it up. Wild won $2 million in compensatory and $5 million in punitive damages for that. Last, he won equal sums in compensatory and punitive damages for "defamation of character." The attorneys for the defendants were unavailable for comment on these matters.

Wild, of course, does not have any of the money as yet. The jury's verdict has been stayed temporarily, pending an appeal. If and when he does get it, the 58-year-old scientist plans to go back to research.

—BARBARA J. CULLITON

Los Alamos Scientific Laboratory: Weapons Are Still the Focus

Los Alamos. Despite the central role that the Los Alamos Laboratory played in the effort to develop the atomic bomb, at the end of World War II the laboratory's future hung in the balance during the national debate over the future of atomic energy. Even with the formation of the Atomic Energy Commission (AEC) and the transfer of Los Alamos and other facilities from the Manhattan project to civilian control, there were those in Washington and elsewhere who doubted that competent scientists could be attracted to the remoteness of northern New Mexico. With the decision in 1947 to proceed on a massive program of nuclear weapons development, however, the renamed Los Alamos Scientific Laboratory (LASL) gained a new lease on life. Then, as now, nuclear weapons were LASL's main business.

In recent years, LASL has again entered a period of uncertainty about its future. Two cutbacks in nonweapons projects that were among the laboratory's major diversification efforts lowered morale among the scientific staff. Questions persist about the impact of a possible total ban on nuclear weapons tests and about the extent to which LASL will remain primarily a weapons facility or will diversify into other areas. A new director and some vigorous new projects are now providing an upbeat note, and there are signs that the laboratory may be about to embark on a period of renewed expansion, along with a gradual broadening of its mission. But the laboratory's prime responsibility and largest activity—like that of its sister laboratory at Livermore, California—is still the design, simulation, and prototype construction of new nuclear weapons.

Following the end of World War II, the laboratory at Los Alamos was rapidly reduced to a skeleton of its former self. With the detonation of the first atomic bomb at the Trinity test site some 200 miles south of Los Alamos on 16 July 1945, and with the bombing of Hiroshima and Nagasaki 3 weeks later, the original mission of the laboratory was completed and many of the original staff left. The laboratory was reformed with Norris Bradbury as director (see box) and by 1947 had begun the task of upgrading the crude, ad hoc designs of the wartime weapons into standardized devices for the nation's stockpile. Efforts to develop a thermonuclear, or hydrogen bomb, were begun and were intensified after the 1949 explosion of a nuclear device by the U.S.S.R. Dissatisfaction with the pace of thermonuclear research at Los Alamos led Edward Teller, one of the leaders of the H-bomb effort, to leave and help form a second weapons laboratory at Livermore. Research at LASL soon proved successful, however, resulting in the first thermonuclear test in 1952.

Bradbury continued as director of LASL until 1970, when he was succeeded by Harold Agnew, the present director. During this time, the laboratory grew slowly but steadily to its present size of about 4000 employees, including a scientific staff numbering over 1700. LASL's efforts were devoted primarily, but not exclusively, to weapons. Under Norris Bradbury, LASL soon developed a strong basic research effort that in the early 1950's accounted for about a third of the laboratory's budget. In those early years, the laboratory was given a relatively free hand by the AEC and by its military sponsors. The basic research, although largely supported by the weapons program, was viewed as a means of ensuring that high-quality scientists in many fields would be available at Los Alamos as a backup for the weapons work. Projects in physics, chemistry, computer science, metallurgy, and explosives were encouraged, and research was initiated on such problems as the effects of radiation on human health.

In addition to basic studies and weapons development, LASL's efforts in the 1950's were also applied to several nonweapons projects. The early diversification projects included work on nuclear reactors, controlled fusion (Project Sherwood), and the design and construction of a nuclear rocket (Project Rover). Work on nuclear reactors began on a small scale during the war and became a full-fledged division in the early 1950's, employing about 200 people at its peak. The Sherwood effort was smaller, although it attracted considerable interest in the scientific community when it, along with other controlled fusion projects, was declassified in the mid-1950's. Rover became a formal project in 1955 and received a big boost after Sputnik was launched in 1957. The largest nonweapons program at LASL to date, Rover in the mid-1960's accounted for about 15 percent of LASL's staff and about a quarter of its overall budget.

None of these attempts at diversification has led to a permanent broadening of the laboratory's mission, however. The reactor effort at Los Alamos was almost entirely canceled, and the reactor division disbanded, by the AEC in 1970. The Sherwood project, like other efforts to contain fusion magnetically, is still without notable successes, although the program is still active. The nuclear rocket program was effectively dismantled in 1971 by the Office of Management and Budget, leaving only residual pieces of the program at LASL. That the laboratory retained any of the program is at least in part due to the intervention of Senator Clinton Anderson (D–N.M.), a longtime supporter of LASL and an influential member of the Joint Committee on Atomic Energy who is retiring this year.

The cancellations in the reactor pro-

gram and in Rover came shortly after Bradbury's retirement and the appointment of Harold Agnew as LASL's director. The cuts represented the laboratory's first major setbacks in 25 years, although their timing—coming one after the other—seems to have been more a matter of bad luck than a result of any reversal of AEC plans for LASL. The resulting "reductions in force" amounted to about 200 staff members in each case and precipitated feelings of insecurity and some agonized self-appraisal throughout the laboratory.

The dilemma facing the laboratory is in part a result of its very success. The sense of urgency that once characterized weapons research has been missing in recent years, and weapons design has increasingly become a matter of minor but sophisticated modifications and routine calculations. Under Bradbury, LASL was not aggressive during the 1960's in finding new directions for its scientific energies, nor was the laboratory encouraged by the AEC to engage heavily in nonnuclear projects. The result was what some resident observers described as a sense of stagnation, which was compounded by the longevity in their jobs of the laboratory's administrative personnel and the lack of opportunities for ambitious younger men.

Morale at the laboratory seems to have rebounded somewhat from the cutbacks, and several new projects are generating fresh enthusiasm among at least part of LASL's staff. One such effort is the Los Alamos Meson Physics Facility (LAMPF), an 800-Mev proton accelerator that is the country's newest and most versatile research tool for medium-energy physics.

Planning for the accelerator began in 1962 at Los Alamos, and the effort was accorded division status within LASL in 1965. Designed as a national facility, LAMPF gained broad scientific support in the mid-1960's and survived a lengthy series of funding delays and economy measures with the skillful advocacy of Louis Rosen, LAMPF director, and the political assistance of Senator Anderson, for whom the accelerator center is named. Allocation of time on the $65 million accelerator, which produced its first full-strength beam in June, will be largely determined by the more than 600 nuclear scientists from universities and other laboratories who compose its user group. The LAMPF thus breaks new ground at LASL, both in its independence from the LASL administration and in its being entirely "out from behind the fence," meaning that

LASL Directors, Past and Present

During World War II, J. Robert Oppenheimer directed the development of the atomic bomb at Los Alamos. He is given credit for forging the diverse scientific talents that were assembled there into an effective team. In doing so, he opposed with some success the military's penchant for excessive security and their insistence on a narrow compartmentalization of research, thus permitting discussion and more rapid solution of the scientific problems that arose.

After the war, Oppenheimer and many of the more prominent scientists left Los Alamos to return to university posts. Oppenheimer's choice to succeed him was Norris E. Bradbury, at the time a relatively unknown commander in the U.S. Navy. Bradbury had received his Ph.D. at the University of California at Berkeley in 1932, had done research at the Massachusetts Institute of Technology and at Stanford University on the conduction of electricity in gases, and, while in the Navy, had worked on ordnance.

Assigned to Los Alamos during the war, he was placed in charge of the Trinity field test that resulted in the first atomic explosion, and he also headed the assembling of the nonnuclear parts of the bomb. Bradbury initially accepted the appointment as director of the Los Alamos Laboratory for a 6-month period—at a time when the laboratory's future was in doubt. He came to believe, however, that the safety and security of the country depended on the continued development of nuclear weapons, and he stayed on to lead the renamed Los Alamos Scientific Laboratory (LASL) after its transferral from the military to the newly formed Atomic Energy Commission (AEC). Bradbury remained as director of LASL for 25 years, until his retirement in 1970.

Bradbury's style as director was marked by informality. His office was sparsely decorated, and he rarely wore a suit. Indeed, he enjoyed a reputation as something of a character, typified perhaps by the Model A Ford that he drove to and from work for many years. He was, however, an autocratic director who, as one observer put it, "ran a tight ship" and who was not known for his tolerance of opposing views. Bradbury's performance as director draws high praise, in retrospect, from many of the senior staff members of the laboratory, although some expressed the opinion that his leadership had been less vigorous in the latter part of his term, resulting in some stagnation within the laboratory.

Upon Bradbury's retirement, Harold M. Agnew, a longtime LASL staff member, was selected to become the laboratory's third director. Like his two predecessors, he was associated with the laboratory's wartime effort. Agnew joined the laboratory in 1943 and later flew on the atomic bomb strike against Hiroshima, Japan, as a member of the scientific team. After the war, Agnew left Los Alamos to complete his Ph.D. at the University of Chicago, but then returned to resume work in weapons development. Among other activities, he served two terms in the New Mexico State Senate (1950 to 1955) and spent 3 years (1962 to 1964) as scientific adviser to NATO headquarters in Paris. Previous to his appointment as director, Agnew headed the weapons physics division of LASL.

Under Agnew, the laboratory has undergone some reorganization and is more actively engaged in "selling itself" to the AEC and other federal agencies. Agnew has greatly increased the flow of official visitors to LASL and has instigated efforts to involve more outside scientists in the life of the laboratory. No stranger to the ways of the federal science bureaucracy in Washington, D.C., Agnew is said to have been influential in pushing through the 1971 federal intern program aimed at employing recent science graduates. In his personal style, Agnew cultivates a more polished image than did Bradbury, but he appears no less determined to run the laboratory with a firm hand. Despite his weapons background, he is given credit for supporting new initiatives to further diversify the laboratory's mission.—A.L.H.

security clearances are not required of visitors; some weapons-related research will be carried out with the accelerator, but in an area separate from the main facility.

Under Agnew, the laboratory has made some new but so far feeble moves toward diversification, notably in the field of energy technologies. Work on lasers, including both weapons-related research and laser-induced fusion concepts, is being pushed. A new method of tapping geothermal energy, proposed by some LASL staff members, is being studied, and work on superconducting transmission lines and tunneling technology is also in progress. Agnew has made other organizational changes in the laboratory, splitting off weapons work from nonweapons work, shifting several senior administrators around, adding four new divisions for a total of 15, and initiating steering committees to guide interdisciplinary work that involves more than one division. Weapons development now accounts for about 68 percent of LASL's $100 million budget, although perhaps a quarter of this goes toward supporting basic research; the remaining 32 percent is divided among LAMPF, fusion research, the remains of the Rover project, and other nonweapons projects. Some 6 percent of LASL's budget comes from federal agencies other than the AEC.

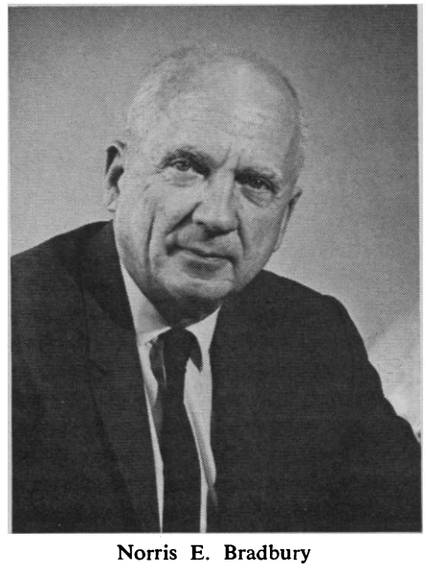
Agnew has made a number of small changes designed to make the laboratory a more pleasant place to work—for example, omitting the requirement that all incoming mail be opened and scrutinized by the mail room. He is attempting to upgrade the laboratory's scientific and academic contacts by recruiting well-known university scientists to fill the equivalent of professorial "chairs." The half-dozen LASL Fellows, as they are to be called, will not be permanent employees of the laboratory, but may come and go as they please, serving the director as, in effect, top-level consultants. A persistent problem for the laboratory is the lack of "room at the top," and Agnew admits to some difficulty in finding a place on the management ladder for younger people and in removing older staff members who, while still competent, are not as vigorous as they once were. He is looking into early retirement incentives and similar measures.

Several other trends are visible at LASL. Intensive security measures are less ubiquitous than they once were, and, whenever possible, groups and

Harold M. Agnew

parts of divisions are being moved out from under the classified blanket. There is, however, a new concern about physical security and possible sabotage. The import of the bombings at the University of Wisconsin mathematics center and at the Stanford Linear Accelerator have not been lost on LASL officials, and fences that had been torn down are being replaced to protect the laboratory's $35 million computer center and other facilities.

Although the basic organizational unit of the laboratory is still the division, composed for the most part of research groups within a traditional field of endeavor such as physics, chemistry and materials science, or health, some changes are evident. The divisions are now somewhat less independent than they were, and Agnew has encouraged more informal groupings around particular projects, such as lasers, geothermal energy, or applications of stable isotopes. The laser work in particular is cited as an example of a project that grew up to become a division in its own right.



Norris E. Bradbury

The laboratory as a whole is less independent of Washington than it was in its early years. In fact, many old hands believe that part of the laboratory's difficulties stem from its being overregulated, and they attribute the rising cost of research to this growing bureaucratization. Others think that the laboratory is increasingly dominated by a different kind of person from those who accomplished its early successes. One recently retired staff member who participated in those early exploits told *Science*, "In the old days, it was the thinkers rather than the doers who made waves in the laboratory, but the situation is now reversed," a change that he believes is not entirely for the better.

Relations between the laboratory and the University of California, contractor for LASL since the beginning of the wartime effort, appear to be at low ebb. The university provides legal services, insurance, retirement programs, and similar logistical assistance to LASL, but it has very little to do with the scientific administration of the laboratory. The connection between LASL and the university supposedly provides certain intangible benefits for both—for example, a link to academic life for LASL and cross-fertilization of the research efforts of both institutions. Officially, both parties are satisfied with the arrangements, the contract for which is now in the last stages of renewal, but campus criticism of the university's role in managing a facility that does classified research led to a review of the relationship by the Berkeley academic senate and the creation of an academic review committee to look over the laboratory programs. Privately, some LASL officials complain that the university does not help them to fight their budget battles and, in effect, gives the laboratory little in return for its fee except occasional heartburn.

In the past, the laboratory could count on a steady flow of money, largely from a single source—the AEC's Division of Military Applications. Work for other agencies is slowly expanding—LASL officials point to a new memorandum of understanding with the Depart-

ment of Agriculture for cooperative research on using physical instrumentation and sophisticated chemical tracers to study agricultural problems—bringing with it new uncertainties about funding and additional administrative chores.

The AEC itself, with a new administration and a recently broadened charter that permits a wider range of research efforts, is supporting some of the laboratory's moves toward diversification. Work for outside agencies up to about 20 percent of LASL's budget would be permitted, according to the AEC. But that leaves substantial limits, imposed in Washington, on how far the laboratory can go in broadening its activities. The AEC attitude is one of encouraging diversification as long as the laboratory does not go all out. In addition, the AEC is concerned that the weapons work, which it still views as LASL's main mission, not be neglected nor jeopardized by siphoning the laboratory's most talented people off onto new projects.

The weapons work itself has changed character since the early years, when building the bomb at all was the job, to the more tedious but routine task of matching a device to its particular military mission. At Los Alamos, the weapons research is depending more and more on computing as design and even simulated testing is carried out by means of sophisticated computer programs. The laboratory has become increasingly involved with nonnuclear weapons, such as lasers, which constitute the fastest growing part of LASL's budget. And despite the generally improving relations with the U.S.S.R. over the past 10 years, the weapons budget at LASL has increased 60 to 70 percent in that period.

Weapons work is not the most exciting part of LASL's research, for most of the staff. Indeed, among younger scientists associated with some of the newer, nonmilitary projects weapons work is regarded with some disdain, although the staff does not seem to be strongly polarized on the subject. The LASL administration looked on tolerantly during the one antiwar demonstration that took place at the laboratory but has made it clear that staff members must be sympathetic to LASL's main mission, with the result that the staff is for the most part, as one administrator described them, "a pretty hard-hat bunch."

Whether the laboratory can remain intellectually vigorous on a steady diet of weapons development is an open question. Some staff members believe that LASL's health and productivity in the long run might well depend on how successfully it can diversify, and they point to LAMPF and other new projects as where the action and excitement are within the laboratory. Others hope that LASL, along with the other AEC laboratories, will be transformed into real "national laboratories." A total test ban treaty or other possible SALT agreements might have significant impact on the character of the laboratory, but whether it would mean cuts in its weapons work or an expansion of, for example, its theoretical and computational weapons research is uncertain. But in the absence of such dramatic changes, diversification seems likely to be, at best, a gradual process at LASL. In the meantime, Agnew told *Science*, "We intend to continue being the best weapons lab in the country as long as the Department of Defense asks us to."

—ALLEN L. HAMMOND

U.N. Environmental Program: Despite Hitch, Coming on Strong

Until last week it appeared that the recommendations of the United Nations Human Environment Conference in Stockholm last June would be translated smoothly into a new U.N. environmental program. It is true that the original script had been altered substantially when a coalition of developing countries engineered the locating of the proposed Environment Secretariat in Nairobi, Kenya, rather than in Europe, but the change in venue had been taken in stride in New York. Then on 6 December, it was reported that Maurice F. Strong, chief organizer of the Stockholm conference and presumptive head of the new environmental program, had sent a letter to U.N. Secretary General Kurt Waldheim resigning his current job and taking himself out of the running for the prospective permanent post.

By noon the next day Waldheim had announced he would nominate Strong as first executive secretary of the Environment Secretariat, and Strong had indicated he would let the nomination be considered by the General Assembly. There was no official account of what had occurred between Wednesday and Thursday, but the matter is regarded as settled on terms satisfactory to Strong by those close to him. Whether a letter of resignation was actually sent but returned, as was reported, is a matter of polite dispute, but there is no real doubt that Strong had reached the point of going to the mat on how the new program was to be run. The underlying issue seems to have been Strong's misgivings over how the new program would function within the U.N. structure.

As a big international civil service, the U.N. bureaucracy is almost by definition cautious and unwieldy. In addition to tortuous inner politics, the United Nations in recent years has been relatively short of funds. It is therefore not surprising that, within the secretariat, the new environmental agency might be perceived as a rival for money and a potential administrative maverick.

Strong, a successful industrialist before he became head of Canada's International Development Agency, has had a clear and consistent idea of how a U.N. environmental program should operate since well before the Stockholm conference and has been determined to ensure the program more flexibility than is usual within the U.N. framework. To an extent remarkable in U.N. affairs, Strong has established a personal constituency that cuts across regional, political, and economic lines, and observers say this allowed him ultimately to win assurances of the