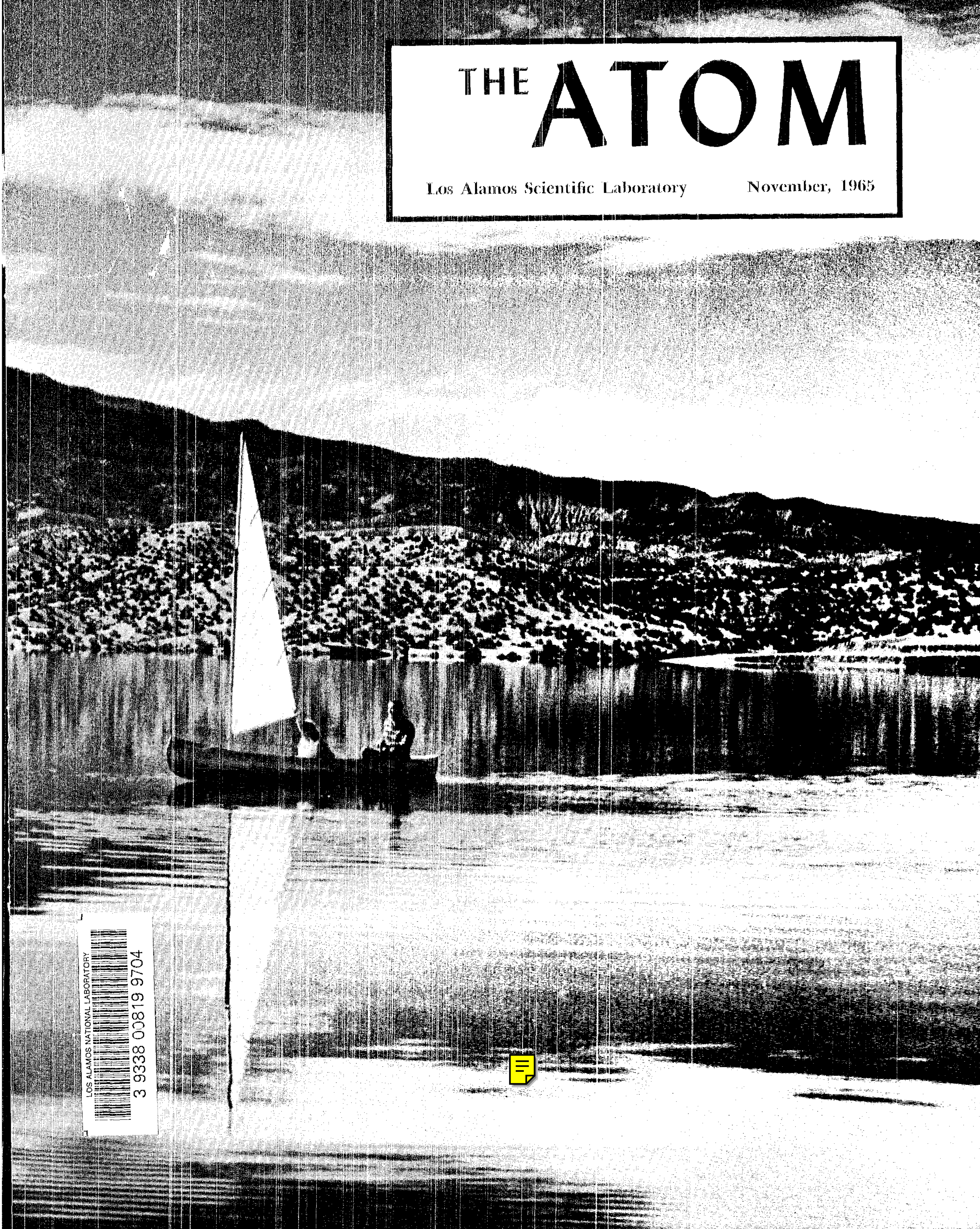
THE ATOM

Los Alamos Scientific Laboratory November, 1965



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ON THE COVER: It's a little late in the season for sailing but in lake-hungry northern New Mexico you take advantage of every opportunity. LASL's John Cole and daughter Nancy were photographed by John Young in their 17-foot sailing canoe on Lake Abiquiu, an impoundment behind Abiquiu Dam. The lake is mostly water transferred from El Vado Dam upstream on the Chama River. It will be there through most of November, according to Army Engineers. Unless there is a heavy demand for irrigation, water will be retained at a recreational level for the 1966 summer season.

Short Subjects

Los Alamos hunters are again urged to contribute game hides to the Elks Lodge, which exchanges them for leather used in physical therapy work at New Mexico veterans hospitals. The project is a part of a statewide Elks program. Bob Lory, chairman of the local "Deer Hide" committee, says deer, elk, antelope and cow hides and sheepskins are particularly desired, but any other hair animal skins are acceptable. The hides may be deposited at the Elks Lodge, 1600 Trinity Drive, or at various deposit stations in Los Alamos. The Future Farmers of America will man similar stations at Espanola.

The Civil Defense Fallout Shelter Handbook prepared by the Los Alamos County Civil Defense organization won a first place award for special CD publications at the fourteenth annual meeting of the United States Civil Defense Council that was held in Las Vegas, Nev., last month. The award plaque was presented to County CD Director Robert Y. Porton, who attended the conference with Deputy County Director John W. Schroer. The plaque will be exhibited in the LASL Museum.

Joint Task Force 8, the military command to which LASL personnel are attached for atmospheric weapons test activities, is being transferred from Washington, D.C., to Sandia Base in Albuquerque. JTF-8 is a subordinate command of the Defense Atomic Support Agency and is responsible for atmospheric nuclear weapons testing and the readiness to resume testing if the Nuclear Test Ban Treaty is abrogated. Operation Roundup, the simulated test operation this fall in which LASL is participating, is a JTF-8 operation.

First sale of Government-owned houses may come late this month, according to E. Daryl Mabee, head of the Housing and Home Finance Agency office in Los Alamos. The "finding of feasibility of sale" of the AEC's residential property, one of the last requirements before sales begin, was published October 19. Mabee said 316 units in Eastern Area, with an appraised value of nearly $3,500,000, will be offered first. The entire sales program is expected to take about 18 months.

Accord was reached last month by a House-Senate conference committee on the inclusion in the fiscal 1966 Public Works Appropriations bill of $3.2 million for further research on LASL's proposed meson physics facility. The House had earlier approved $2 million for advanced research and design for the facility; the Senate added $1.2 million for architect-engineering work. LASL has been fully supported in its bid for the unique accelerator by Senator Clinton P. Anderson and Represenative Thomas Morris. The appropriation now must be approved by the Bureau of the Budget.

Serafico Segovia, a metal cutter in SP-3 and one of the Laboratory's most unusual commuters, retired last month. Segovia joined Project Y in 1942 as an Army employe and came with the University in 1945. For all of his 22-plus years, Segovia lived in Santa Fe and commuted, but he never drove an auto! For many years he arose at 4 a.m. to catch an Army bus and in later years was a member of various car pools. He estimated he traveled some 350,000 miles getting back and forth to work. In retirement, Segovia and his wife, Adelina will do some gardening and visit with their eight children and 22 grandchildren.

John S. Malik Is Cited for EMP Work

LASL's Dr. John Malik gets congratulatory handshake from Air Force Systems Command's General B. A. Schriever for his Outstanding Achievement award.

Quiet, soft-spoken John S. Malik, of LASL's J (Test) Division, has been cited by the Air Force for his outstanding contributions to the understanding of both electromagnetic pulse (EMP) phenomenology caused by atomic bomb blasts and effects on military systems. In recognition of this work, he received the Air Force Systems Command Award for Outstanding Achievement at Kirtland AFB, October 7, from General B. A. Schriever, Systems Command commander.

The Air Force Weapons Laboratory (AFWL) at Kirtland nominated Malik for his award, which covers the period from September, 1961, through June, 1965. The work grew out of supporting contributions of an ad hoc group formed in 1961 to formulate criteria and corrective measures to employ in the design of hardened defense facilities which had to withstand an initial enemy attack and still be capable of delivering an immediate retaliatory punch. Along with Malik on the ad hoc committee were Conrad Longmire, Alternate T Division Leader, Bergen Suydam, T-DOT, Ralph E. Partridge, now with J-DO, and a number of scientists from other installations.

The ad hoc committee was the start of EMP studies. Longmire said Malik, more than anyone else, devoted his time to EMP studies as a member of the ad hoc group, as a member of other EMP committees, and as a consultant. "He is a walking EMP encyclopaedia," Longmire added.

The Air Force Weapons Laboratory was assigned primary responsibility in furthering work on EMP, both in the laboratory and in the field. The work was a cooperative effort of several organizations, with AFWL and the Defense Atomic Support Agency as focal points, and accepting guidance and contributions from LASL, among others.

Dr. Malik was employed by LASL on May 22, 1950, first with GMX Division and later with J Division. He started working on gamma ray studies connected with nuclear detonations—a field that led naturally to EMP studies. Longmire says Malik is the U.S. expert on gamma output of bombs.

In the past, Malik was an experimentalist. Today he is more of a theoretical man. One of a small group working on special problems in J Division, Malik has taken all available EMP information, both past and present, and has helped the Air Force apply the information to hardening of missile sites, Partridge explained.

Malik thought up the idea for a device at Kirtland AFB which simulates a nuclear electromagnetic pulse and which is also a sensor facility to study specialized instrumentation. Partridge, who works with Malik, explains that EMP is a very high-powered radio signal—bigger than a lightning bolt—created by an atomic blast. The signal could disrupt defense communications, missile control systems, and power systems.

In nominating Malik for the award, Colonel Raymond Gilbert, AFWL director, wrote: "Over the past four years, Dr. Malik has been

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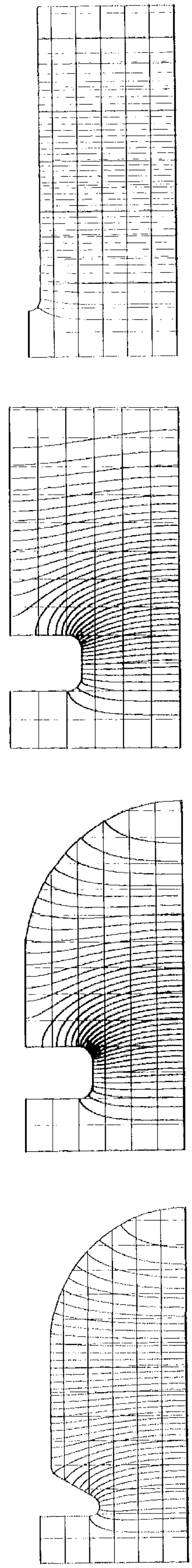
LALA



These drawings, made by LASL's 7094 computer, depict the evolution of a cavity design for the Laboratory's proposed meson physics facility accelerator. LALA, standing for Los Alamos Linear Accelerator, is the computer printer identification for the project. The four varying drawings progress from top to bottom and show the upper left quadrant of four cavity designs for the accelerator. The horizontal lines, which curve at the ends in some instances, are electric field lines as predicted by the computer. The drawings result from a computer code written by Harry Hoyt of T-5. The code was used to alter the shapes of prospective designs in the interest of better power efficiency. A period of three years of development, supervised by the research group that was first P-11 and is now the MP Division, is represented by these four drawings. At top is a cross-section of the iris-loaded waveguide. Its power efficiency factor was about 12. A succession of design changes upped the power efficiency to 46 for the new side-coupled cavity.

BY DUDLEY LYNCH

Fundamental design changes in the accelerator of LASL's proposed meson physics facility have markedly brightened the giant atom smasher's cost and performance picture. Playing the key roles in the design advancement, which has been perfected since January, are a new accelerator cavity scheme (its originators call it the side-coupled cavity), a "new concept" computer code and a small group of Los Alamos physicists.

As a result, the accelerator structure, heart of the half-mile-long research complex, should cost fewer dollars and be less troublesome to construct than was first envisioned three years ago. The accelerator should also need less electrical power, of which a prodigious

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amount will be used, to achieve given beam powers than present linear accelerators. And, too, it should be less temperamental in tune-up and day-to-day functioning.

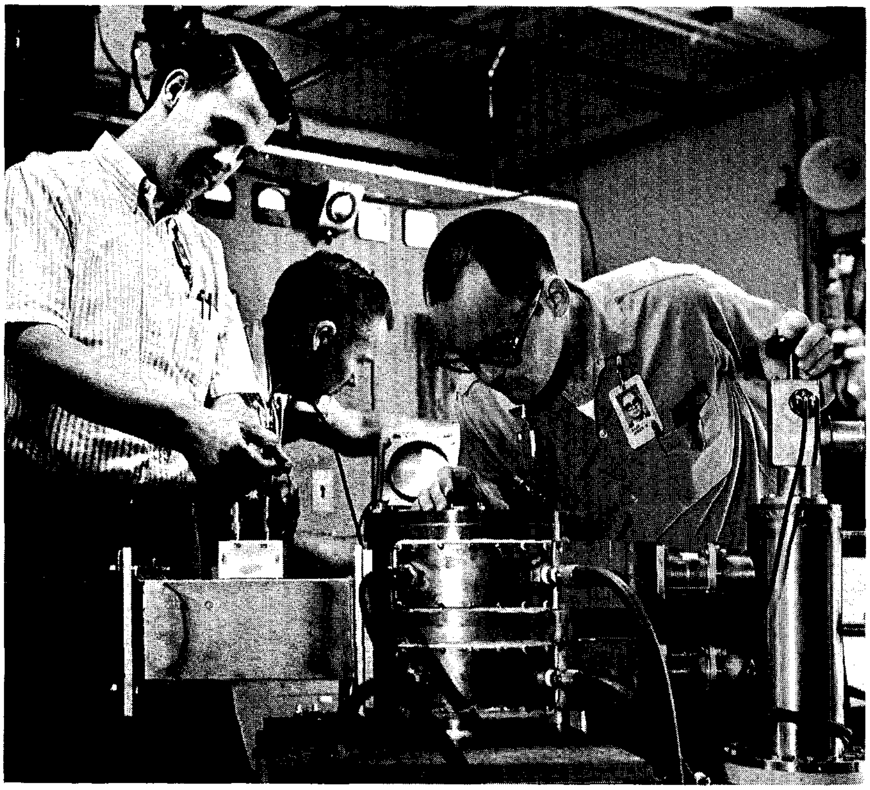
Although only actual operation will concretely confirm its effectiveness, the new design appears to hold significant promise for future development of this type accelerator.

The innovations affect the high-energy end of the two-part, 2,400-foot-long proton accelerating tube. This structure is designed to accelerate protons to nearly 84 per cent of the speed of light. A secondary beam of pi mesons, the elusive "glue" particles that hold the atomic nucleus together, results when the primary proton beam collides with atomic nuclei targets.

In the accelerator's high-energy end, the protons ride an electric field wave through an astoundingly long series of cavities or cells (more than 4,000 will be required) which form the accelerator tube. The wave velocity, which in empty space would be the speed of light, is made to match the proton velocity by the cavities. In this way, the protons stay in synchronization with the wave.

The new system involves a novel, simplified cavity design and a "detour" in coupling, or transferring, electromagnetic energy from one cell to the next. Both of these innovations are made possible by an ingenious change in the cell-to-cell electric field pattern.

A trio of LASL scientists is responsible for the new cavity scheme. They are Darragh Nagle, Associate MP Division Leader; Edward A. Knapp, Group Leader of MP-3, the section designing the accelerator cavities, and Harry C. Hoyt, Alternate Group Leader of T-5. A Harvard University graduate student, Bruce Knapp (no relation of Edward), also made significant contributions to the studies while working as a summer student at Los Alamos.



In testing a Model E side-coupled cavity prototype for sparking characteristics, these MP-3 personnel have driven the device five times over its design power. They are, left to right, David R. Copenhagen, J. Richard Eichor and James Doss.

Research on a meson facility accelerator began here in early 1962. By the end of the year, following intensive study, the small group of physicists involved agreed that LASL should concentrate on design studies of linear accelerators (linacs). The scientific requirement was for an accelerator to propel a larger number of protons at higher energies than any accelerator built before. Technically speaking, they envisaged an accelerator with a capability of generating 1 milliampere average current of protons accelerated to an energy of 800 million electron volts (MeV).

The low-energy section of the accelerator posed few design problems. It would be an Alvarez-type drift tube section, so named because of perfections by Luis W. Alvarez, a University of California physicist who worked here on the atomic bomb during World War II. In essence, the drift tube device consists of a series of cylinders (or drift tubes), of increasing length, arranged in a straight line. The drift tubes shelter the traveling protons as the electric fields around them alternately change directions. Since the protons are not accelerated while in the tubes, the particles, in effect, "drift" through the hollow cylinders. The drift tubes progressively lengthen as the wave velocity, and thus the speed of the proton beam, increases.

Operating at 201.25 megacycles (Mc), the drift tube section of the accelerator could be effective up to 55 per cent of the speed of light (a proton energy of about 200 million electron volts). Then some other design must take over.

The most obvious candidate in 1962 was a design known as the iris-loaded waveguide. First constructed by D. W. Fry and collaborators in England in 1946, the device consists, in simplified terms, of a copper tube, divided into sections by disks, with holes in the center. The holes serve two functions. Through these openings pass (1) the particle beam and (2) the electrical energy, the latter achieving a "coupling" effect between sections or cavities. Coupling is a term used to describe the transfer of electrical energy from one cavity to the next.

"After about six months it became clear that a system was needed which didn't couple through the beam hole," explains Ed Knapp, a young physicist who joined LASL in 1958. When coupling is achieved in this manner, he points out, the geometry of the cavity is frozen. With the cavity configuration untouchable, then, little can be done toward correcting other deficiencies of the iris design: extremely high manufacturing tolerances, poor power efficiency and low electrical stability. The iris-loaded waveguide was eliminated as impractical in this instance.

Other designs were studied, including structures with such fancy, albeit descriptive, labels as the loop-coupled pillbox structure, the crossed bar structure and slow wave helices. But two others were singled out as "most promising." One was the cloverleaf waveguide, so named because, when viewed head-on, the cavity has a cloverleaf design.

The cloverleaf cavity accomplishes the coupling effect through eight elongated slots placed at 45 degree intervals around the beam opening. Operated at 805 megacycles (exactly four times the frequency of the Alvarez section), the cloverleaf design evinces good coupling quality, or energy exchange, and, just as important, needs only about one-half the electrical power of the iris-loaded waveguide to propel the beam with equal force. (The power efficiency factor increased from 12 for the iris design to 28 for the cloverleaf.) Manufacturing tolerances can also be relaxed.

For several months, this was the prime design. Knapp and his group built a number of models to test various characteristics. When the 515-page official meson facility proposal was prepared in September of 1964, the cloverleaf waveguide was the favored design.

But Nagle and the two Knapps continued their theoretical discussions on the second design possibility, a version known as a resonant coupled structure, operating in

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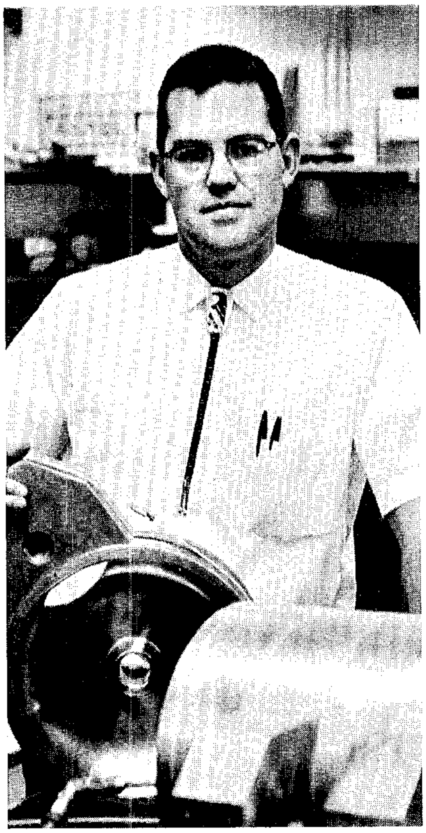

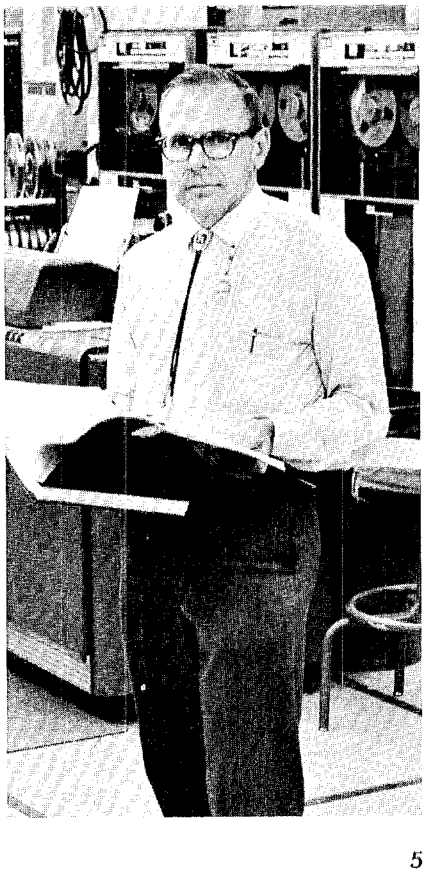

Three LASL staff members were instrumental in the design of the new accelerator cavity. Daragh Nagle (above left), Associate MP Division leader, assited in the theoretical studies. Edward A. Knapp (above right) is Group Leader of MP-3, the section which is responsible for designing the accelerator. Harry C. Hoyt (right), Alternate Group Leader of T-5, wrote a new computer code used to optimize the power efficiency of the unusual cavity design.

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what scientists label the 90-degree or $\pi/2$ mode. In this instance, a 180-degree directional shift by the electric fields occurs in sets of two cavities. The first cavity has an electric field pointing right, the second cavity stores no energy at all and the next cavity's field points left. In contrast, the iris-loaded and and cloverleaf waveguides operate in the 180-degree or π mode, i.e., the electric field reverses directions, or shifts 180 degrees, from each cavity to the next.

With consideration of the $\pi/2$ mode, an entirely new avenue of cavity design opens up. Using this mode, the center cavity—which contains no energy—can be moved out of line with the proton beam. The empty cell can then be attached to the side of the accelerator tube, astraddle the cavities where the fields are active. Small slots are cut to connect the side cavity with the two active cells, and through this "detour" coupling is achieved. And with this design, less coupling is needed.

With coupling occurring off the proton beam path, the designers are now free to change the cavity configurations considerably. They can, for example, give each cell cylindrical symmetry, so that the outer circumferences look the same from the axis in any direction. The cavity designers did this, and they promptly found that the power efficiency factor moved from 28 for the cloverleaf to 32 for the new side-coupled design.

At this point they were able to interest Hoyt, a theoretical physicist whose everyday job is weapons design, in the quest for a more suitable cavity design.

Hoyt had started work in early 1963 on a program to calculate electric and magnetic fields in the accelerator's Alvarez section and had produced a computer code similar in principle to one developed by the Midwest University Research Association (MURA). But the MURA code had a severe limitation—it required that the cavities have a coffee can shape: the outer wall flat with the ends of the cavity being joined at 90-degree angles. Hoyt's new code was much more flexible. He could now change the shape of the outer wall, an innovation which he says has become "the most important freedom in this computer program." In addition to containing greater flexibility, the new code also is faster than the earlier MURA edition.

Even with this new code, however, Hoyt was not able to compute fields and efficiencies on the cloverleaf design because the waveguide was not cylindrically symmetric.

When the side-coupled design came into favor, however, it met this requisite of the computer code, and Hoyt could now mock up Knapp's experiments with the new shape. "We compared values that I calculated with values that he measured and we got very excellent agreement," reveals Hoyt.

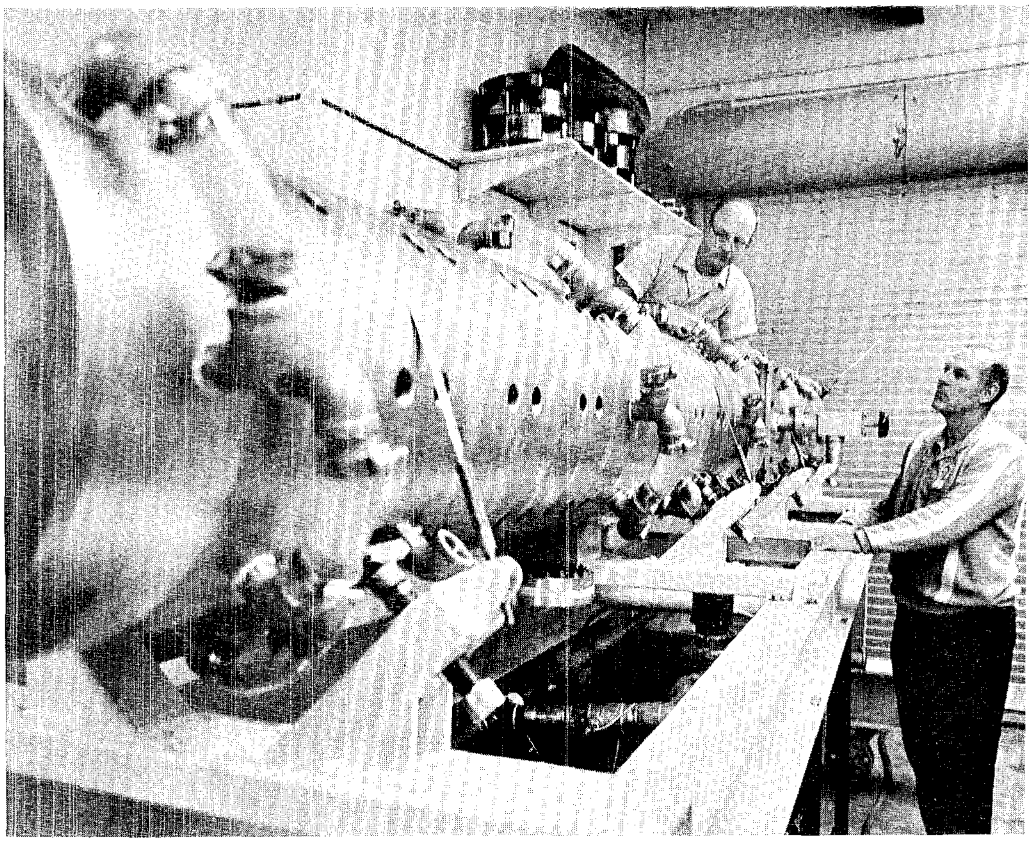
He then set about optimizing the cavity configurations in order to achieve better power efficiencies. He curved the cavity wall, and the power efficiency factor rose to 40.1. Then he smoothed out the "noses" or drift tubes, added earlier around beam openings in the cavities, and the factor climbed to 41.9. Next, the drift tube design was altered

CODE USES ARE MANY

The computer code written by Harry Hoyt for use in designing the proton accelerator for the meson facility is not restricted to this use alone. It can also be used for electron accelerators, such as the two billion volt Stanford Linac. Another field in which it may have great promise is the design of microwave tubes, such as are used in power supplies for accelerators, radar system and TV systems. Already, the program has been used to compute the electromagnetic fields inside the coaxitron, the power tube (which converts "standard" electric power into radio-frequency power) being considered for the meson facility.

James M. Potter (left) and Lars N. Engel, both of MP-3, check the electric field on a Model H, four-cavity prototype of the new side-coupled cavity design.

Dennis Simmonds (left) and Walter F. Rich, both of T-5, programmed the computer code used in designing the accelerator cavity for meson facility.



Over 17 feet long and weighing 2,000 pounds, this full-scale, 40-cavity prototype accelerator tank is examined by Valgene E. Hart (left) and H. G. Worstell of MP-3. The tank, which is of the cloverleaf cavity type, will be tested as a back-up to the now favored side-coupled cavity design for new meson facility.

from a rectangular to a triangular cross-section. The factor crested at 46. At the same time, studies were being done on the length of the drift tubes and the cavity radius. When all was done, a vastly improved design was the result.

Concurrently, another decision was made. That was to effect the transition from the Alvarez low-energy section to the side-coupled high-energy end near the point where the proton beam reaches an energy level of 100 MeV, instead of the 200 MeV level first discussed.

Again, the rationale was a matter of efficiency. The 100 MeV juncture is near the region where the performance of the Alvarez section begins to ebb and where the efficiency of the high-energy end is picking up. Too, at 100 MeV, the accelerated particles are ready to be handed over to the higher frequency portions (from 201.25 Mc to 805 Mc). The key is positioned in front of the key hole, so to speak.

What are the more salient effects, then, of these substantial design changes?

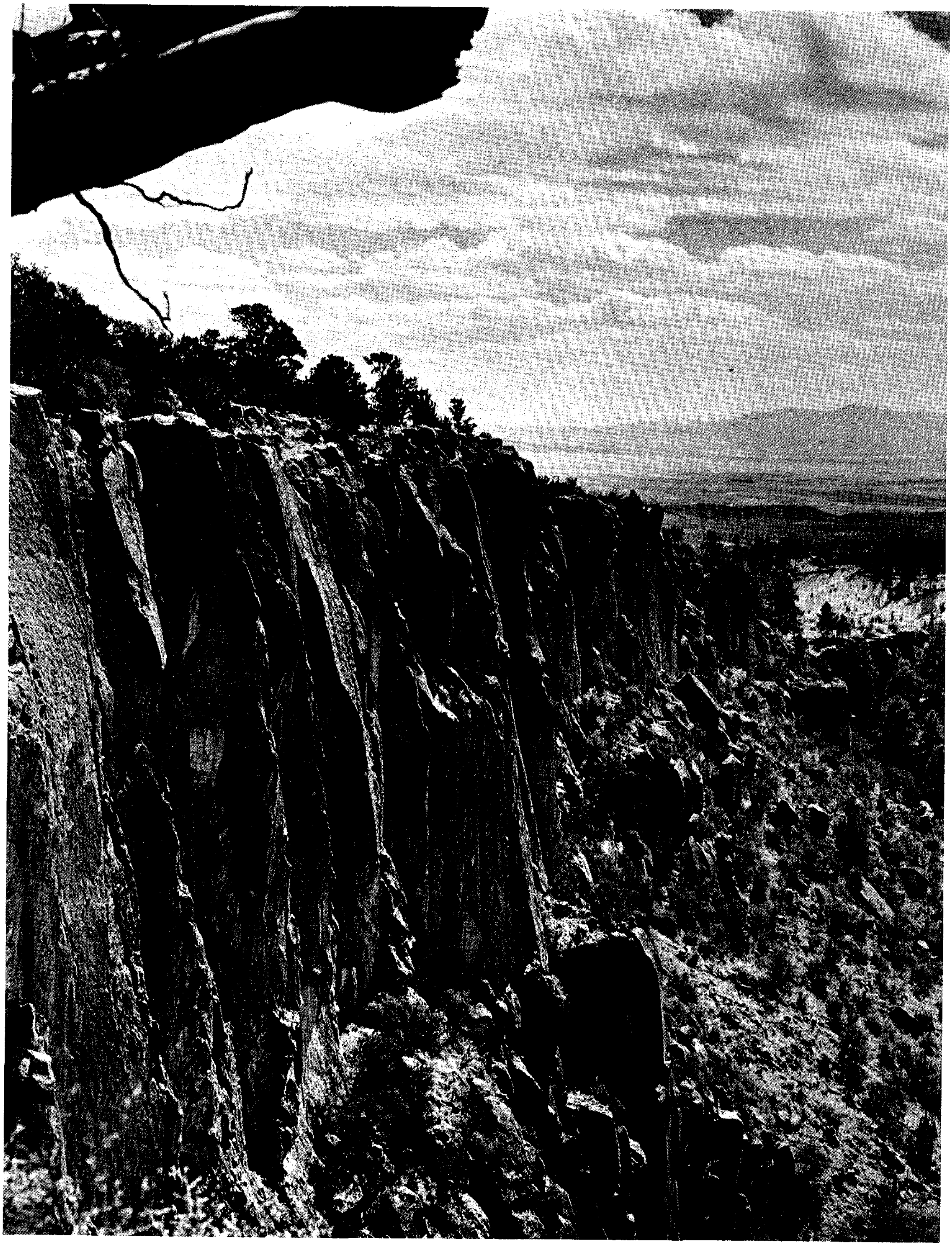
- Obviously, less electrical power will be needed. Collaterally, fewer power amplifiers will be required, another economy in cost and maintenance.
- Little or no tuning of the individual cavities is anticipated. (The cloverleaf waveguide system, which incidentally will continue to be tested as a "back-up" for the new design, would require thousands of man-hours of delicate frequency adjustments.)
- The simpler cavity shapes can be machined to ordinary shop tolerances, whereas the iris-loaded waveguide, for instance, could not be.
- More cavities can be built together in one unit, or tank, because of achievements in electrical stability.

The total package adds up to fewer dollars, easier maintenance and better performance.

Models of the new design have been run at full-power, corroborating the computer calculations and MP Division's expectations. Prototypes also have been built, indicating the design can be economically fabricated using copper forgings.

"At the present time our plans are to build the accelerator system of this design," says Knapp, adding, "I would guess that this scheme and modifications of this scheme will be used on future accelerators."

The development of the side-coupled cavity appears to be a salutary advance in the evolution of linear particle accelerators.



St. Peter's Gates Unlocked

New Road to Forest Lookout Gives Long Look

Photos by Bill Jack Rodgers

Opposite: The road from St. Peter's Dome fire lookout to Cochiti Pueblo leads along the spectacular cliff rim before its descent into Cochiti Canyon.

Northern New Mexico seems to spread out at your feet when viewed from St. Peter's Dome Lookout in the Jemez Mountains. One feels it is almost possible to reach out and touch Los Alamos, and the vast panorama from the new, two-story, cinder block, steel and glass lookout reaches farther north than Taos, south beyond Albuquerque, and east across the Rio Grande's White Rock gorge to the Sangre de Cristo range of the southern Rockies.

Access to the fire lookout during the past few years has been a virtual impossibility, unless one was lucky enough to find a gate unlocked. This is all changing now. A short section of U.S. Forest Service Road now nearing completion through the Baca Location will allow Los Alamos residents to take some rather spectacular trips through the Jemez.

The road in question is located 11 miles west of Los Alamos off State Road 4, and leads specifically to the lookout. Until recently the gate to this road was

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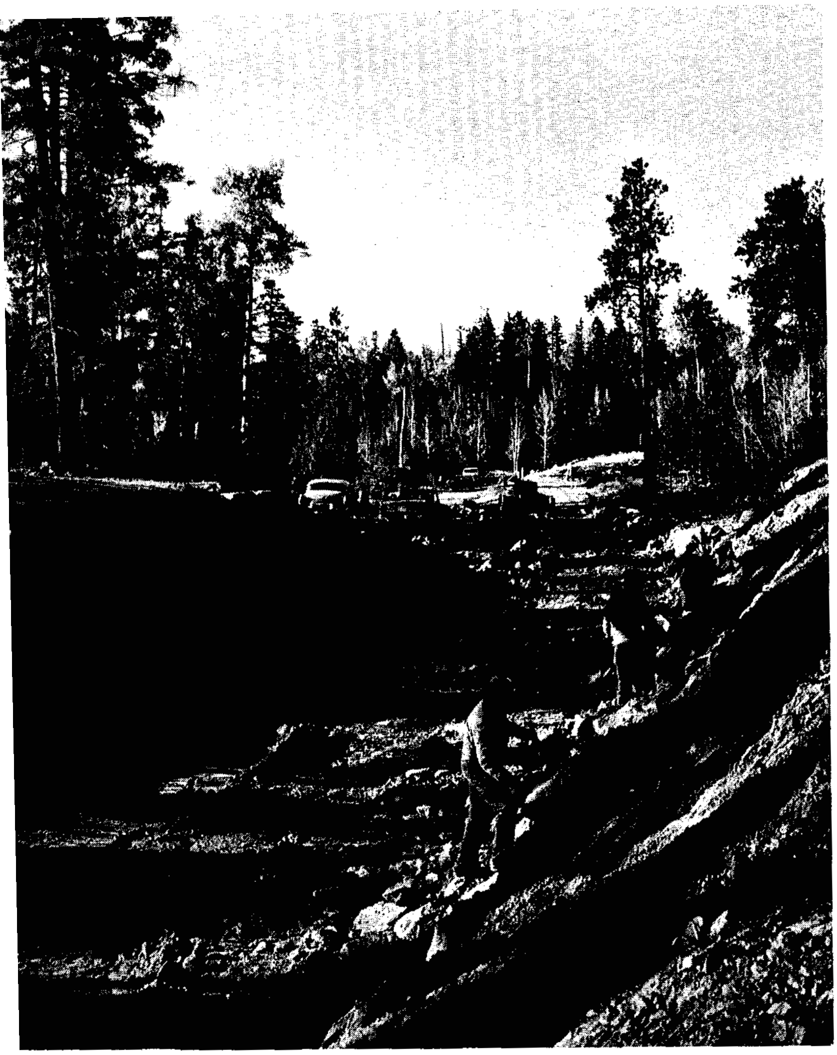
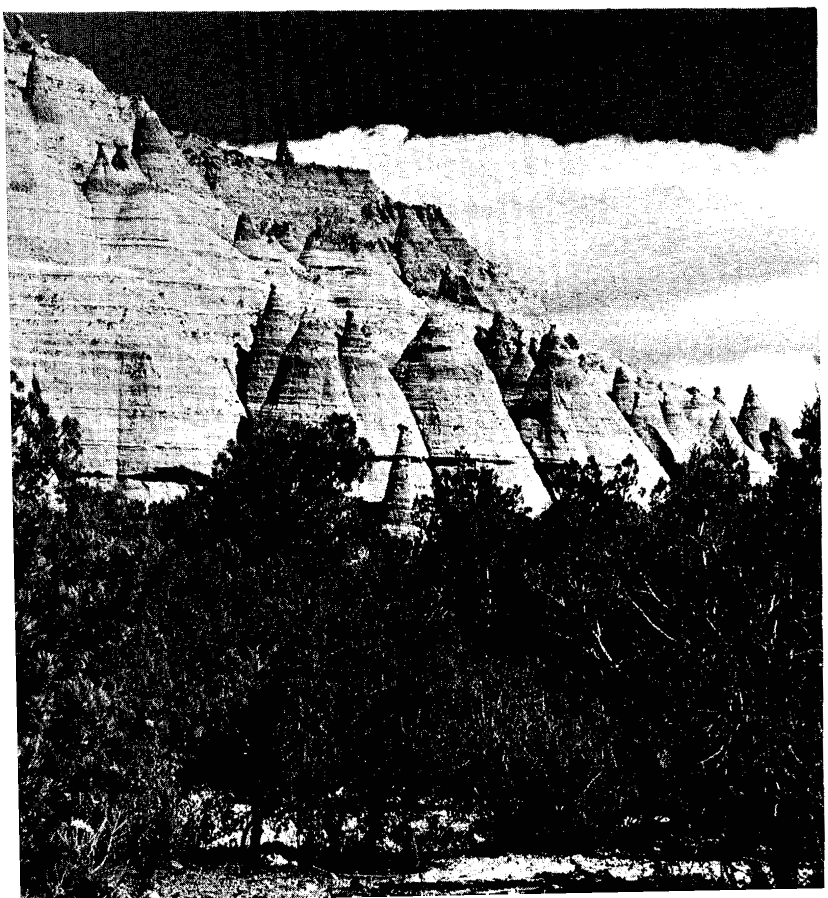


Above: St. Peter's Dome fire lookout.

Left: A new section of Forest road, just off State Road 4 towards St. Peter's Dome fire lookout, is nearing completion for public use.



Left: A whole cliffside of tent rocks maintain their quiet vigils over the valley just north of Cochiti Pueblo on the Bear Spring - Ponderosa road portion of new scenic loop.

St. Peter's

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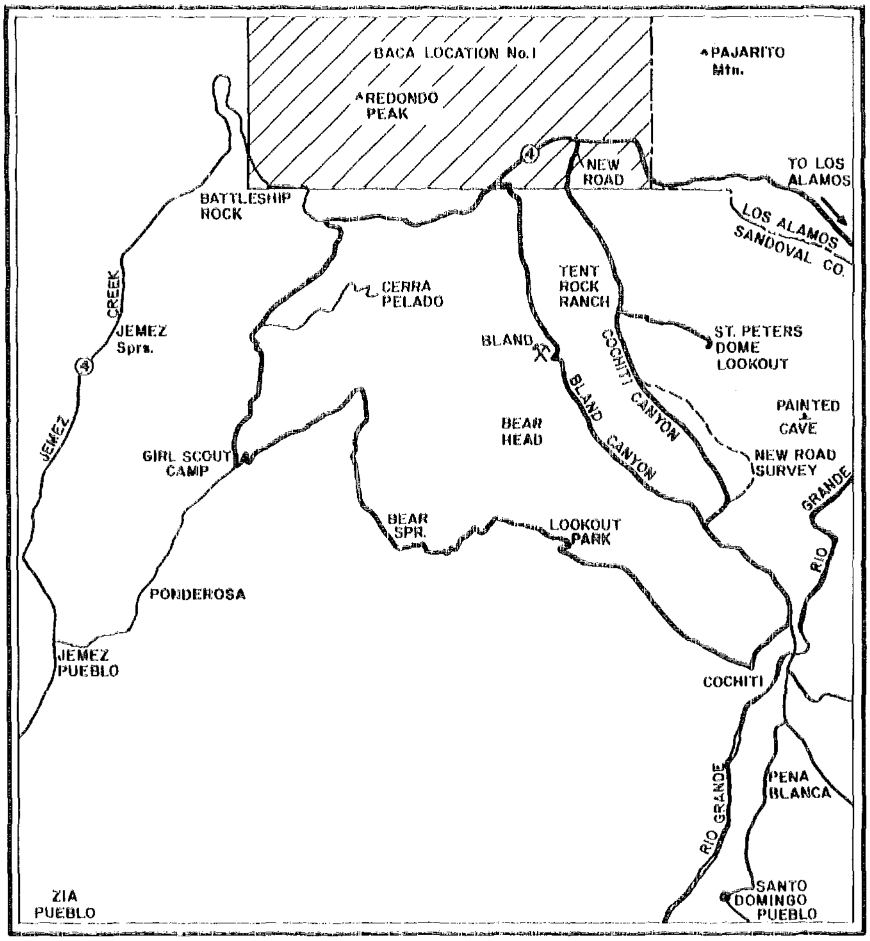
locked, however, the Forest Service purchased right-of-way through this 2.139-mile section of the Baca Location prior to its sale to James Dunigan. As soon as the road is complete this fall, a whole new area will be open to the public.

It will then be possible to drive to St. Peter's Dome Lookout, to Cochiti Pueblo along the rim of the rugged Cochiti Canyon, and back to State Road 4 via the Bland Canyon road, or a longer trip taking the Bear Springs-Ponderosa road from Cochiti Pueblo to State Road 4. The trip can be made with sedan, but the roads are better suited to pickups, jeeps, or other four-wheel-drive vehicles.

The Forest Service is surveying a new road all the way to the lookout, and plans a new section of road



Left: Map shows area that is opening to easier access with construction of "Forest Use" roads in Jemez Mountains.

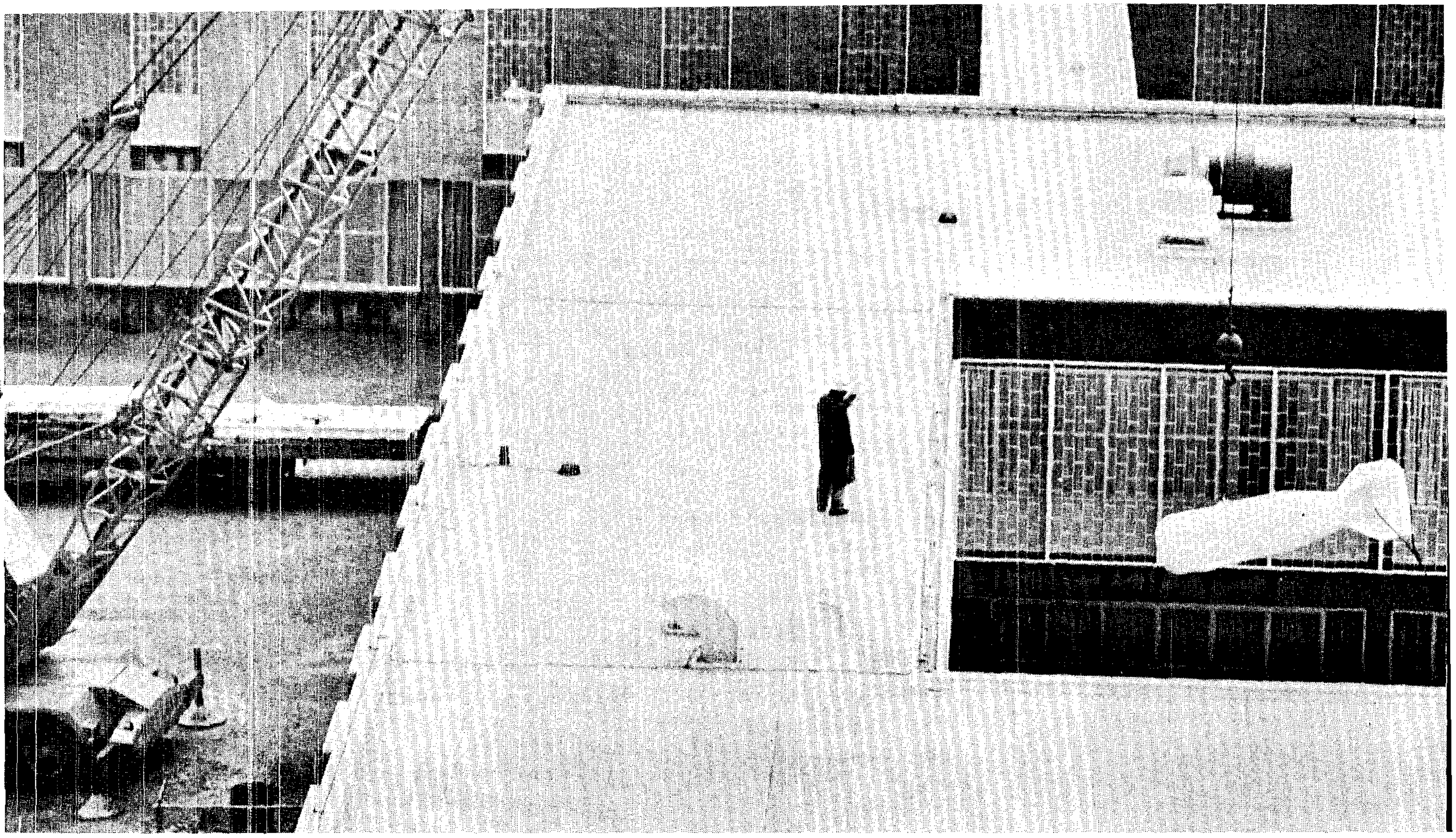
Below: Apple orchards at the mouth of Cochiti Canyon are clearly visible from St. Peter's Dome - Cochiti road.

from the rim of Cochiti Canyon to the Rio Grande valley floor.

The ultimate easy access to the Dome will open up the Bandelier back country to hikers, putting the Stone Lions, Painted Cave, Turkey Springs and many ruins within easy walking distance. However, the Park Service sees fire protection for remote areas of Bandelier as the biggest advantage of the new road.

Forest Service officials explain that roads in the Jemez (and in most national forest areas) are known as "forest use" roads; they are maintained, but are not recommended for the average motorist out for a Sunday drive. "Forest use" means exactly that; the roads are for those who use the forest—loggers, wood cutters, campers, hunters, fishermen, piñon pickers, hikers, prospectors, but not travelers.

Roads that receive much travel are generally designated Forest Highways and are funded through the Bureau of Public Roads. Forest use roads are maintained with Forest Service Funds.



Opposite Page: Ballistic case for Fat Man, the nuclear weapon used over Nagasaki and the military version of the Trinity test device, is lowered into place for exhibit.

Above: Crane delivers Little Boy bomb casing. Placement on pedestals was directed by observer on roof using hand-held radio to give instructions to operator of crane.

Museum Displays A-Weapons Cases

BY EARL ZIMMERMAN

Although World War II ended more than 20 years ago, it wasn't until last month that the public got a look at the instruments that brought the war to its speedy conclusion.

Ballistic cases for the Fat Man and Little Boy atomic bombs were put on display in the LASL scientific museum as part of a six-item array that illustrates the evolution of nuclear weapons at the Los Alamos Scientific Laboratory. The display is in the patio of the museum, next to the Kiwi A reactor.

The weapons cases are gleaming white, the same as many of their armed kin, although the wartime cases originally were the standard military olive drab color. White epoxy was applied as protection against the rigors of open-air exposure and small boys.

As museum pieces, the weapons cases have already attracted much attention and have caused

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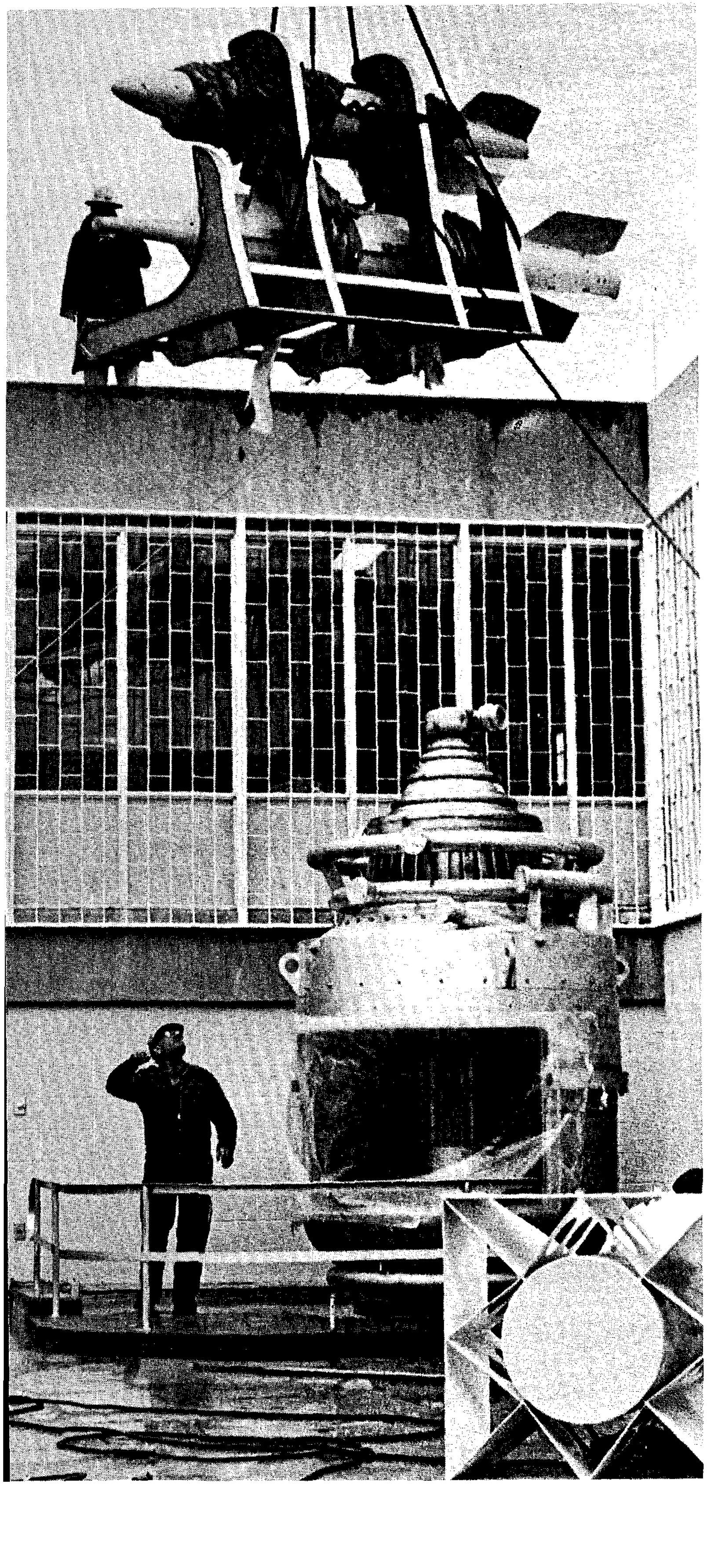


Brace of weapons cases descends above Kiwi A that also is on public view for first time at LASL Museum.

no little amount of surprise to Laboratory old-timers. The actual nuclear configuration and some other particulars still retain the "secret" classification, but general details of the operating principles and approximate yields have been declassified.

The Little Boy, the type used over Hiroshima, was never field-tested because its designers were virtually certain it would work; Trinity had proven a nuclear explosion was possible. Little Boy was a gun-type weapon using fissionable uranium instead of plutonium. The gun mechanism, which assembled the critical mass of fissionable material by firing one piece against another, made it possible to build this type in a slender configuration. Little Boy's explosive power, called the yield, was equivalent to approximately 20,000 tons of TNT (a World War II "block buster" was rated at 10 tons).

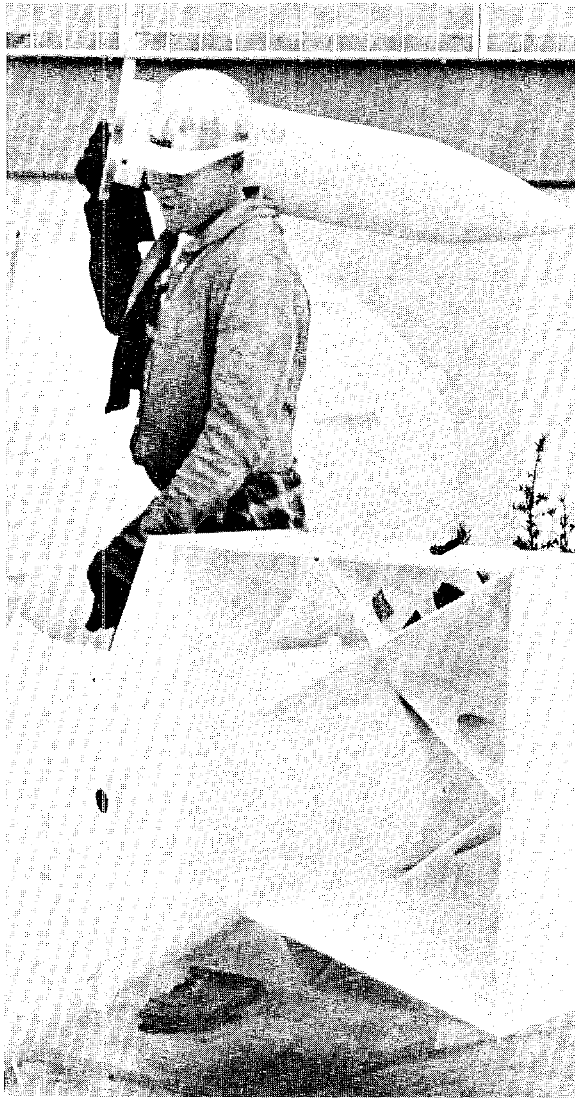
The Fat Man, an implosion-type plutonium device, was similar to the "gadget" that was tested at Trinity Site in New Mexico. A bomb of this type was exploded over Nagasaki, three days after Hiroshima. It also had a yield in the 20,000-ton, or "nominal," range.

One of the new developments in nuclear weapons is their miniaturization. The display includes two examples of small weapons. One is the atomic artillery shell, only 8 inches in diameter. The atomic cannon shell has a yield that is below nominal.

The other tactical-type weapon on display is the well-known Davy Crockett. It can be fired from a portable launcher mounted on a jeep or other vehicle. The warhead represented in the display is a fission weapon with a low yield that is suitable for the relatively short-range—about 4,000 yards—of the launcher rocket.

Another display is a long, slender fission bomb, vintage 1962. It is designed to be carried either in the interior bomb bay of a multi-engined bomber or under the fuselage of a fighter plane. Its yield, while in the nominal range, gives a single fighter plane more fire power than there was in a World War II saturation bombing raid by a fleet of 2,000 B-17 Flying Fortresses.

Walking between historic wartime bomb cases, Zia rigger Jerry Edwards carries atomic cannon shell casing.



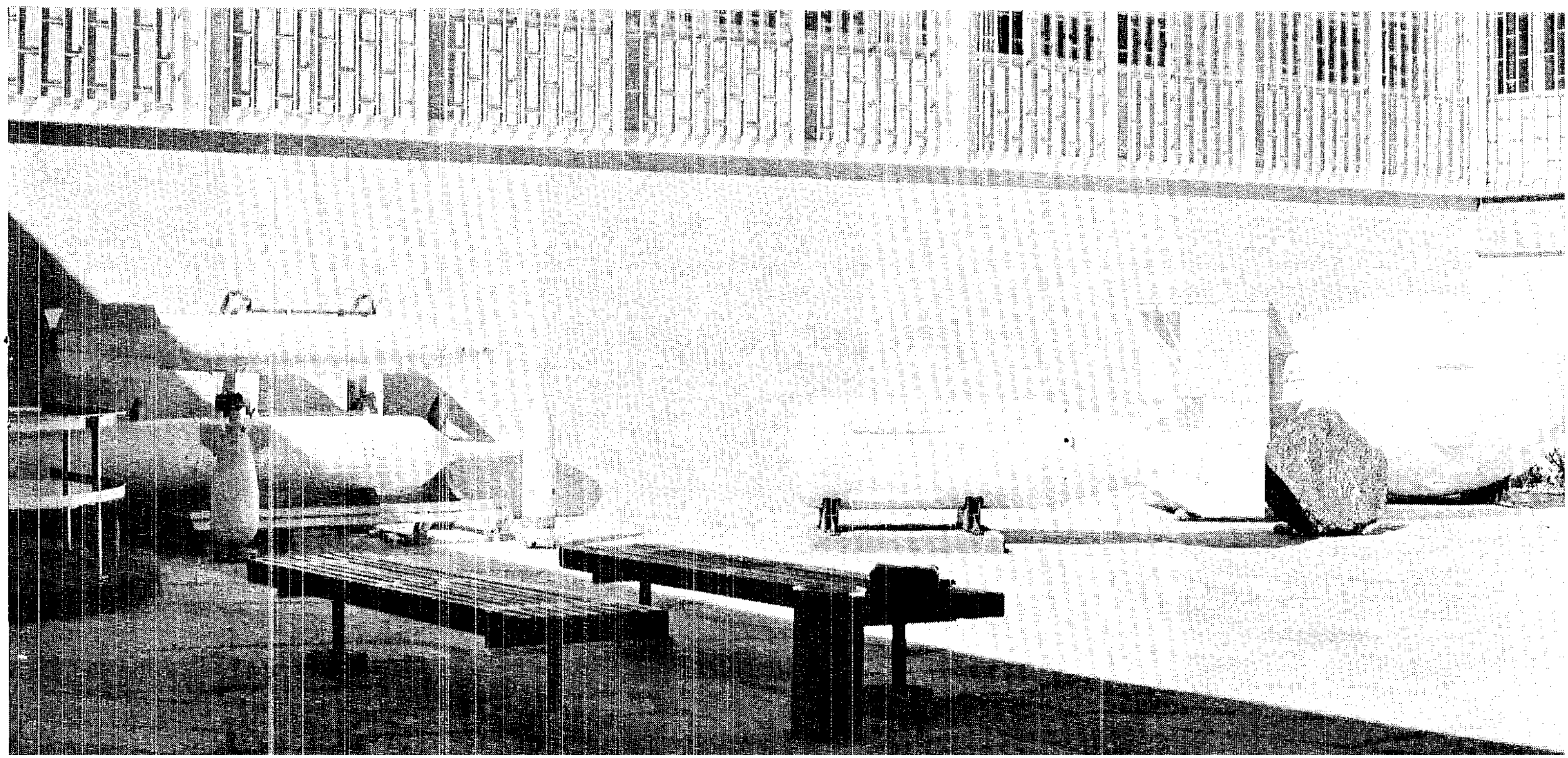
The sixth case on display, with a spike on its nose, is for a thermonuclear weapon with a yield in the megaton (one million tons) range. Among its several uses is that of low-level parachute-retarded delivery by a fighter plane. The spike helps to lessen the shock of impact on a hard target, such as a concrete strip. A delay mechanism gives sufficient time before detonation to allow the drop plane to get away.

The Fat Man and Little Boy ballistic cases were located for the historical display by Wayne Fisher of the AEC's Albuquerque Operations Office. He is a former LASL staff member. The cases had been in storage since the bombs were removed from the nuclear weapons stockpile about a decade ago.

The artillery shell and Davy Crockett were available because they had been sent to Los Alamos for some experimental work.

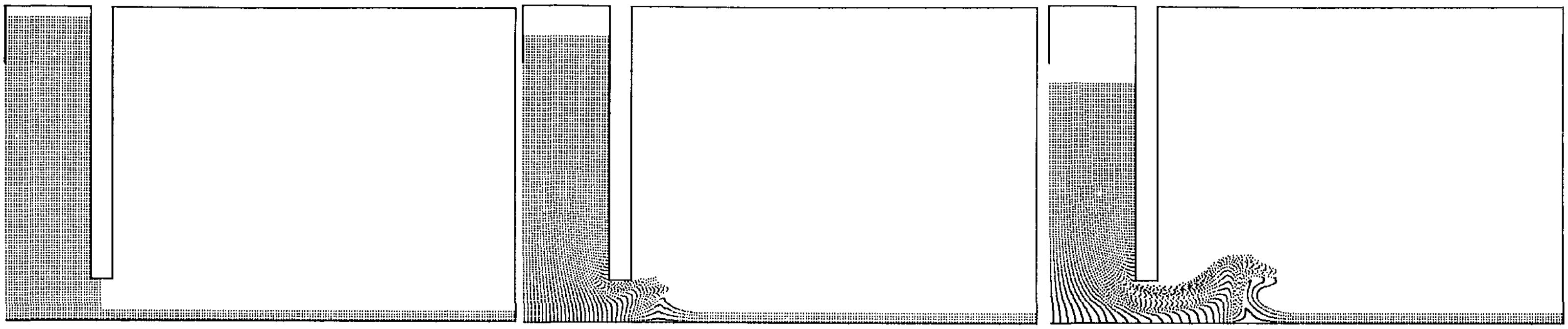
The other two weapons are gifts of the Sandia Corporation. The cases had been used in experiments by Sandia scientists and engineers at the Sandia drop test facility.

Lineup of nuclear weapons ballistics cases in museum patio traces LASL developments from Fat Man and Little Boy (at right) to tactical bombs and artillery devices. Plaques tell history of the first weapons and later work.



Fan Mail for T-3

Reading across these two pages is a representation of the flow of water under a sluice gate, calculated by John Shannon of T-3 and photographed from the high speed print out system of a LASL computer. Note the major forward wave plus a slight wave that breaks toward the back.



BY PETER MYGATT

"Dear Sir: Our institute is concerned with the study of snow avalanches . . . . [and] the investigation of natural snow avalanches is restricted to mere observation (with quite a bit of luck), and it requires an extensive logistic support.

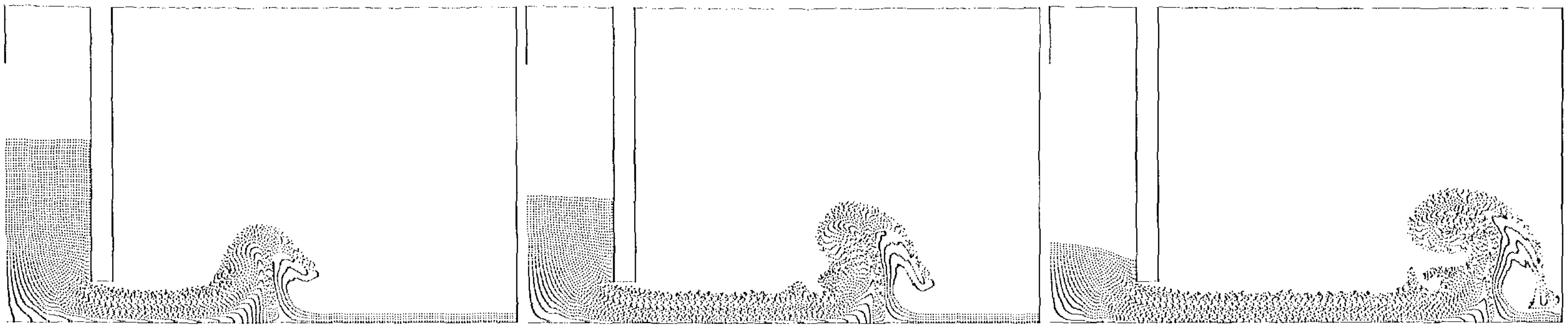
"Therefore, I believe that the most rewarding approach would be computer experiments. However, I would appreciate to have your opinion on this subject as you have already a lot of experience in the field."

This letter, from Dr. C. Jaccard of the Swiss Federal Institute for Snow and Avalanche Research, is typical of hundreds received by Frank Harlow, T-3 Group Leader, during the past year. The queries have resulted from two articles in "Science" and "Scientific American" written by personnel of T-3 (a fluid dynamics theory group at LASL). The articles explained two completely new computer techniques developed by T-3 for the numerical solution of problems in fluid dynamics, techniques that are particularly applicable to studies of waves and other phenomena in the motion of fluids. Examples are the generation of air currents near a cold window, the flow of water from a broken dam, generation of water waves from an explosion, and formation of breakers on a beach.

Of particular interest to most people, the letters indicate, is the fact that in many cases a physical experiment is more complicated and costly and does not provide as much information as a computer experiment.

Group T-3 receives three or four queries per day, and the group members answer all letters. They tell the inquirer whether the problem is computable by any of the T-3 techniques, explain that the LASL group is not generally in a position to take on a project, and that T-3 is willing to talk with representatives from firms or laboratories about their problems. A number of serious outsiders have already taken advantage of this invitation and have come to LASL to discuss specific projects. T-3 welcomes queries, many of which ask extremely provocative questions which help the group with practical

Articles on Computer Predictions of Fluid Flow Result in Flood of Queries to LASL for Advice on Application to Specific Problems and Projects



applications of the program. Harlow explains that T-3 exists to develop computer techniques, carry out laboratory applications of these techniques, and to make pilot studies to show the scope of what can be done with them, particularly since "T-3 and the Laboratory have a responsibility to the scientific community and the public as a whole."

Eddie Welch's computer code, SPLASH (a computer code name which stands for nothing in particular), has created the most recent interest. The University of Alaska is interested in using it to simulate the flow of glacial ice.

The Speech Department of the University of Wisconsin sees the possibility of an extensive study of the speech mechanism through computer application by looking at air pressures and air flows within the vocal tract.

A firm in California called long distance to see if the T-3 computer technique was applicable to designing large surf-generating machines which could generate six-foot waves for surfing enthusiasts.

The University of Oklahoma points out that the program is of considerable interest to safety engineers concerned with storage of potentially hazardous liquid chemicals and gases. The University's question: In the event that the bottom of a large storage tank should fail completely and the entire liquid contents are dumped in a matter of seconds, how high should a surrounding dike be to prevent splashing over the sides when the liquid wave impacts against the dike walls.

A bee keeper in Great Britain received a "no" answer to his query. He wondered if the T-3 computer program could handle the problem of keeping his bees warm by distributing hot air over the hives through a series of ducts.

The U.S. Fish and Wildlife Service, Bureau of Commercial Fisheries, in Honolulu, believes the LASL program can be adapted to simulate the flow in an eddy stream, such as that which occurs near the Hawaiian Islands.

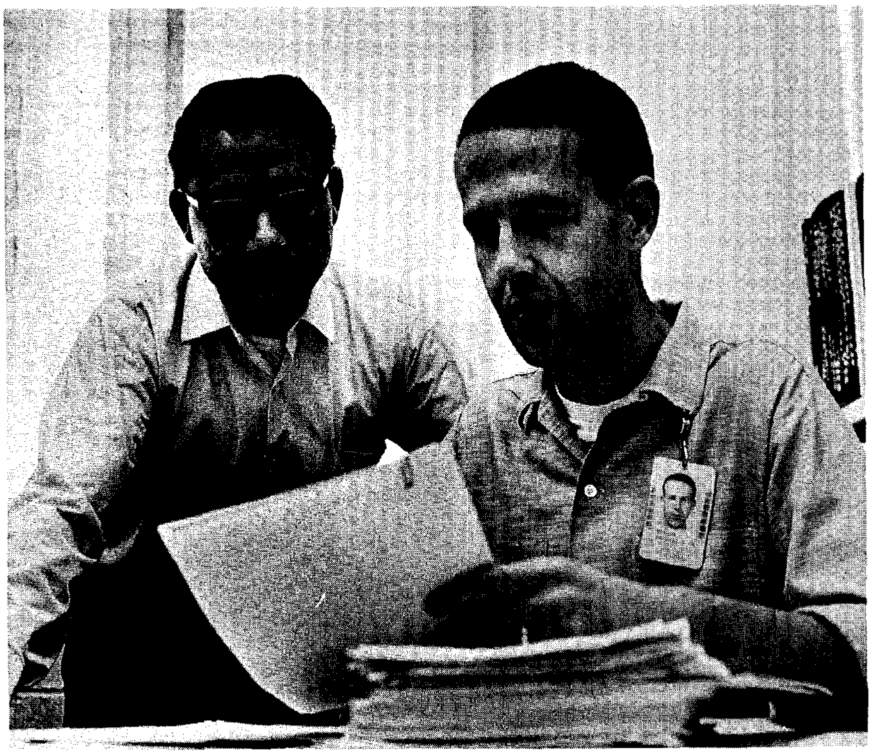
West Germany's Ernst-Mach Institut has been working with Bart

continued on next page

Daly of T-3, through NATO, on bomb shelter shockwave studies.

The National Institute of Health, as well as numerous doctors and veterinarians, is interested in computer studies to calculate the flow of blood through constricted arteries and branching capillaries. Jacob Fromm, of T-3, explains that this is a particularly challenging application since red blood cells become modified in shape in flowing through constrictions in blood vessels.

Navy contractors are interested in using the LASL computer code for ship design, and for harbor breakwater studies. Argonne National Laboratory believes the code is applicable to a large liquid hydrogen bubble chamber that is being built there. Agricultural engineers at Iowa State University have inquired about use of the LASL program to design large scale irrigation projects in an effort to move quantities of water from one place to another through channels and sluice gates. Scientists interested in a new field of computers which use hydraulic rather than electrical switching have already visited T-3, since the LASL program may help solve problems in this field.



Frank Harlow (right) and Jacob Fromm sort through hundreds of letters asking about Group T-3's new computer techniques for problems in fluid dynamics.

Tony Amsden, of T-3 has been carrying out pilot calculations of meteorite penetration of a solid, such as a space vehicle. His PIC technique is being used by a number of laboratories with appropriate high speed computers. Dan Butler, T-3, has been extending the work to include molecular effects in high-speed gases.

And the requests continue to pour in: Southwest Research Institute, San Antonio, Texas; University of Arizona's Institute of Atmospheric Physics; University of Illinois; Department of Oceanography, Oregon State University; University of Cambridge, England; University of California; Purdue University; Bell Telephone Laboratories; Science Digest; New York University, Courant Institute of Mathematical Sciences; U.S. Weather Bureau; Cornell University; IBM; U.S. Army Mathematics Research Center, University of Wisconsin; Air Force Cambridge Research Laboratories, Bedford, Massachusetts; Institute of Animal Genetics, Edinburgh, Scotland; and the American Institute of Physics, to name a few.

Harlow said the whole T-3 group has contributed to the computer flow studies, and members of the group have presented 21 talks this year. Fromm recently completed a speaking engagement in Europe; C. W. Hirt will make a presentation of NATO's AGARD (Advisory Group for Aerospace Research and Development) so European scientists can become familiar with the LASL computer code and its applications to fluid dynamics; Eddie Welch has just finished a tour of talks in New York and Massachusetts; Bart Daly will give an invited paper in Los Angeles in February; and Richard Gentry gave an invited paper at the summer APS meeting in Honolulu.

Results from LASL computer codes can be photographed directly from a high speed print out system, giving a motion picture which for all the world looks like the actual thing—a dam breaking, a sluice gate opening, or the flow of liquid around a stationary object, whether it be a rock or the Hawaiian Islands. The detailed comparisons show that the results are quite accurate representations of actual events.

Daly and Hirt, through D-8 and D-10, recently put together such a motion picture, which is in continuous demand for showings, and a French scientist recently suggested the movie be entered in the International Film Festival at Cannes.

Left: This photo, by Sid Stone's coronal camera group, shows comet and its apparent double nucleus. Light at edges is sunlight scattered by the aircraft window and frame of mirror.

Lower left: Too much sun! That was the essential reason for failure of an experiment here October 20 as the Ikeya-Seki comet neared the Sun. This photograph, deliberately printed dark to demonstrate the difficulties faced by optical instruments, shows the LASL contingent atop a GMX-2 bunker. The group hoped to study light emissions.

Solar Visitor

The September discovery of a new comet—one of the luminous-tailed celestial objects that zoom in periodically for a pass at the Sun—sent two groups of LASL scientists scurrying on ground and aircraft observation missions last month.

A Los Alamos team flew a six-hour sortie October 20 high above northern New Mexico, observing the Ikeya-Seki comet from Sandia Corporation's NC 135A flying laboratory. They were in the air just before the comet, discovered September 18, made its nearest approach to the Sun in a celestial "*near-miss*" at 300,000 miles.

On the ground, meanwhile, another team of LASL scientists

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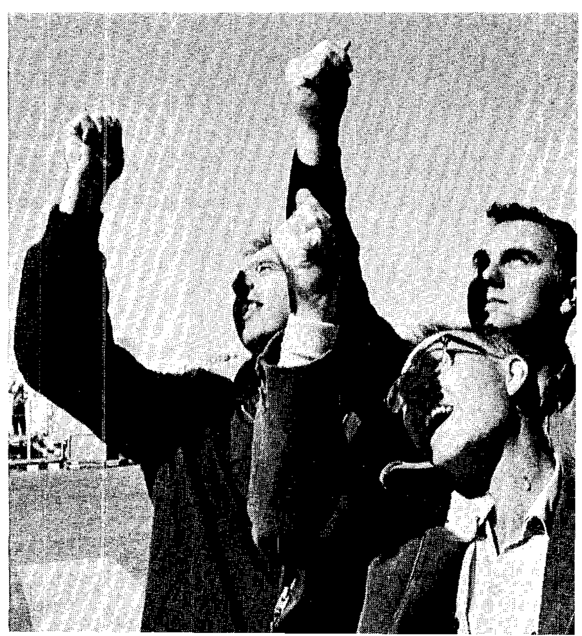
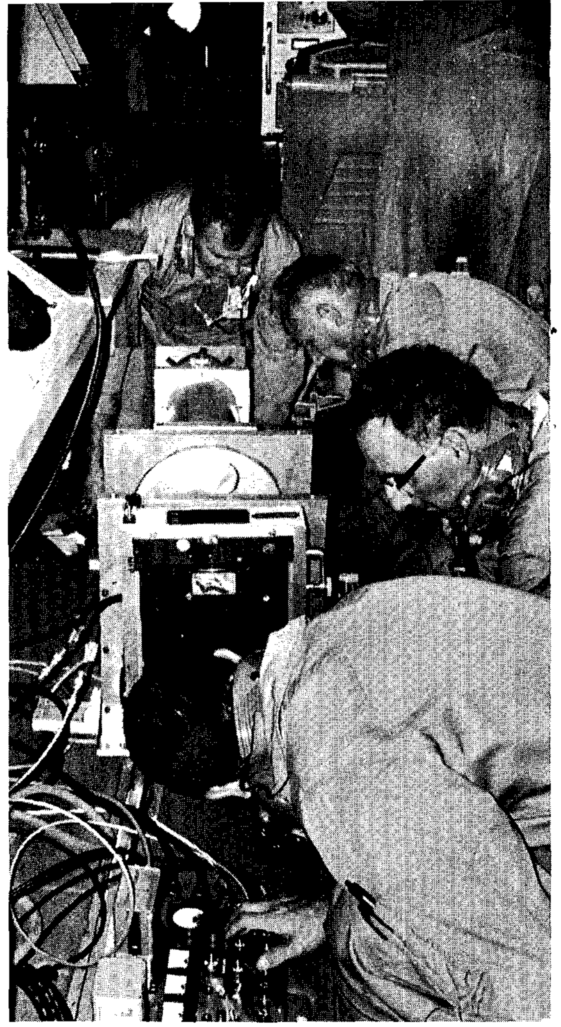
Below: Exhibiting "comet squint" as they made a layman's sighting before departing on flight are (from left) Art Cox, Sid Stone and Walter Wolff.



Instruments used for analyzing comet spectrum get attention from (from left) Jim Hill, Paul Rudnick and Don Liebenberg.



White dot at top is where light from comet entered experiment setup. Making alignment adjustments are (from top down) Walter Wolff, Casmir Stevens, Sidney Stone and Ralph Partridge.

Comet . . .

continued from preceding page

was attempting to use one of the nation's highest resolution spectrographs to analyze the comet's light emissions. Operating from a bunker at the laboratory's GMX-2 site, the researchers hoped to gain insights never before achieved into the comet's chemical composition. But optical problems caused the failure of their experiment.

On the 20th, while both scientific teams were having their difficulties, the comet and its 20-million-mile tail were clearly visible to spectators at Los Alamos. Laboratory employes streamed in and out of buildings all day, seeking a shaded spot from which to peer skyward.

The comet, named after its two amateur Japanese astronomer discoverers, was the brightest since the Great Comet of 1882. Its brilliant luminosity was the result of its close approach to the Sun, a million-mile-per-hour dash that pierced the Sun's gaseous, high-temperature envelope, the corona.

It was this aspect of the Ikeya-Seki comet's solar passage that intrigued LASL's high-flying observers. Only last May, the Los Alamos researchers had studied the temperamental corona from LASL's own flying laboratory as it sped through the shadow of a total eclipse over the Pacific Ocean. They still had the instruments used then. So on October 15, only six days before the comet was to round the Sun, they received the go-ahead for the aerial reconnaissance mission.

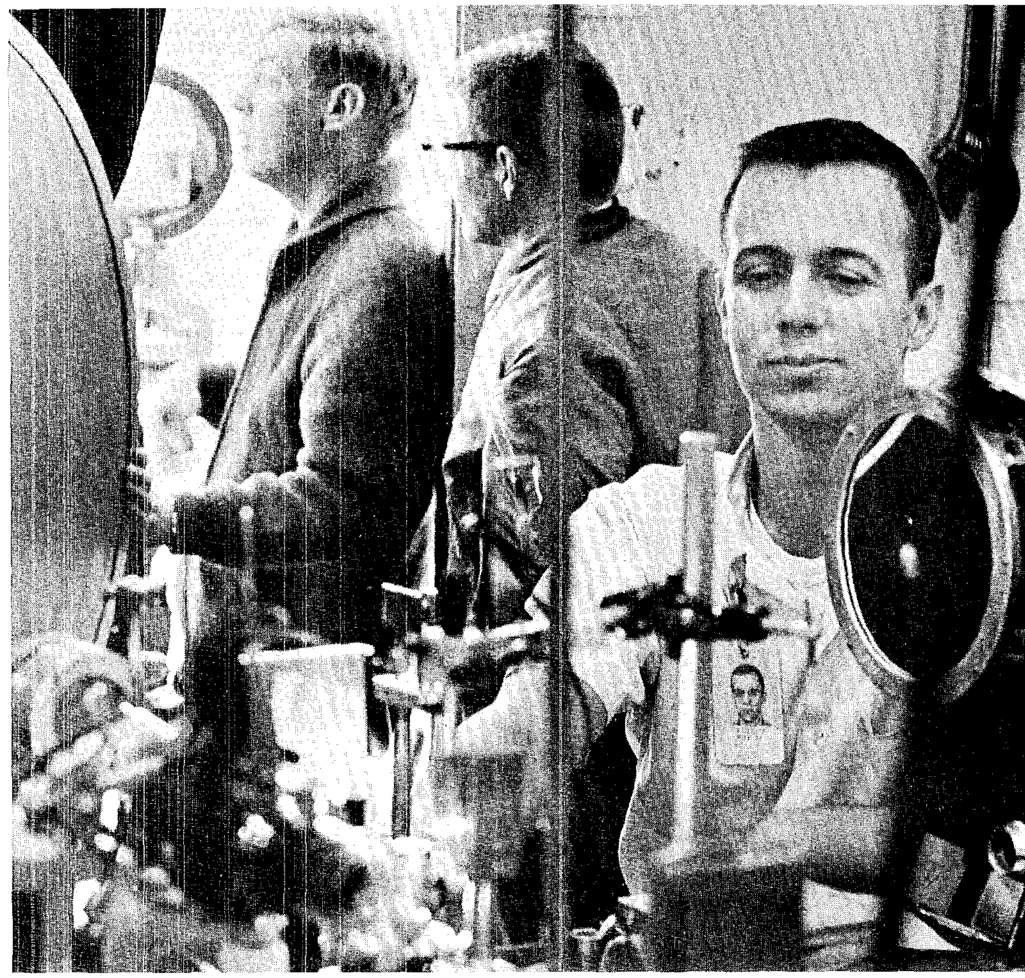
The flight was made from Kirtland Air Force Base, Albuquerque, the home base for the giant flying laboratories, on Wednesday, October 20. A second flight, set for dawn Thursday, was cancelled because of scattered light problems and the faintness of the comet, which was at least a magnitude dimmer than on the day before. Instead, the LASL researchers set up their instruments at Kirtland.

Results of the varied experiments will not be available for several weeks, according to Arthur Cox, group leader of J-15 and the expedition's scientific coordinator.

Broadly speaking, the mission objectives were split into photographic and interferometric observations. The latter involves the recording of light and other radiations and the sorting of the radiations according to wavelengths. Energy levels and composition of the objects giving off the light can then be studied.

Heading the photography team was Sidney Stone of J-10. Stone and his four assistants used the coronal camera, a modified Air Force design with a 42-inch focal length lens rigged for the venture last May.

In photographing the comet, they sought to measure position and shape, brightness, polarization and color or spectrum characteris-



Rolf Engleman, Jr., of GMX-2 mans controls of spectrograph while others adjust the nexus of mirrors and lenses.

tics. Working with Stone were Ralph Partridge of J-DO, Bob Brownlee of J-15, Walter Wolff of J-8 and Casmir Stevens of J-10. Bill Regan of PUB also made the flight as a photographer.

The interferometer team had four members. They were Don Liebenberg of CMF-9, Paul Rudnick of J-16, Eugene Lamkin of D-8 and James Hill of J-7. Their objective was narrowed to the measurement of the shape of the sodium D spectrum line which occurs in all bright comets. The instrument used was a special type of spectrometer, the interferometer, a compact, ultra-sensitive device capable of delicate wavelength resolution. It, too, was used last May.

The passage of the Ikeya-Seki comet afforded LASL, and the rest of the world's scientists, their first opportunity to employ modern technology and tools in the study of a comet this bright. Only seven times has a "Sun-grazer" of this type been observed at all.

One of the modern advantages is observation from the upper atmosphere where the sky is darker, clouds can be outdistanced and less light interference from ground sources is found. The Sandia jet, the military version of Boeing's 707, plied an oblique corkscrew pattern while its occupants aimed their lenses. Beginning at 31,000 feet, the aircraft was flown in elongated orbits of about 30 minutes each. In each orbit, there was one 12-minute observation period. Meanwhile, the plane was gradually climbing, cresting at the end of the mission at 39,000 feet.

At Los Alamos, the unsuccessful observation attempt was directed by Milton Peck, associate group leader of J-10, assisted by Kenneth Mitchell and Guy Barasch, also of J-10, and Rolf Engleman Jr. of GMX-2.

Using a heliostat, a devise which tracks objects across the sky, a series of mirrors and a five-inch, concave lens, they tried to transmit the comet's image into the bowels of the bunker where the giant spectrograph is located.

Peck said, however, that a lack of proper equipment and inadequate time to set up the apparatus they did have led to the disappointing result. "What we needed was a solar coronograph," he said.

Working with Engleman from GMX-2 were Roy Greiner and B. J. Killoran. Also in on the experiment from J-10 were Alan Olcott, Ray Swansen and John Chapman.

Comets are among the most mysterious of celestial phenomena. It has been suggested that they were perhaps formed by the planetary disruption that led to the formation of asteriods. According to American astronomer Fred J. Whipple, the primary mass of a comet may be nothing more than an amalgamation of frozen "gravel"—mineral particles suspended in an icy mass of solidified methane, ammonia and carbon dioxide and water. This is called the nucleus.

As a comet nears the sun, the ices in the nucleus—sometimes seen as a small, starlike region in the interior of the comet's nebulous mass—begin to melt. Some of the material, obviously, will be lost; calculations indicate about five per cent of the mass is lost on each approach to the Sun. The sacrificed material is dispersed in space directly or through the comet's tail, if one develops, and they frequently do as the comet approaches within 100 to 200 million miles of the Sun. Tails, a conspicuous part of comets if they do form, sometimes extend outward 50 to 100 million miles.

Comets in the category of the Ikeya-Seki comet have elliptical orbits about the Sun ranging from several hundred up to a million years. The full orbit of the Ikeya-Seki comet has not been plotted, but a rough estimate puts the orbital period at about 1,000 years. This means that the comet wouldn't return to the Sun until after 2,900 A.D.

The Technical Side

Presentation at International Conference on Polarization Phenomena of Nucleons, Karlsruhe, Germany, Sept. 6-10:

"Elastic Scattering of Polarized Nucleons" by Louis Rosen, MP-DO. (INVITED PAPER)

Lecture: Senior Mathematics Class, Los Alamos High School, Sept. 8:

"Look Out For Statistics" by Roger H. Moore, T-1.

Presentation at Washington-Baltimore Chapter of the Health Physics Society, Gaithersburg, Md., Sept. 18:

"Status of Air Sampling in Health Physics" by H. F. Schulte, H-5.

International Conference on Thermionic Electric Power Generation, London, England, Sept. 20-24:

"Heat Pipe Systems, Synopsis for the Press" by George N. Grover, N-5.

Presentation at Information Meeting of Contractor librarians of the U.S. Atomic Energy Commission, Oak Ridge, Tenn., Sept. 21-22:

"Evaluation of Contractor Libraries: Application of the Checklist" by Helen F. Redman, D-2.

Sandia Surface Chemistry Seminar, Sandia Base, Albuquerque, N.M., Sept. 23:

"A Study of Some of the Parameters Affecting Knudsen Effusion" by John W. Ward, CMF-5.

Presentation at Rio Grande Chapter of Association for Computing Machinery, El Paso, Texas, Sept. 23:

"MADCAP in Review" by Mark B. Wells, T-7.

"A Method for Solving Polynomial Equations with d' Alembert's Lemma" by Billy L. Buzbee, T-1.

Presentation at Explosives Safety Engineering Conference, Sandia Corp., Albuquerque, N.M., Sept. 28-30:

"Interstate Commerce Commission Regulations and Permits for the Safe Transportation of Explosives" by Horace E. Noyes, SP-DO.

AIME Nuclear Metallurgy Symposium on High Temperature Nuclear Fuels, Delavan, Wisc., Oct. 3-5:

"Coated Particle Fuel Elements for UHTREX" by R. J. Bard, CMB-8 and J. M. Taub, CMB-6.

Presentation at Harpur College, State University of New York, Binghampton, N.Y., Oct. 4:

"Phase Relationships of the High Carbon Portion of Lanthanide-Carbon Systems" by N. H. Krikorian, T. C. Wallace and M. G. Bowman, all CMB-3.

Twentieth Annual Symposium of the Instrument Society of America, Los Angeles, Cal., Oct. 4-7:

"Acquisition and Interpretation of Data from Essentially Discontinuous Mechanical Phenomena" by John W. Taylor, GMX-6. (INVITED PAPER)

"Analytical Model for Study of Thermocouple Error Attributed to Electrical Conduction in Insulation" by Charles R. Tallman, N-4.

"Thermal Radiation from Burning Hydrogen Plume" by Paul E. Martin, NTS.

Symposium on Electron Beam Welding, Fall Meeting of the American Welding Society, Birmingham, Ala., Oct. 6:

"Electron Beam Welding at Los Alamos Scientific Laboratory" by D. J. Sandstrom and G. S. Hanks, both CMB-6.

Presentation at Minnesota Section of American Ceramic Society, Minneapolis, Minn., Oct. 6:

"Nuclear Applications Utilizing Ceramic Materials" by Stephen D. Stoddard, CMB-6.

Optical Society of America Meeting, Philadelphia, Pa., Oct. 6-8:

"Comparison of Methods for the Determination of Refractive Indices of Interference Films" by W. P. Ellis, A. D. Mulford, both CMB-8; and L. D. Allen, CMF-4.

Eleventh Annual Bio-Assay and Analytical Chemistry Meeting, Albuquerque, N.M., Oct. 7-8:

"The Determination of Low Level Plutonium Activity: Autoradiographic Techniques vs. Scintillation Counting" by William D. Moss and Evan E. Campbell, both H-5.

Presentations at New Mexico Industrial Photographers Association, Las Cruces, N.M., Oct. 9:

"Automatic Lens Designs" by Charles A. Lehman, T-5.

"Aurora Expedition, or Cool Man, Cool!" by Bill Jack Rodgers, PUB.

Presentation at the National Academy of Sciences Meeting, Seattle, Wash., Oct. 11-13:

"An Electronic Particle Separator with Potential Biological Application" by M. J. Fulwyler, H-4.

Annual Meeting of UAIDE (Users of Automatic Information Display Equipment), New York City, Oct. 11-14:

"Moving Picture Computer Output" by J. Eddie Welch, T-3.

The International Conference on Safety, Fuels, and Core Design in Large, Fast Power Reactors, Argonne National Lab., Ill., Oct. 11-14:

"Molten Plutonium Alloys as Fast Reactor Fuels" by L. D. Kirkbride, K-2.

"Nuclear Design of MPBE" by William H. Hannum, K-1.

"Effect of Fission Gas Bubbles on the Response of Molten Fuel Reactors to Fast Transients" by Byron M. Carmichael, K-1.

First Pan American Congress of Electrical and Mechanical Engineers, Mexico City, Oct. 11-14:

"Determination of Hoop Stresses Induced in a Cylindrical Steel Die by Compacting Metal Powders" by S. J. Bustamante, CMB-7 and H. Sheimberg, CMB-6.

Presentation at Dinner Meeting of the Los Alamos-Albuquerque Subsection of the IEEE, Los Alamos, Oct. 22:

"Electrical Conductance in Detonating High Explosives" by Bernard Hayes, GMX-8.

Presentation at Fourth Symposium on Detonation, U.S. Naval Ordnance Lab., White Oak, Silver Spring, Md., Oct. 12-15:

"Initiation of Detonation by the Interaction of Shocks with Density Discontinuities" by C. L. Mader, GMX-2.

"Initiation by Short-Duration Shocks" by E. F. Gittings, GMX-4.

"Structure, Chemistry, and Instability of Detonation in Homogeneous, Low Density Fluids--Gases" by Garry L. Schott, GMX-7. (INVITED PAPER)

"Discussion of the Enig and Petrone Equation of State" by Charles L. Mader, GMX-2.

"Hydrodynamic Calculations of Diverging Detonations" by Charles L. Mader, GMX-2.

"Shock Wave Research on Inert Solids" by William E. Deal, GMX-6.

"Interactions of Detonation Waves in Condensed Explosives" by S. D. Gardner and Jerry Wackerle, both GMX-7.

"Failure of the Chapman-Jouguet Theory for Liquid and Solid Explosives" by W. C. Davis, B. G. Craig, and J. B. Ramsay, all GMX-8.

"Transition of Weak Reactive Shock Waves to Detonation Waves in Solid Explosives" by J. B. Ramsay, GMX-8 and A. Popolato, GMX-3.

"On Electrical Conduction in Detonation Products" by B. Hayes, GMX-8.

"Experimental Observations of Initiation of Nitromethane by Interactions at Discontinuities" by J. R. Travis, GMX-8.

"Transducer Studies of Initiation Phenomena" by J. R. Travis, GMX-8.

"Phermex Applications to Studies of Detonation Waves and Shock Waves" by D. Venable, GMX-11.

Fifth Annual Coulter Counter Users Conference, San Francisco, Cal., Oct. 21-22:

"Comparison of Particle Size Distribution Data from Coulter Counter and Sedimentation Balance" by Albert L. Hipp, CMB-6.

Twentieth Annual Instrument Automation Conference, Instrument Society of America Meeting, Los Angeles, Cal., Oct. 11-15:

"Response of Pneumatic Pressure Transmission Lines" by Geoffrey P. Watts, N-4.

"Hydraulic Control Rod Actuators for the Kiwi-TNT Nuclear Reactor" by Roy A. Frame and Charles P. Milich, both N-4.

"Analytical Model for the Study of Thermocouple Error Attributed to the Electrical Condition in Insulation" by C. R. Tallman, N-4.

Ninth Conference on Analytical Chemistry in Nuclear Technology, Gatlinburg, Tenn., Oct. 12-14:

"Problems and Progress in the Analysis of Super-Pure Plutonium" by Charles F. Metz and Glenn R. Waterbury, both CMB-1.

Presentations at Institute of Electrical and Electronic Engineers Twelfth Nuclear Science Symposium, San Francisco, Cal., Oct. 18-20:

"Nuclear Reactor Control with Stepping-Motor Rod Actuators" by Robert M. Lang and Bobby G. Strait, both N-4.

"Rocket Electronic Instrumentation for the Measurement of Ultrasoft Solar X-rays" by James A. Bergey, P-1.

"The LASL Tandem Accelerator Facility Data System" by Thomas Gardiner and Jules S. Levin, both P-9.

Twenty-fifth National Convention of the Society for Nondestructive Testing, Detroit, Mich., Oct. 18-22:

"A Specialized X-Ray Generator for Radiographing Circumferential Welds in Small Diameter Tubes" by Neville B. Edenborough, Frank J. Sattler, and Gerold H. Tenney, all GMX-1.

"Neutron Radiography Utilizing (n, 2) Processes in Gadolinium Activation Foils" by Bruce L. Blanks and Donald A. Garrett, both GMX-1.

Presentation at National Metal Congress, Detroit, Mich., Oct. 20:

"Anomalous Temperautre Dependence of Elastic Moduli of Niobium Metal" by Philip E. Armstrong and Harry L. Brown, both CMF-13.

Ninth Symposium on Advances in Tracer Methodology, San Francisco, Cal., Oct. 22-24:

"Quench Monitoring and Efficiency Calibration Through External Standardization" by F. N. Hayes, H-4.

IEEE Thermionic Specialist Conference, San Diego, Cal., Oct. 25-27:

"Viscosity of Cesium Vapor" by C. V. Waver and T. F. Stratton, both N-5.

"Spacing and Cesium Pressure Dependence of Electron Temperatures and Ion Densities in a Thermionic Converter" by Walter H. Reichelt, N-5 and William Kruer, Summer Student in N-5.

"Heat Pipe Experiments at Temperatures from 50°C to 2000°C" by J. E. Kemme, J. E. Deverall, E. S. Keddy, and G. F. Erickson, all N-5.

"The Interpretation of Cesium Spectra" by Lewis Agnew, N-5.

Eighteenth Pacific Coast Regional Meeting of the American Ceramic Society, Los Angeles, Cal., Oct. 27-29:

"A Flame and Arc-Spray Powder Feeder for Ultra Fine Materials" by Edward L. Bradley and Stephen D. Stoddard, both CMB-6.

Presentation at National Safety Congress, Chicago, Ill., Oct. 28:

"A Proposed Standard for Safety Showers" by James G. Stearns, H-3.

Presentation at Physics Dept., Oak Ridge National Laboratory, Tenn., Oct. 29:

"Neutron Experiments with Nuclear Explosions" by Ben C. Diven, P-3.

Seminar on Preparation and Standardization of Isotopic Targets and Foils, AERE, Harwell, United Kingdom, Oct. 20-21:

"Preparation of Thin Films of UO^2 and PuO^2 by Vacuum Evaporation" by John G. Povelites, CMF-4.

Fifth Thermal Conductivity Conference, University of Denver, Colo., Oct. 20-22:

"High Temperature Thermal Diffusivity Measurements by the Flash Technique" by Bruce H. Morrison, Douglas J. Klein (Summer RA) and Leo R. Cowder, all N-1.

WHAT'S DOING

SINFONIETTA: Civic Auditorium, November 21, 8:15 p.m. Featured presentation will be the Haydn Cello Concerto with Hans Schmettau soloist and Rex Eggleston conducting. Season tickets, $5 for adults and $2.50 for students, available at Decol's or Hayes Jewelers or Mrs. Rosemary O'Conner.

SEVENTH ANNUAL CHARITY BALL: Immaculate Heart of Mary Parish Hall, November 19, 9 p.m. to 1 a.m. Don Lesman Orchestra. For reservations call Mrs. Frank Hauser, Mrs. Joseph Duben or Mrs. John Buchen.

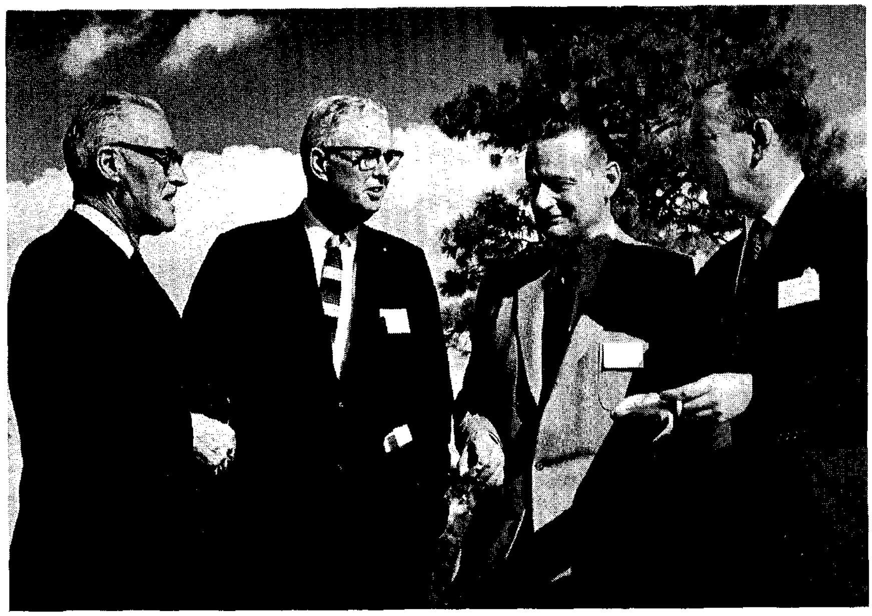
LITTLE THEATER: Unitarian Church, November 12, 8:15 p.m. John Ramsey directs readings of "The Open Window" with Lucile Hodges; "Baker's Dozen" with David Woods, Lucile Hodges and Deborah Toth; "Roan Stallion" with Jeanne Stein; "Mujina" with Deborah Toth, and "The Tremendous Adventures of Major Browne" with Don Liebenberg. Admission by membership only; memberships, 50 cents per year, available at the door.

OUTDOOR ASSOCIATION: No charge; open to the public. Contact leader for information regarding specific hikes.

- Saturday, November 6, Apache Springs to Beaver Pond to Upper Crossing. Bob Skaggs, leader.
- Sunday, November 14, Painted Cave, probably from the direction of Cochiti. Terry Gibbs leader.
- Saturday, November 20, La Luz Trail. Bob Skaggs, leader.
- Sunday, December 5, short hike or snowshoe event, depending on weather. Ken Ewing, leader.

ST. JOHN'S COLLEGE FILM SOCIETY: Great Hall at the Student Center in Santa Fe. Films shown at 7:30 p.m. Series subscription for non-students $4. Tickets available at door for most showings for $1 per person.

- Saturday, November 6, "Viridiana," (Spain, 1961). The most controversial of Luis Bunuel's films but regarded as his greatest achievement.
- Saturday, November 20, "Potemkin," (Russia, 1925, silent with English titles). The most famous of Sergei Eisenstein's works, it is unsurpassed in regard to the importance of its influence on subsequent motion pictures.
- Saturday, December 4, "On the Waterfront," (1954). Directed by Elia Kazan and written by Budd Schulberg, this film portrays the corruption on a great harbor's waterfront and the struggle of one man to resist these forces.



Two representatives from the United Kingdom were among 53 persons who attended a Biomedical Program Directors conference in Los Alamos October 14 and 15. The meeting was sponsored by the Laboratory and the Atomic Energy Commission's Division of Biology and Medicine. In the photograph with Dr. Thomas Shipman (left), head of Health Division, are (left to right) Drs. Charles L. Dunham of Washington, D.C., Director of the Division of Biology and Medicine of the AEC; Gordon Stewart, Director of the Medical Division of the Chalk River Nuclear Laboratories in Ontario, Canada, and Dr. Andrew McLean, who is Director of the Health and Safety Branch of the Atomic Energy Authority in England.

Malik . . .

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a major contributor to the solutions of many and varied nuclear weapons effects problems of concern to the Air Force. These contributions were made at great sacrifice of his personal time. He was one of the first to effectively recognize the potential military significance of the nuclear electromagnetic pulse and to make quantitative measurements to better define the phenomena. The criteria which Dr. Malik was instrumental in developing have remained essentially constant with the attainment of increasingly detailed understanding of the phenomena."

His award citation reads: "Dr. John Stanley Malik has distinguished himself by outstanding scientific contributions to the understanding of both electromagnetic pulse phenomenology and effects on military systems. These contributions have been in the form of original scientific papers and through many hours of consultant and committee service. Through his seemingly untiring efforts and scientific competence, Dr. Malik has brought great credit upon himself, the United States Atomic Energy Commission, and by close voluntary cooperative efforts, the United States Air Force."

The blue-eyed Malik, a captain in the U.S. Army during World War II, received his BA degree from Kansas State Teachers College, Emporia. He received his MA and Ph.D. degrees from the University of Michigan, Ann Arbor, where he designed and supervised the building of most of the electronic control and measuring equipment of the 300 mev synchrotron.

Malik, born September 3, 1920, at Geddes, South Dakota, is married and has a daughter. He is a member of the American Physical Society and Sigma Xi.

Pulitzer Prize winner novelist Edna Ferber, whose works span several generations, was an October museum visitor. The author of Show Boat, Cimarron, Saratoga Trunk, Ice Palace, and Giant was intrigued by the potential of *nuclear rockets as exemplified by the museum's* Kiwi A reactor exhibit. In the photo, Miss Ferber (center) accepts a packet of LASL publications from Marysue Wooten of the Public Relations Office. Miss Ferber, who lives in New York, came to Los Alamos as a guest of Mrs. George Boyce (left) of Santa Fe, where she was visiting.

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