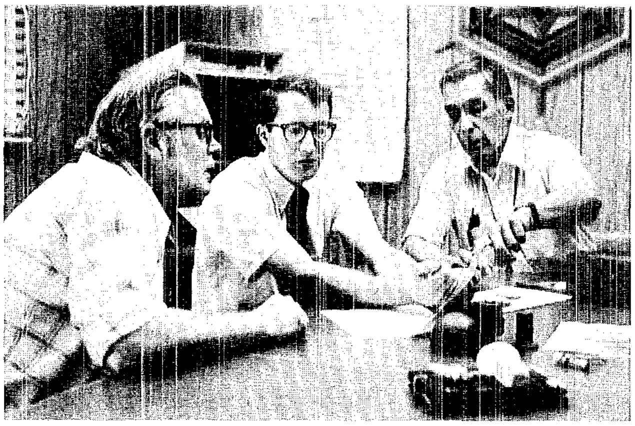


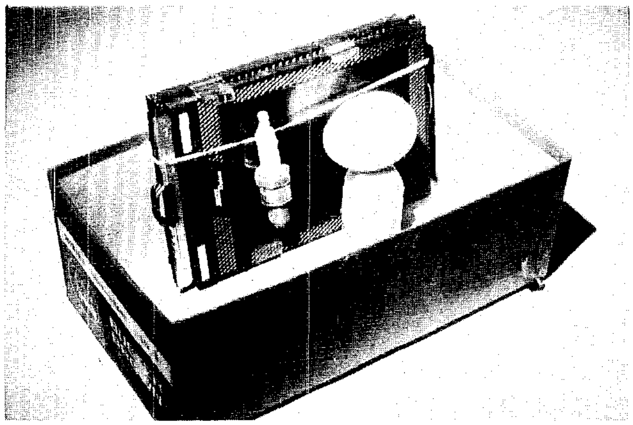




Investigators of proton-scattering radiography include Rich Barrett, T-2, and Jasper Jackson, P-11, above setting up target, and Rex Fluharty, P-11, and Mike Cannon, C-8, below reviewing results with Jackson.

The first proton-scattering radiograph made at LAMPF (above) shows the objects below. The egg's shell is outlined by both dark and light edges. The yoke is not seen because its density is virtually the same as the white's.





Jackson and his colleagues placed their odd collection of items in a shoe box about 2 meters from the point-scattering source at an angle of 20° to the beam. Behind his target, he placed a 4″ x 5″ x-ray film in a conventional film holder.

The negatives thus obtained were underexposed and marginal at best. Yet these, the first proton-radiographs made at LAMPF, vividly demonstrated the most distinctive and potentially useful characteristic of proton-scattering radiography: edges not only defined with great clarity, but actually "underscored" due to the low-angle scattering effect of high-energy protons passing through materials.

Jackson believes that because x-ray film now available reacts but poorly to proton radiation, image enhancement will be desirable or necessary if film is used in the future. Thus, Mike Cannon, C-8, has been involved with the project to apply computer image enhancement techniques.

An attractive alternative to film is to count protons electronically. In effect, each proton entering the target area would pass through a grid, its charge leaving a "signature" in space and time. Feeding this myriad of data into a computer would produce an image—and with substantially less proton flux than would be required for film.

Assisting Jackson in the project were Fluharty, who consulted on interpretation of the radiographs obtained, Phil Seeger, who assisted Cannon in application of C-8 image enhancement computer runs, and Dick Bagley, C-8, who made densitometer scans of radiographs.

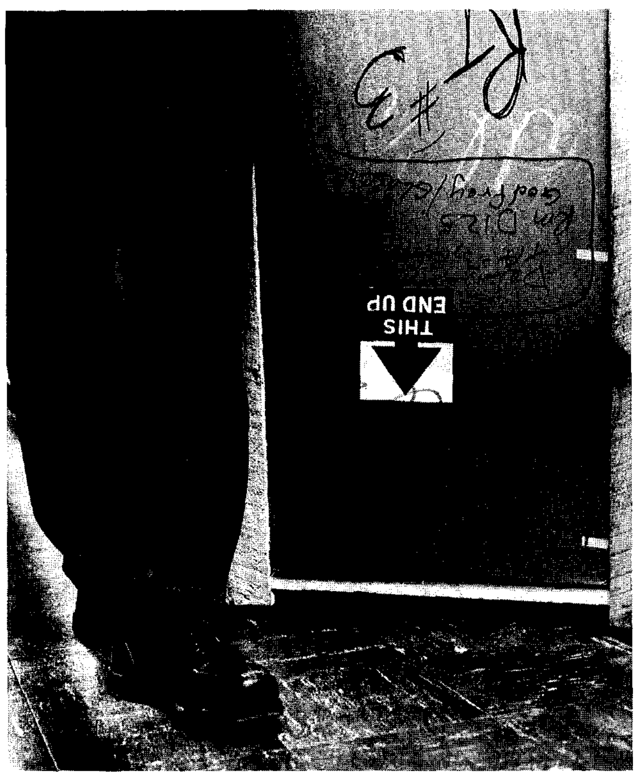
With some satisfaction, the handful of staff members involved report that "our budget was zero . . . and we stuck to it."

Like Benjamin Franklin experimenting with a kite, a jar and a key, it is reassuring that some physics can still be demonstrated in simple ways with simple objects.

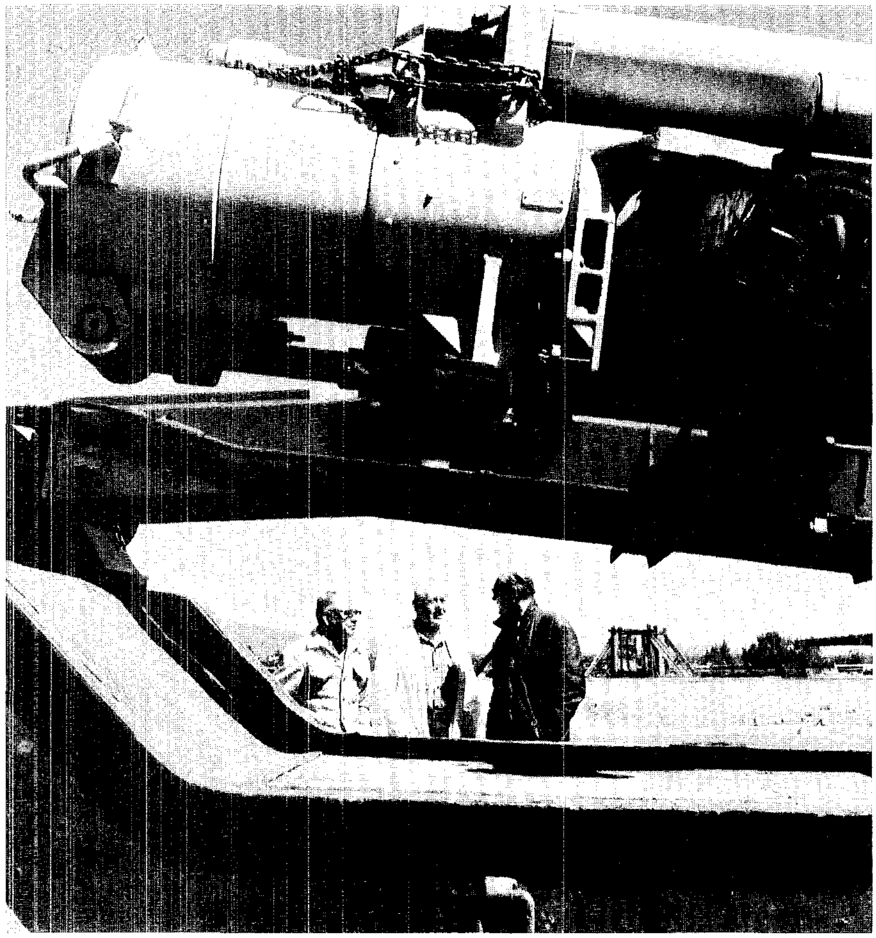
Such as an egg, a chassis punch, a spark plug, scraps of depleted uranium, a rubber eraser, and an old shoe box.

Photo Shorts

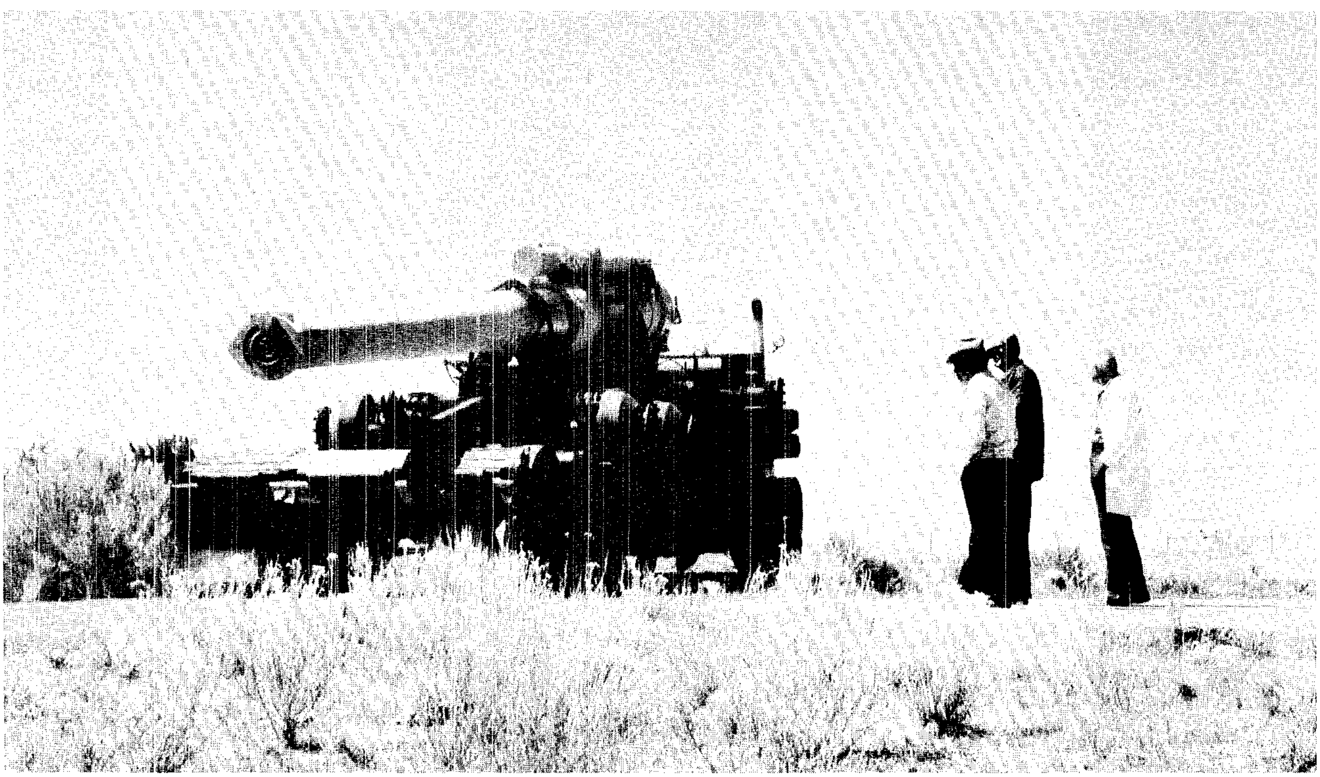
A check for $100 was presented by Richard Bohl, ADWP-1, president-elect of the New Mexico Academy of Science (center), and David Yos, Eastern New Mexico University and president of the Academy (right), to L. D. P. "Perc" King, LASL-retired, chairman of the J. Robert Oppenheimer Memorial Committee (left). The donation will help support a series of lectures by prominent visiting scientists, such as one by Hans Bethe at Los Alamos Civic Auditorium on June 16.



What's wrong with this picture? Turn the page upside down and see. Then you'll know why equipment may arrive at your group offices from time to time in less than perfect condition.



Collector's item: a rare 8-inch field artillery piece (somewhat whimsically also designated as "mobile"—an 80-ton crane has to accompany the gun to assemble it) was removed from its home since the 1950's at TA-33 and shipped to the Artillery Museum at Fort Sill, Oklahoma, in May. Models like this saw action in World War I and have a range of about 20 miles. Supervising the removal of the weapon are, left to right, Joe Salazar, SP-2, Don Winchell, WX-3 and Dwight Clayton, SP-DO.



On March 25, the Los Alamos Scientific Laboratory was visited by a man distinguished not only by his eminence in his calling, but by that calling itself: Evangelist Billy Graham.

Speaking at a colloquium in the packed Administration Building auditorium, Billy Graham displayed the conviction and oratory that have made his name synonymous with evangelism in modern times.

LASL employees of all faiths—and of no faith—were at the least impressed by the power of Graham's personality, at the most moved by his message. As Graham sees it, tranquility in troubled modern times comes from a personal relationship with a Supreme Being through his Son who was on earth.

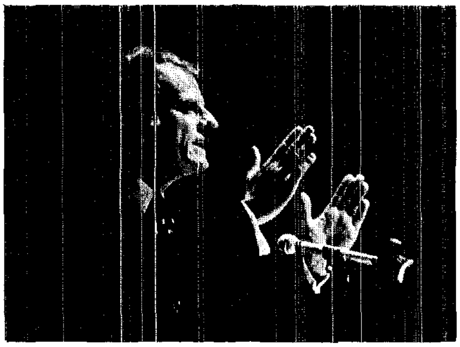
With few exceptions, great minds through the ages have held that no comprehension of the universe and the role of man in it is complete without some view of realms that may lie beyond space and time, energy and matter.

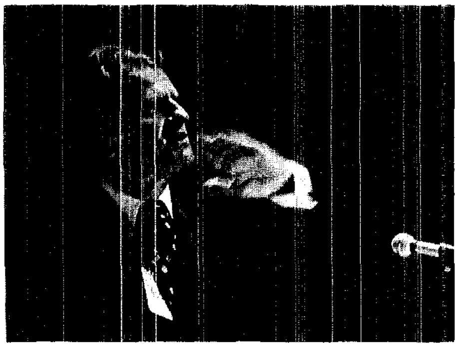
A particular kind of view, held by many scientists, was perhaps most eloquently stated by Albert Einstein when he said, "My religion consists of a humble admiration of the illimitable superior spirit who reveals himself in the slight details we are able to perceive with our frail and feeble minds. That deeply emotional conviction of the presence of a superior reasoning power, which is revealed in the incomprehensible universe, forms my idea of God."

Thus, from different perspectives an evangelist and a scientist contemplate the same mystery.

In an age where many insist on total separation of the secular and spiritual, the significance of Billy Graham's visit may not have been so much in what Graham said, but that he appeared at LASL at all. It speaks eloquently of the broad freedom of inquiry and expression at LASL and, through colloquia, of frequent opportunities for LASL employees to gain first-hand insights into a rich diversity of worlds other than science.

An unusual visitor . . .





At left, Billy Graham displays the power and conviction that have made him preeminent among evangelists. At right, he visits the Bradbury Hall of Science where he enjoys watching Bill Barrow, son of Graham's music director (behind Graham's shoulder), attempt to handle the remote manipulator of a simulated hot box.

From April 16 to 18, the Los Alamos Scientific Laboratory opened its doors to some 700 high school students from 4 states for Science Youth Days. Science Youth Days are sponsored by the Thomas A. Edison Foundation to stimulate science interest among youth. Assisted by honor guides from the Los Alamos High School, groups throughout the Laboratory gave the students a first-hand introduction to science.

A typical student group arrives by bus early on the morning of their visit, is treated to a morning of talks and movies in the Administration Building auditorium, and then is guided to representative Laboratory sites to see science in action during the afternoon. At the site, staff members usually explain activities and give guided tours.

An annual spring event at the Laboratory for 18 years, Science Youth Days provide as refreshing a change of pace for scientists at the Laboratory as they do for the visiting students.

Corrine Adley, Alchesay (Arizona) High School, gets a look via closed circuit TV of Scyllac's "innards" as Laurie Clayton, Show Low, Arizona, watches and Milt Machalek, CTR-3, explains the performance monitoring system.

. . . and annual springtime visitors

"Come on, put your hand in there. It won't hurt a bit," is what Darrell Drake, P-3, seems to be saying to Tammy Atchison, Aztec (New Mexico) High School during a demonstration of how high voltage is built up in the chamber at left to snap over to the sphere at right. Equipment demonstrates how the "real-life" accelerator works at LASL's Tandem Van de Graaff.

At the Tandem Van de Graaff, Kirk Christensen and Doug Brode, both of Los Alamos High School, experience the "fun side" of science by playing a game of ping-pong on a computer. Manipulating controls "swats" a "ball" across a scope.

To the Rescue!

A lost and injured "victim," is rescued by, left to right, Explorer Scouts Bob Westervelt and John Drummer as Doug Balcomb, Q-DO, supervises.

On the morning of May 3, 5 inflatable rafts shoved off into the roaring Chama River below El Vado Dam. Icy spray doused the Explorer Scouts of Post 20 as they dipped and swirled through foaming rapids. There was a special intensity to their efforts, for this was a race.

But not against each other. Against time. They were searching for 6 "injured boatmen" believed to be "lost" somewhere in the dark and chilly depths of Chama Canyon.

Fortunately, it was all an exercise, although no less serious because of that. Each of the participating Explorer Scouts and accompanying adults, mostly Los Alamos Scientific Laboratory employees, knew that the next time it could be "for real." They wanted to be prepared in training, equipment, and communications.

Earlier that morning, Les Redman, ISDO, Larry Dauelsberg, MP-9, and 6 Explorer Scouts had run the river to 2 locations unknown to the searchers. They had placed tags on the "victims" describing symptoms, but not the nature, of injuries (it was up to the rescuers to diagnose and administer first aid). Then they placed the victims in brush where they would be difficult, but not impossible, to spot.

At noon, the first 3 search rafts, led by Doug Balcomb, Q-DO, arrived and promptly spotted the first victims. The rescuers quickly improvised a litter of oars, tree limbs, and a boat seat, administered first aid, notified other searchers of their success via radio, and left team members behind to care for the victims as they departed to seek the other "victims" downstream.

The second 2 rafts, led by Bert Helmick, A-5, arrived at the accident sites afterwards and took the victims to safety.

The whole carefully planned exercise is a timely example of the diversity and extent of the apparatus that the Los Alamos Civil Preparedness Search and Rescue Organization is prepared to activate at a moment's notice. Actual members of the Search and Rescue Organization, a part of the Los Alamos Emergency Preparedness Organization, number only about 20, many of whom coordinate tasks rather than actually taking to the field during a search and rescue operation.

However, the effective force that can be assembled for a large-scale search may number more than 300. That is because a number of independent volunteer organizations have agreed to participate in operations coordinated by the Los Alamos Search and Rescue Organization. Many of the past and present officers of these participating organizations also serve as officers or directors of the Search and Rescue.

In addition to water-borne operations, searches can be conducted by land and air, using a variety of specialized skills, with units linked together through a smoothly functioning radio communications system.

On foot, the Auxiliary Fire Brigade, the Sportsman's Club, and Explorer Posts 20 and 222, stand ready to search mesas and canyons, while for steeper slopes, the Los Alamos Mountaineers may be called upon. In winter, the special knowledge of the Los Alamos Ski Patrol has proven invaluable. The Los Alamos Sheriff's Posse can cover large areas of suitable terrain rapidly on horse, while the Los Alamos Civil Air Patrol and the Los Alamos Aeronautical Association can search from the air for downed aircraft or lost campers in isolated areas. The Atomic City Citizen's Band Radio Club of Los Alamos swings into action to provide short-range mobile communication while the Los Alamos Amateur Radio Club can quickly set up a state-wide network if required.

Most members and participants of the Search and Rescue Organization are LASL Scientific Laboratory employees. Holding office in the Search and Rescue Organization (and often in participating organizations) are Larry Campbell, Q-26, Terry Gibbs, DIR-O, and Kenneth Spicochi, M-2, alternate search and rescue coordinators; Bob Mitchell, C-9, Mike Thomas, CTR-8, Howard Richerson, ERDA, and Don Janney, C-8, land search coordinators; Jim Prine, H-4, Bob Cowan, CMB-6, and Clarence Woodcock, MP-2, communications coordinators; Bob Klaer, Zia, Dick Malenfant, Q-DO, Bill Overton, Q-26, Allene Lindstrom, T-4, air search coordinators; and Jim Dominic, ERDA, staff support.

The versatility of the Search and Rescue Organization is being considerably expanded through its participation in the New Mexico Emergency Services Council, composed of volunteer search and rescue teams around the state. The Council held its first meeting in Los Alamos 2 years ago. The Los Alamos Search and Rescue Organization sends units to participate in searches in other areas, such as the one for survivors of an airplane crash near Eagle Nest last winter. In turn, the Los Alamos organization may call on units from outside Los Alamos County. Two units of unusual capability are located in Albuquerque: one of parachutists, and another handling German shepherds specially trained to seek lost persons by scent. Los Alamos Search and Rescue teams are awaiting, with a great deal of interest, an opportunity to call on these units.

As Al Evans, A-1, the present Search and Rescue coordinator explains, there was a special need for a competent search and rescue organization in Los Alamos due to the many canyons surrounding the city, the large influx of newcomers to the county who were unfamiliar with the terrain, and the hazards of becoming lost in New Mexico's vast expanses of wilderness. The organization came into being in 1964 following a proclamation by the Los Alamos County Commission, and has increased in size and proficiency ever since.

"We conduct perhaps 3 or 4 searches during a typical year," Evans says, "but this can fluctuate wildly from none last year to about a dozen so far this year—and 1975 is barely half over. One weekend we were called 4 times. We think our search and rescue missions will increase in the future owing to the continued growth of Los Alamos County and because other member organizations of the New Mexico Emergency Services Council will call on our units more and more for operations in other parts of the state.

"We receive most of our alerts through the Police Department," Evans says, "although we occasionally receive requests from the U.S. Forest Service, the U.S. Park Service at Bandelier, and the Air Force Rescue Control Center in Illinois."

Evans advises LASL employees that the proper procedure for activating the Search and Rescue Organization to search for someone who is missing is to phone the Los Alamos Police Department at 662-4176, or the shorter emergency number of 911. The Police Department will then alert the Search and Rescue Organization.

That could be a point worth remembering as you take to the outdoors this summer. Hopefully, you will never have to call for the Search and Rescue Organization. But, if you do, it's reassuring to know that an extensive and competent organization stands ready to search—and rescue.

Moving Things Around

Two recent movements of equipment, both of which happened to catch a photographer's attention, serve to remind us that the Los Alamos Scientific Laboratory, like an organism, is in a constant state of change. Individually, the changes may go unnoticed; collectively, they can mount up to where a previous employee, revisiting the Laboratory after an absence of several years, may feel like a stranger in what was once a comfortably familiar place.

The 2 photos at the top of the opposite page show 1 of 5 aluminum collector plates being lowered into "the pit" at SM-105, an extension of A-Wing of the Administration Building. There the plates will be used to accept current from 600 capacitors to impress a magnetic field on the tube of Scylla IV-P, a 5-meter linear theta-pinch machine. The round objects on the top of the plate are "jacks" for connecting cables from the capacitors.

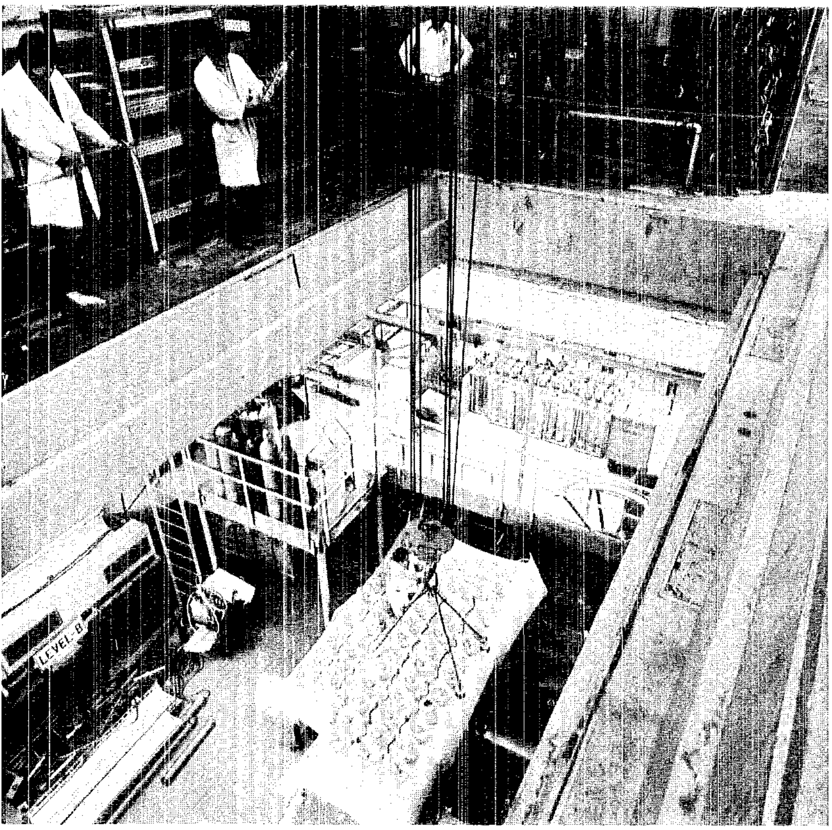
Operating on the same principles as CTR-Division's Scyllac, a toroidal theta-pinch device with no open ends, it will allow a number of studies to be made more rapidly and economically than with the larger and more intricate Scyllac. Several magnetic waves are impressed on Scyllac's coils to initiate and contain a thermonuclear reaction; it is hard to separate the fields. Scylla IV-P, on the other hand, will allow studies of one type of field at a time with ease and simplicity.

Charged particles "whirl" about magnetic field lines, the nature of the gyration being determined by the type of field and the energy of the particles. Studies of the relationship of the particles' gyration to the size of the pinched plasma may lead to insights for compensating instabilities.

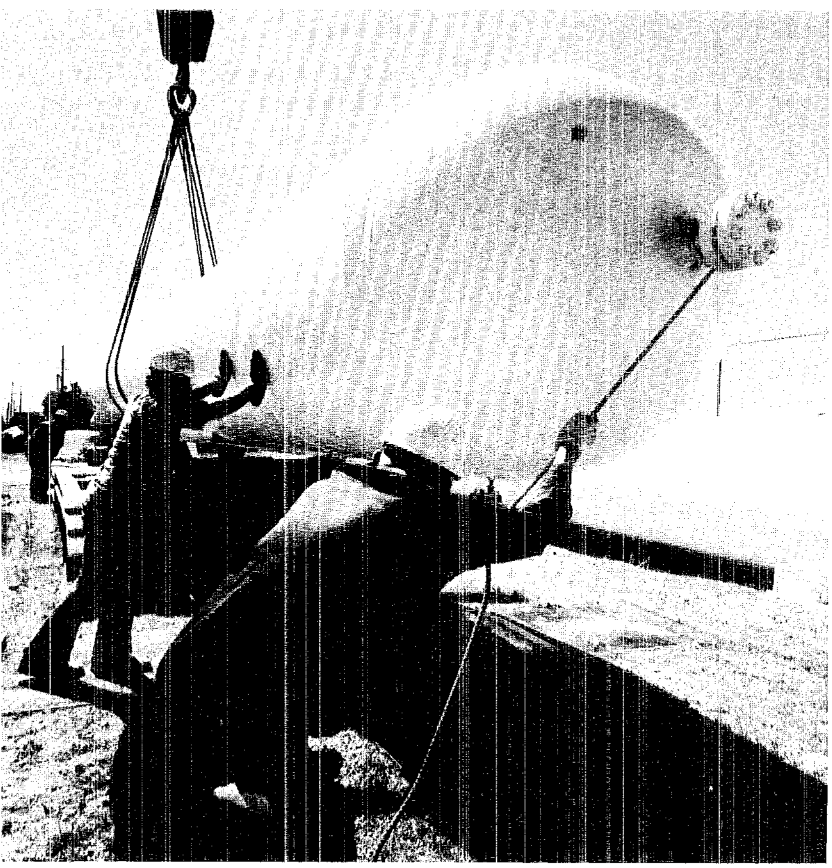
Scylla IV-P will also be used to study high-field, high-density, theta-pinch plasmas in a straight tube. Findings may lead to investigations of a hybrid fusion-fission reactor in which neutrons produced by a thermonuclear reaction within the tube would initiate a fission reaction in heavy materials in a blanket surrounding the tube.

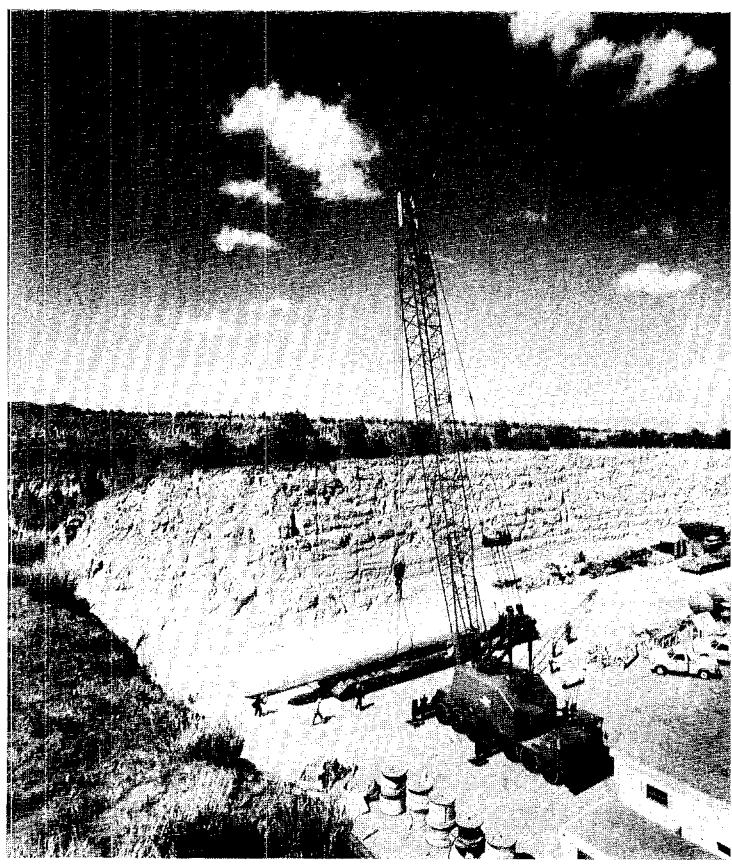
The photos at the bottom of the opposite page are an excellent example of cost saving. The 3 huge hydrogen tanks were left over from Project Rover. They have now been moved from TA-46 to TA-53 near LAMPF where they will be used as high pressure air receivers. By re-utilizing existent but unused equipment, the Los Alamos Scientific Laboratory saved an estimated $200,000 as compared to purchasing similar new tanks.

The movement of equipment into and around the Laboratory provides as good a picture as any of how research programs are constantly changing. LASL, with the frequent assistance of the Zia Company, is continually busy changing the hardware accordingly.



Above, a 4,500-pound collector plate goes down into "the pit" at SM-105. Below, 60-ton tanks are moved from TA-46 (left) to TA-53 (right).





short subjects

Honors: **Albert Migliori,** Q-26, was one of 110 young scientists to receive a National Science Foundation Postdoctoral Energy-Related Fellowship. Migliori is conducting cryogenics research.

Llewellyn Jones, CNC-4, has received the 1975 Honor Scroll Award of the New Mexico Institute of Chemists (a division of the American Institute of Chemists) for outstanding contributions to the fields of infrared and Raman spectroscopy.

Richard Hiebert, E-3, received the annual Electrical Engineering Achievement Award for staff members, and **Robert Butcher,** L-7, received a like award for students from the Los Alamos Sub-Section of the Institute of Electrical and Electronics Engineers. Hiebert was cited for innovative instrumentation work in biophysics and health physics, and Butcher was recognized for design and instrumentation of dye laser and associated high-voltage systems.

Eldon Brandon, CMB-11, received the W. E. Hobart Memorial Medal from the American Welding Society for a paper chosen as the year's best contribution to the progress of welding.

Paul Tallerico, MP-8, was elected a Senior Member of The Institute of Electrical and Electronics Engineers, the highest professional grade for which application may be made. **Duane "Hank" Winburn,** L-DO, was reelected National Secretary of the Laser Institute of America. **Lois Godfrey,** ISD-4, was elected a director of the Special Libraries Association as chairman-elect of that organization's Chapter Cabinet.

The 30th reunion of veterans and pioneers will be held at Los Alamos June 20-22. Anyone present at Los Alamos on or before December 31, 1947, is invited. For information, phone 667-6642, 667-4136, or 667-5898.

Signs of the times: A job description listed recently in the LASL **Bulletin** for a staff member included the requirement, "should delight in the untangling of red tape in order to meet primary project aims."

From ERDA: **H.C. Donnelly,** manager of the Albuquerque Operations complex since August, 1968, has retired after more than 45 years of U.S. government service. He had held this post since his retirement from the U.S. Air Force as a lieutenant general. During Donnelly's military service, he had numerous assignments in the nuclear weapons field, including that of Director, Defense Atomic Support Agency, in Washington, D.C. In June 1971, he received that agency's highest award, the Gold Meritorious Civilian Service Medal, and in March 1973, he received a Presidential Commendation for distinguished contributions to the nation's nuclear weapons program, followed by the AEC's Distinguished Service Award in May, 1974. Donnelly's successor has not been named.

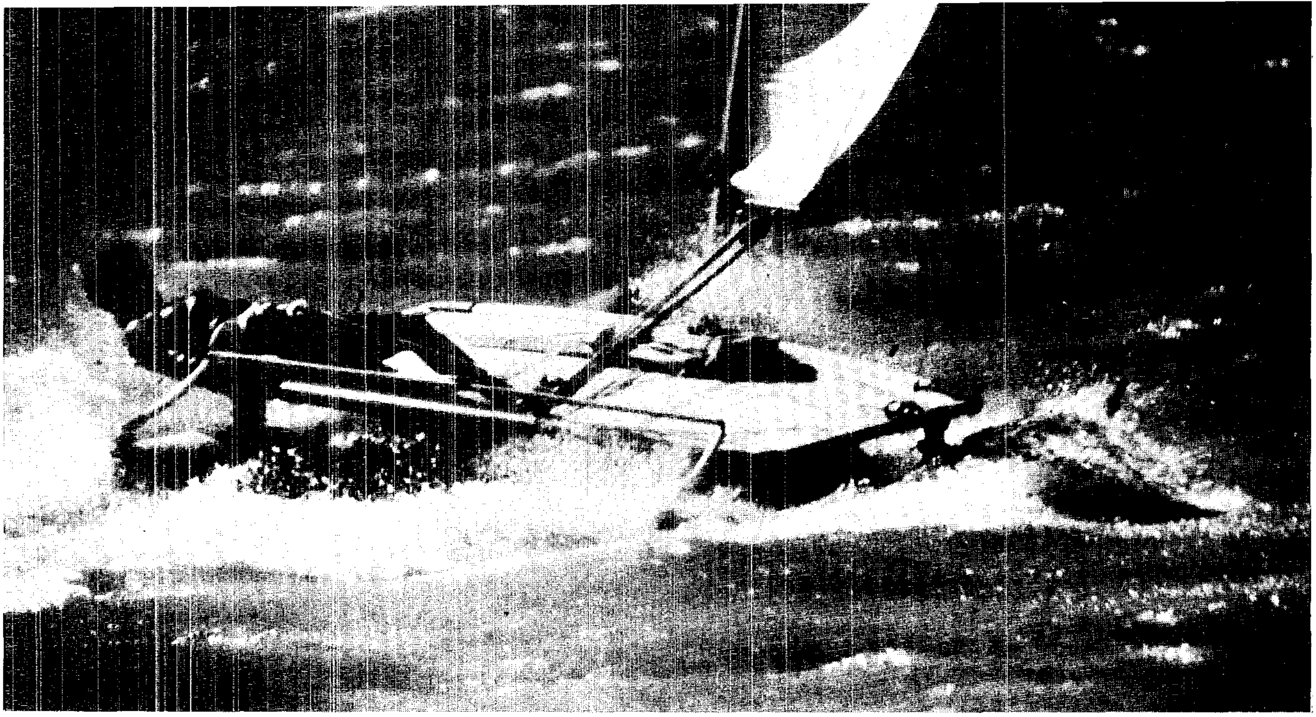
James P. Crane has been appointed director of the Security Division of the Albuquerque Operations Office, succeeding **Donald Dickason,** who has been named director of that office's Transportation Safeguards Division. Crane previously held the same post at ERDA's Richland (Washington) Operations Office.

David Gurule, general engineer for the Los Alamos Area Office, has been appointed safety and health engineer for the Technical Programs Branch of that office.

Snowfall on Saturday, April 11, set an all-time Los Alamos record of 20 inches. The previous records were 18 inches on December 15, 1915, and March 30, 1916.

Retirements: **Leo G. Chelius, Sr.,** H-1 assistant group leader; **Laurene F. England,** SP-3 secretary; **Ralph H. Greenwood,** P-4 instrument section supervisor; **Felix B. Litton,** AEC regulatory staff member (formerly LASL); **Robert N. Mitchell,** H-5 staff member; **Robert H. Osborn,** CMB-6 maintenance and equipment supervisor; **Arthur K. Robison,** WX-3 staff member; **Robert G. Shreffler,** DIR-O staff member; **Donald F. Silver,** SD-5 branch shop foreman; **Jay Todd, Jr.,** WX-7 staff member.

Deaths: **Larry D. Allen,** CNC-4 staff member; **William F. Beichler,** SD-1 laboratory machinist; **R. Gillette Bryan,** CMB-1 staff member; **Dorval D. Jeffries,** CMB-11 metallographer.



Richard Hassman, M-4, speeds across a New Mexico lake in his twin-hulled Hobie Cat. High performance catamarans can exceed 20 miles per hour.

SAILING SCIENTISTS

Toward the end of May, the last of 17 small sailboats came off the "assembly line" in the garage at the home of Floyd Baker, WX-2. Since early January, when the project finally got under way with the actual cutting, gluing, and fastening together of hulls, groups of 3 and 4 LASL employees had been working evenings and weekends to keep the project moving. Now, except for individual sanding, painting, and fitting out at home, the work was completed. The fleet of 8-foot marine-plywood El Toros was almost ready to "take to sea."

The project, which would have been ambitious in any part of the country, is even more remarkable in Los Alamos where the only body of water appears to be Ashley Pond.

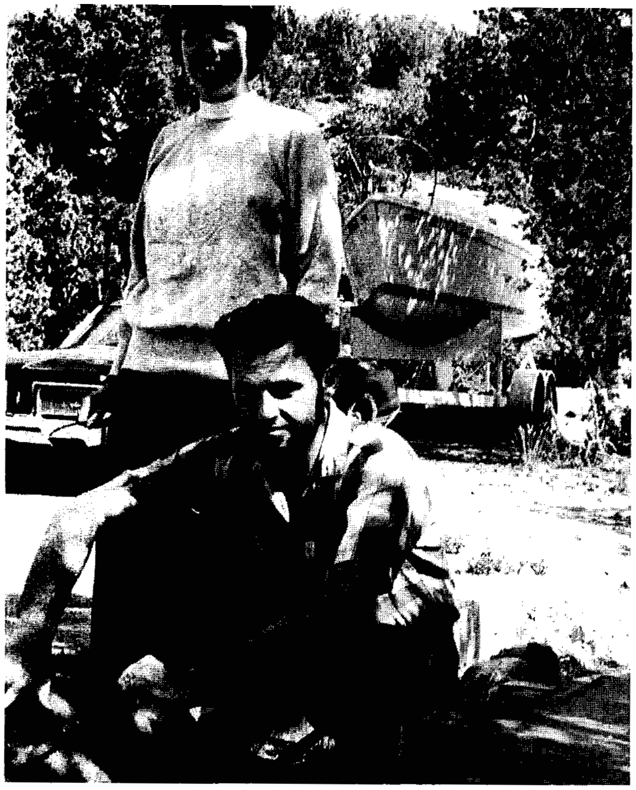
(Not visible from Los Alamos, of course, are the sizable New Mexico lakes, such as Heron, Navajo, Cochiti, Conchas, and Elephant Butte, to which the skippers of El Toros and larger boats drive—up to 200 miles—to indulge in one of their favorite pastimes.)

The El Toro project began last fall when Don Lauer, WX-3, and Jack Nelson, ISD-1, planned to build several of the sailboats for their children. Lauer subsequently had to withdraw from the project, but in the meantime had "talked it up" enough around the Laboratory to attract other participants. The group began meeting during lunch at the South Mesa cafeteria, then at night at Baker's home, and grew to include John Barnes, IV (son of John Barnes, T-4); Sue Bunker, J-15; Chuck Forest, TD-6; Walt Hatch, E-3; Chick Keller, TD-6; Piper Mason, CMB-14; Carl Henry, A-2; Bill Regan, ISD-1; Clem Toft DIR-SEC; Dick Young, TD-4; Gary Worth, A-2; and Terry Gibbs, DIR-O.

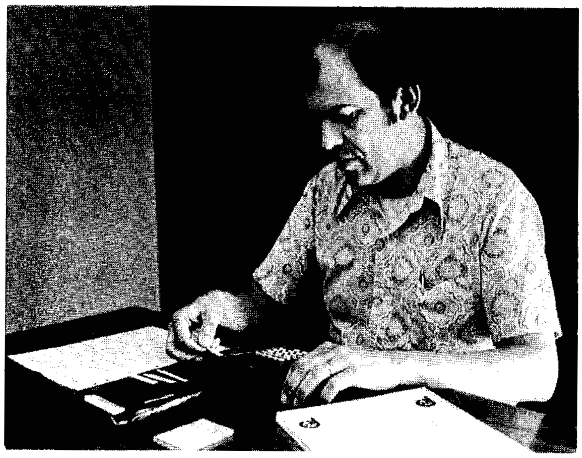
The main production line was set up at Baker's Los Alamos home where a jig was built upon which the marine plywood could be formed and fastened. Each hull took 2 to 3 nights to build, requiring 400 screws in addition to epoxy glue, plus additional carpentry for decks, thwarts, and trim after removal from the jig. Regan, who had built an El Toro in California before joining LASL, loaned his boat as a model.

With this kind of volume, it became obvious that a subassembly plant was needed as finished hulls began filling up Baker's garage. Young provided his home in Tesuque for cutting and finishing components, and for assembling daggerboard trunks and spars. This operation was immediately named "Tesuque Cottage Industries."

The group organized itself into work teams and attempted to assign repetitive tasks to increase efficiency. The idea never did work with absolute perfection as many members could not always work on assigned nights. Nevertheless, it worked well enough to get the job done. The boats were completed at a cost of closer to $200 each than the $150 originally estimated, but still about



Above left, Chick Keller, TD-6, works on a plywood El Toro and, above right, Bonnie Young, SP-12, and Dick Young, TD-4, stand on steel which will become a 35-foot cruiser (their 24-foot boat in the background will serve until then). At left, Group WX-2's sometime Chile Ridge Yacht Club holds its Yearly Uno de Mayo Regatta on the Rito de Los Alamos where homemade boats with sails of sorts compete. Below left, the cruiser of Piper Mason, CMB-14, nestles in a cove in Bahia Concepcion, Mexico, during a New Mexico Sailing Club cruise. Below right, Mason works evenings on boat performance curves and an advanced handicapping system.



50 per cent less than buying the same boat from a manufacturer would have cost.

The group looks forward to a summer of recreation on the water. All boats have been duly registered with the national El Toro Association and will sport brightly colored sails. They should make quite a sight on New Mexico's lakes.

From Cockleshells to Cruisers

The El Toro group is by no means the first or only of LASL's boat builders. A number of LASL employees have built boats ranging from sailing kayaks to large ocean-going cruisers.

One of the more surprising of current boat-building projects is Young's. He's building a 35-foot cruiser of steel.

The Young home nowadays resembles more a boat yard than an adobe-style home at the foot of the Sangre de Cristo mountains. In the driveway, a 24-foot fiberglass cruiser sits on its trailer. In his workshed, 2 sailing surfboards are stored. The veranda of his house is filled with stacked lumber, sawhorses, and tools for making El Toro parts. And in his yard sits almost all of the steel he will need to begin construction next year.

"We chose steel for several reasons," Young explains. "It costs no more and possibly less than comparable wood construction. It will take a lot less labor as construction is basically a cut and weld procedure. I'll probably get some professional assistance on that, but it should go fairly fast once we start.

"There are corrosion problems, especially in salt water, but these can be controlled with paints and electronic devices that create a neutralizing current in the hull and surrounding water. Corrosion is mostly an electrolytic action. We like steel's strength for offshore cruising or in areas where you could run aground."

Young plans to lay out lines and cut patterns in a rented shed this winter, and begin construction in his yard the following spring and summer. After that, he has set no schedule. "We'll pay as we go and work as we feel like it. When it's finished, it's finished, and we'll ship it to some saltwater port and use it for vacations, perhaps chartering it out between times. Some day, Bonnie (his wife) and I may retire aboard her."

In the meantime, the Young's fleet of a cabin cruiser, 2 sailing surfboards, and 2 El Toros should fill their boating needs.

Sailors Everywhere

In 1970, a small group of sailing enthusiasts, partially as a lark, but partially in the hopes that something serious would come of it, founded the New Mexico Sailing Club and began meeting in Santa Fe. Among the founders were Mason, Nelson, and Jim Murphy, L-1.

Today, the club lists over 50 member-families with Nelson and Mason serving as commodore and vice commodore; Bob Workinger, J-8, as a director; Workinger's wife Kay, as editor of the club publication, and Young as program chairman. About one third of the membership consists of LASL employees.

The club holds meetings during the winter, conducts races at Lakes Navajo, Heron, and Cochiti during the summer, and sponsors an annual cruise to Mexico's Sea of Cortez during the fall. Participants such as Mason and Workinger, both with trailerable cruisers, haul their boats some 800 miles to Guaymas or Kino Bay, there to launch them for a week or so of lazy cruising, skindiving, fishing, and clambakes on shore.

New Mexico also has an organized fleet of Hobie Cats—very fast, "hot dogging" twin-hull boats—that race frequently on various lakes. LASL employees who have been contenders are Richard Hassman, M-4; George Price, WX-DO; and David Schultz, C-1.

Another group at LASL has no formal organization, but consists of 10 to 20 LASL employees meeting more or less monthly at the cafeteria to share slides of vacation cruises or occasionally view a film. And at the Clinton P. Anderson Los Alamos Meson Physics Facility, Ed Bush, MP-8, an avid sailor who frequently takes home "the silver" in racing occasionally presents luncheon sailing programs.

A Better Way to Handicap

In the esoteric world of sailboat racing, as theoretical and complex in some ways as that of nuclear physics, handicapping is a necessity if boats of varying size, design, and speed potential are to race equitably.

Many sailors have long been critical of present national and international handicapping systems (or rating rules, as they are also called). Few have done anything about it except to modify the rather arbitrary formulae, which in turn changes ratings. These changes usually result in a new generation of yacht designs, built to take advantage of the new rule, dominating the race scene while "last year's boats" are made obsolete.

An exception among the critics is Piper Mason, CMB-14. Since 1971, Mason has combined his love of sailing with his mathematical and scientific training to derive a new concept in sailboat handicapping. His handicap system, which has been adopted by the New Mexico Sailing Club, determines a variable rating which responds to the courses, speeds, and wind conditions prevalent during a race.

"The prevalent constant ratings used in ocean racing are based on arbitrary formulae which determine a single rating for a yacht. Such a system is not equitable under all conditions. A boat that is fast in light wind conditions may not be so fast in strong winds relative to the speeds of other yachts, and vice versa. Similar arguments can be made for courses with varying degrees of sailing towards or away from the wind."

In the development of his mathematical model, Mason has conducted a series of full-scale tow tests on a large variety of yachts to confirm the accuracy of his theoretical equations. Stability tests have also been made to determine the maximum sail driving force achievable in strong wind conditions. (Attempting to carry too much sail will cause excessive heeling, or leaning, and actually slow a yacht's speed.)

As a result of his extensive analysis, Mason has presented several papers at sailing symposia during the past few years. Influential naval architects, officials of the United States and international yacht organizations, sailing experts, and marine research institutions have expressed considerable interest and encouragement in his research. Mason is presently generating "Yacht Performance Curves" for several large ocean racing yacht owners to further the research of sailcraft performance.

Mason's system relies on after-the-race determination of the applicable handicap ratings, a procedure to which sailors are not accustomed. Critics contend that this poses problems for racers and creates complications for race committees in the calculation of race results.

Conceding these objections, Mason nonetheless holds that such procedures are not difficult with today's pocket calculators, and are necessary to create a more equitable system which will award trophies on the basis of skill alone.

Mason's system indeed challenges concepts predominant in yacht racing and naval architecture for more than 100 years. Who knows but Mason's variable rating system, or something like it, may someday supplant, or at least move alongside of, the present constant rating systems.

A Sailing Beehive

It would be reasonable to claim that Los Alamos, on a per capita basis, is the sailing capital of New Mexico and a major sailing center in the Southwest. Certainly, visitors from Long Island Sound or San Francisco, where sailing is rampant, would be astonished by the scope and depth of sailing activity here. Whether it be in the ambitious mass production of small boats, the equally ambitious building of large boats, racing, meeting for fun and instruction, cruising to exotic waters, or devising a fundamentally new handicapping system, Los Alamos sailors are busy "making waves" this summer.

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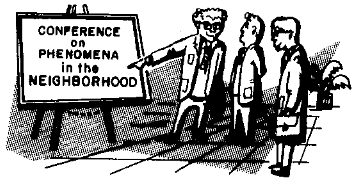


years ago in los alamos

Culled from the March and April, 1965, files of The Atom and the Los Alamos Monitor by Robert Y. Porton

How's That?

Los Alamos scientists Edward Hammel, Eugene Kerr, and Robert Sherman wondered if they were in a quilting bee and gossip session or a scientific meeting when they arrived at a Washington, D.C., hotel last week. The LASL cryogenics specialists were bound for a symposium titled: "Conference on Phenomena in the Neighborhood of Critical Points." But signs pointing the way to their meeting place bore the legend: "Conference on Phenomena in the Neighborhood."

For Sale

The final 141 lots to be developed by the Atomic Energy Commission on Barranca Mesa will be sold during May. The new lots are east of the Barranca Mesa Elementary School. Development of the Barranca Mesa was begun by the AEC in 1958.

Author

G. Robert Keepin, N-2 staff member on leave with the International Atomic Energy Agency in Vienna, Austria, has written a book devoted to spanning the gulf between development in fission physics and their application to fission physics to fission reactor systems. The book, "Physics of Nuclear Kinetics," has been praised by nuclear scientists and reviewers, and has been made a part of the publisher's series in Nuclear Science and Engineering.

Runoff

Northern New Mexico streams will run high and long this year as a result of bountiful winter snows in the mountains. The runoff potential is the best since 1957 for Southern Colorado and New Mexico, the Federal-State-Private Cooperative Snow Survey reported in May. Mountains in the Rio Grande headwaters area of Colorado have a near-record snowpack, upwards of 155 percent of normal.

Honor

Stephen Stoddard, head of the ceramics section in CMB-6, was named the nation's outstanding young ceramic engineer at the annual meeting of the American Ceramic Society in Philadelphia, Pa., last week. Stoddard came to Los Alamos in 1952. He was cited by the National Institute of Ceramic Engineers for achievements "significant to his profession and also the general welfare of the American people."

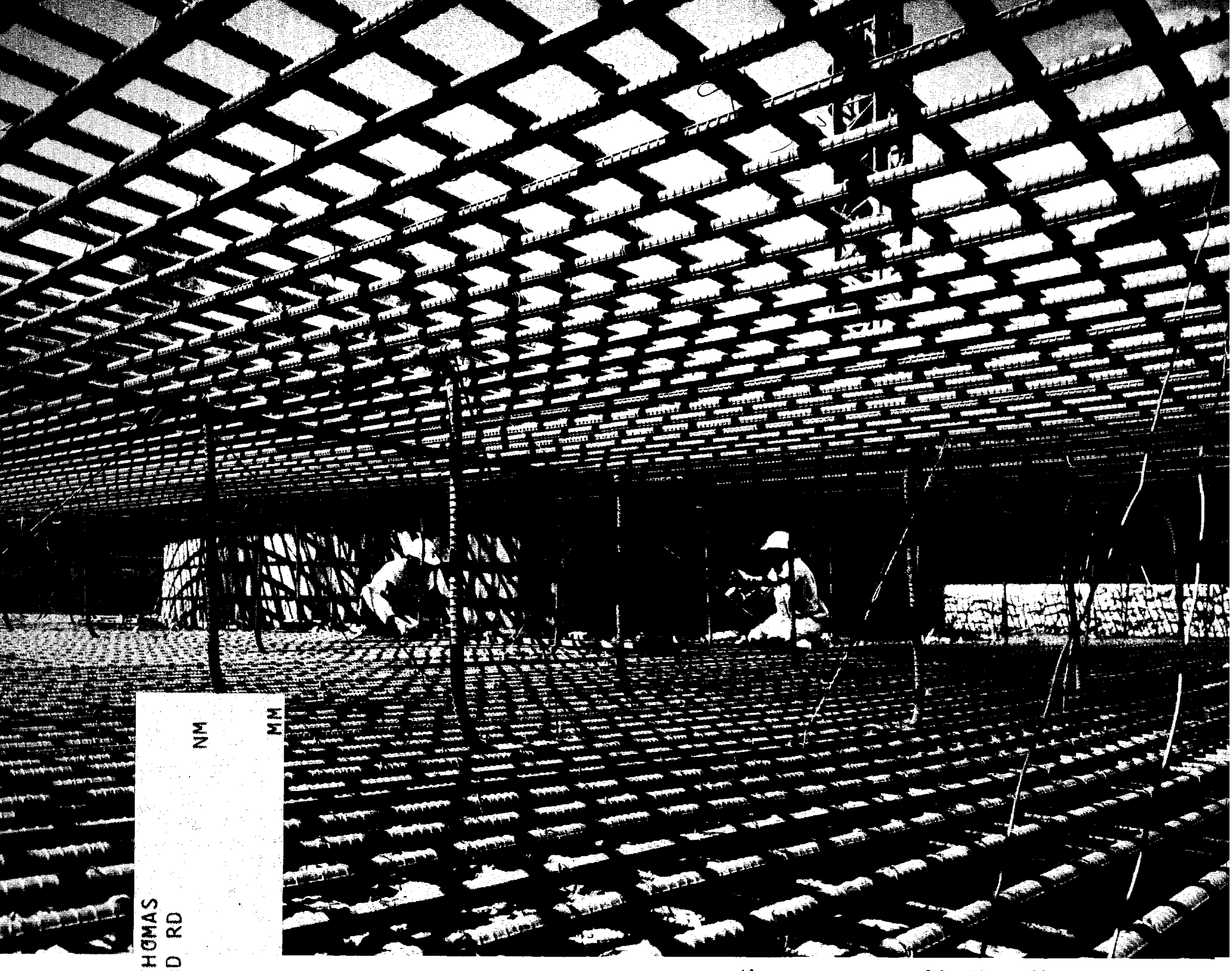
Among Our Guests

On May 28, Michael Yarymovych, ERDA Assistant Administrator for Laboratory and Field Coordination, visited LASL for briefings and visits to various facilities, including the Central Computing Facility. Left to right, Jack Worlton, C-Division leader, Yarymovych, Vitalij Garber, assistant to Yarymovych, Herman Roser, ERDA Albuquerque Operations Office, and Duncan MacDougall, associate director—weapons.

A pensive moment for J. Allen Hynek is captured before he spoke at a colloquium on March 20. Hynek is chairman of the astronomy department at Northwestern University and is head of the Center for UFO Studies in Evanston, Ill. His topic was "Current Status of UFO Research."

Pleasantries are exchanged by Director Harold Agnew and U.S. Representative and Mrs. Manuel Lujan Jr., during the Lujans' visit to LASL on March 28. Lujan later spoke at a special colloquium that afternoon on legislation related to science.

Carlos Penafiel and Luis Monteil, electronics production managers of the *Instituto Nacional de Energia Nuclear*, Mexico City, Mexico, standing left, are shown LASL electronics production methods by Gordon Spingler, E-2 group leader, standing right, during the latter part of April. Seated is Bernice Garcia, E-2, who demonstrated fabrication methods.



Abstract art is created by Mitzi Ulibarri as he photographs reinforcing steel for the foundation of the Weapons Research Neutron Facility in the vicinity of LAMPF. The photo won the top award at a recent statewide photographic competition (see inside front cover).