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LLNL History, the Teenage Years

M. Trost

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Lab History, the Teenage Years

Maxine Trost

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I came to the Lab in 2001 as the Lab's first professional archivist. The Lab has small but respectable archives that contains some amazingly interesting materials documenting an amazingly interesting period of history.

Think of the early 1950s when the Lab opened and what life was like then. Most of us had never flown in an airplane. TWA began the first nonstop coast-to-coast air service in 1953 offering service from New York to California. National Airlines offered the first domestic jet-airline passenger service in 1958 with flights from New York City to Miami.

The average car cost less than \$2,000 and gasoline cost less than 30 cents per gallon. At the same time, the average annual salary was \$4,500. And only 1/3 of women were in the paid workforce. Job ads in the newspapers were often divided help wanted men and help wanted women. Secretaries were called girls.

Only half of US households had a TV set, which was certainly black and white. *I Love Lucy* was the top rated show on TV. *Singing in the Rain*, *High Noon*, and *The Quiet Man* were favorite movies. On the hit parade were Eddie Fisher's "Lady of Spain," Rosemary Cooney's "Half as Much," Johnnie Ray's "The Little White Cloud That Cried," Jo Stafford's "You Belong to Me," Patti Page's "I Went to Your Wedding." We still listened to shows on the radio like *The Jack Benny Show*, *Amos and Andy*, and *The Lone Ranger*.

No one had a cell phone, a blackberry, or a laptop. No one had call waiting, caller id, DVDs, voice mail, or GPS. We barely knew what a computer was; we wound our watches and generally shifted our cars (which probably didn't have seat belts and certainly not airbags).

World War II had been over for only a few years and the Korean War had just started. The Iron Curtin had fallen in the Soviet Union and Moa Zedong and the communist party had won out in China. Sputnik was not launched until 1957.

Into that world, the Lawrence Livermore National Laboratory opened September 2, 1952, on the site of the former Naval Air Station east of Livermore.

The Livermore Naval Air station had been built in 1942 four miles east of Livermore to relieve overcrowding of the naval air facilities at Oakland Municipal Airport. The primary mission of the base was to train pilots. Up to October 1944 some 4,000 cadets trained. Training operations ended in late 1944 and the station began servicing fleet air units preparing for overseas operation, storing aircraft, repairing aircraft and the training of Navy and Marine air reservists. After the war the station closed down in stages and was decommissioned altogether in 1946.

The land that had become the NAS had been ranch land belonging to William Gatzmer Wagoner. Wagoner recalled how the Navy took his ranch land in 1942:

I hadn't any inkling that Uncle Sam wanted the property. The war had already started but there was nothing said. I went up one morning, and I saw some men working out in the field. The field was already cropped to barley, and it was a few inches out of the ground, and here were these men mudding around in my grain.

They never said boo to me when they came. I didn't say anything, but the next morning I was up there before anybody, and I went out and pulled out every one of their grade stakes. [When the crew came back] this boss man come over to me, and he said, "Do you know what become of all of those stakes?" "Yes, I said, I took them out. They're piled under the oak tree. If you want them, get them and get the hell out of here."

Commander Johnson invited me into Alameda and said "you know we're going to take that ranch?" I said "well, there's a war on. I guess you have the privilege." What else could I do? All they had to do was talk to me.

Mr. Wagoner was eventually paid for the land, perhaps \$75,260, although there are several stories that give different amounts.

How did what is now Lawrence Livermore National Laboratory come to be on the former air station? We need to start with two men who co-founded the Lab. Ernest Lawrence and Edward Teller. Both were involved in the Manhattan Project, Lawrence in Berkeley where he worked on finding ways and machines to separate uranium for use in the atomic bomb and Teller at Los Alamos as one of the scientists designing the bomb. After the war, both went back to their earlier work, but both remained interested in continuing weapons work.

Ernest Lawrence was born August 8, 1901, South Dakota. He was awarded a Ph.D. in physics in 1925 from Yale University. He came to the University of California Berkeley in 1928. In 1939 he won the Nobel Prize in physics for the invention and development of the cyclotron, a circular particle accelerator. He died in 1958 at the age of 57.

Edward Teller was born in Budapest, Hungary, January 15, 1908, seven years after Lawrence. He received his Ph.D. in physics at the University of Leipzig in 1929. In 1934 he moved to England to avoid the Nazis and in 1935 came to the United States. He joined the Manhattan Project in 1942 and worked at Los Alamos until the end of the war and off and on after. He died in 2003 at the age of 95.

Both Lawrence and Teller were brilliant scientists; both could be charming; both had very strong opinions and could be extremely persuasive. However, they were very different personalities. Lawrence was a product of small town mid-western America. Teller was educated in the capitals of Europe. Lawrence was an experimentalist, Teller a theorist. Lawrence was an optimist, Teller a pessimist. Both worked hard to get support for a second laboratory, but they worked more or less independently.

From the beginning of his time at Los Alamos, before the atom bomb had been developed, Teller pushed for work on the "super," a hydrogen bomb. He found little support at Los Alamos for his idea. But Teller was convinced that the work was necessary and after the war, he continued to push for research and development of the "super." Teller felt that although Los Alamos was doing some

research on the hydrogen bomb, they weren't working hard enough or fast enough. He therefore proposed a second laboratory to carry out the work and to provide competition for Los Alamos. The idea of competition was one of the major arguments for a second laboratory.

Lawrence wanted to continue doing work for the federal government to expand the Berkeley Laboratory. He wanted to do "big science" with the support of federal dollars. He too talked to Washington in favor of creating a second lab under the guidance of his Berkeley Lab and himself.

Leaders in Washington, however, were initially cool to the idea, as was Los Alamos. They felt a second laboratory would dilute the work at Los Alamos in terms of dollars and staffing. However with the Russian test of an atomic bomb in August 1949, much sooner than expected, and with the continuing lobbying of Lawrence and Teller, the mood in Washington began to shift. The Air Force supported a second lab and proposed to begin one of their own if the AEC did not set one up.

The AEC did not want to lose control and decided they needed to support the second Laboratory. On June 6, 1952, they sent a letter to the University of California asking them to carry out thermonuclear work. According to the letter, the new lab would undertake: "diagnostic and measurement work in close collaboration with the Los Alamos Scientific Laboratory, somewhat similar but more basic and on a larger scale than the assistance UCRL provided in last year's Eniwetok tests the Commission hopes that the group at UCRL will eventually suggest broader programs of thermonuclear research to be carried out by UCRL or elsewhere."

The selection of the University of California Radiation Lab to manage the second laboratory was not at all a sure thing. Teller had presented several alternative suggestions. Further, the charter proposed in the letter, making the new lab a support function for Los Alamos did not please Teller and he refused to be involved with the new lab without a broader charter which included thermonuclear research. Lawrence was happy enough with the charter as proposed. His optimism led him to believe that once he had a foot in the door he could expand the charter. Lawrence proposed to go ahead with or without Teller but Washington convinced him that Teller's experience and influence were necessary and he and colleagues talked Teller into joining.

Although Lawrence and Teller are generally considered the co-founders of the Lab, there is a third figure, without whom the Lab probably would not have happened. Herb York was born November 24, 1921, in Rochester, New York, where he received his B.S. and M.S. from the University of Rochester. He obtained his Ph.D. from the University of California, Berkeley in 1949. He worked with Lawrence on the separation of uranium during the war.

According to Harold Brown, one of the original scientists at Livermore, the Lab's third director, and later secretary of defense:

Edward had lots of ideas and a very, very strong drive and persistence. Most of the ideas were no good, but that's all right. A couple of them were very good, and the idea of a separate, competitive laboratory was, at the time certainly, very good. ... Without Lawrence's prestige and influence, if there'd been a second laboratory, it would not have been very much of one. It would have been an adjunct essentially, because Herb did not have the reputation and Edward did not have the gravitas to get people to do what had to be done to make a second laboratory. ... And without Herb, the place never would have gotten anywhere,

because he was the one who provided a lot more than the administrative skills. He provided the leadership skills, the persistence, the intellectual leadership was there, and made decisions. And I think the rest of us were quite willing to work for him, which I think would not have been true of Edward.

York has told the story many times about Lawrence asking him to investigate whether a second laboratory was necessary. At the time, York was young and a new graduate. He was teaching physics at Berkeley. He traveled around the country at Lawrence's direction, talking to the major stake holders on Lawrence's behalf about whether a second laboratory was needed. He returned to Lawrence with the recommendation that a second lab was indicated.

York was fully aware that Teller's and Lawrence's visions of the proposed laboratory were at odds in almost every particular except its existence and that it would be considerable feat to keep them focused on their common overall objective, and he consciously made an effort to keep them apart. But he managed to coordinate and bring the two visions together.

York wrote the original plans for the Laboratory's organization and programs. According to York:

[Lawrence] used to ask me to draw up a plan, and then he always said, "Fine!" We added Sherwood [which did research on fusion energy] and we added a Physics Division [to do basic research] in order to have something besides weapons. We did it not because we thought Sherwood was a great thing to do, but because we thought Sherwood would be an interesting thing to add in a weapons laboratory, to add breadth, to provide breadth from the start. And, I think, with the additional idea to make recruiting more interesting by having something besides weapons going.

These plans included major research not only on thermonuclear weapons put also on fusion energy.

After Berkeley had been selected to manage the new laboratory, a site had to be selected. In 1951 the Berkeley Lab had participated in diagnostics for the George Event in Operation Greenhouse. Due to lack of space at Berkeley, the experiments had been set up on the Livermore Naval Air Station site. Lawrence had also set up the Material Testing Accelerator project at Livermore managed by California Research and Development Corporation. So there was already a presence in Livermore.

Charlie Blue was the Lab's business manager. According to him:

There was a great search that went on for a remote site. There were criteria established: an hour or an hour and a half drive from the intellectual community in Berkeley, convenient roads to get here, ability to have materials readily delivered here, power, utilities, all this sort of thing. So, quite a search was made. A number of sites were looked at, and then it became apparent, since the Government owned this property, since it was fenced to afford security, and since not only was there quite a bit of power coming into the place but there was ready access to additional power that the Government could put in, that this was a good choice. So we ran a fence down the middle of the field, and CR&D stayed on their side of the fence

and we stayed on our side.

The new Lab opened September 2, 1952, on the Naval Air Station site. It was 111° F in Livermore that day. There are 77 names in the Lab's first telephone directory issued that September. Staff moved into the old Naval Air Station buildings. According to Herb York, who "ran the place:"

The original building that was used for office space was the Navy dispensary, the hospital. They had this basement room, which was an autopsy room. We used that initially for classified record storage and it was quite a problem to find a safe door that would fit, and muscle it down the stairs and install it down there.

There was no air conditioning. A large majority of the staff had come from Berkeley and were not used to the heat. The new computer facility, which had air conditioning, was a popular place to go. Wally Decker, an engineer who moved to the director's office staff remembers:

I know that there was an ongoing campaign to get air conditioning out here. Unfortunately, the people who really controlled our destiny, those from Berkeley like the business people, the Director, and the AEC office people, always managed to come out for morning meetings. I can recall when the strategy changed to scheduling our meetings in the afternoon, so that they got the full brunt of it, and making sure we had plenty of them in the summer.

Office space was at a premium. Director Herb York's office was in the lead-lined x-ray room. Some staff members had offices in the former showers. There were not enough telephone lines. There were no post office boxes available in Livermore, and the new Lab had to wait for one. They did not have enough desk lamps. Business manager Charlie Blue tells the story:

Later, as progress occurred, we had to install more utilities and equipment, and that meant getting in the crawl space between the building floors and the ground. It turned out this area was badly infested with black widow spiders. The manholes were full of black widow spiders, and it became quite an issue to get control of these spiders with spraying, but we persuaded employees that it was safe.

One more story of the very early days about the air strip that still remained on the new Lab site. According to business manager Blue:

While the landing strip was still out here -- there was a 4,000 foot landing strip diagonally across the site -- there were eleven planes during my time of responsibility that landed here. The guards would rush out, and they'd apprehend the pilot of the plane and station a guard at the plane. The government people would always say, "No! You can't allow them to fly it out of there. Take it apart. Take the wings off. Don't let them fly out of there. That's a secret site." So we'd go through this rain dance every time. One guy who landed here finally said, "Can I make one phone call? Even a criminal can make one phone call." He called his secretary, and she called the governor, a personal friend. We didn't require him to take his airplane apart.

The staff came to the new lab was extraordinary. They were very young; Director Herb York was 31. The scientific staff were in their 20s and 30. They were bright, brash, and committed to Lawrence and the new project.

Herb York remembered:

But the spirit was one of Edward always interested in trying to invent things, and Ernest with the notion of building a floor, and the sky's the limit, and let's try something new and so on. Ernest didn't contribute any ideas at all, but he encouraged that kind of adventurous spirit. So both Lawrence and Teller, as older people, had this kind of spirit and then the rest of us younger people had it because, I think we were just young and naive. It wasn't as if Lawrence and Teller were telling us to do these things. It was natural for us to do them, and they participated with a lot of boyish enthusiasm.

The new lab was part of the Berkeley Lab and the culture and management style were Lawrence's. Many of the functions were either managed from Berkeley or handled in Berkeley. Ernest Lawrence was director of the of UC Radiation Laboratory. Herb York "ran the place," the Livermore branch, for him. Departments were organized similarly to Berkeley Lab.

The new Lab was set up to provide diagnostics for Los Alamos and Livermore, to design weapons, to work on nuclear fusion, and to theoretical research. The two major projects were named Project Whitney and Project Sherwood. Project Whitney worked on designing nuclear weapons; Project Sherwood worked on controlled thermonuclear energy. In planning the new Lab structure, Herb York believed that it would help recruiting if there was a program other than weapons. Livermore was meant to be the "new ideas" Lab. The staff was very young and inexperienced. The only staff members with weapons experience were Teller (who started as a consultant and joined the staff in 1953) and Herb York who had worked on diagnostics for a Los Alamos test.

Los Alamos was cool to the idea of a second Lab from the start. The cultures of Livermore and Los Alamos were very different. Harold Brown observed:

The people at Los Alamos, it seems to me, had in a way been both marked and limited by their success and their guilt feelings about the creation of the bomb, the atom bomb, and its use at the end of World War II. ... Whereas the people at Livermore were starting new. They had these drives from Lawrence and Teller and York, which together with their youth, made them approach things in a very different way. As I say, both technologically and in terms of a willing to interact on the national scene.

Lawrence came to Livermore more or less once a week. He walked through the Lab, stopping in offices to ask employees what they were doing. He sat in meetings, generally in the back and generally without speaking. Lawrence's style and personality was a central factor in the culture of the early Lab. He valued total dedication and risk taking, and fostered the idea that if you didn't fail from time to time, you weren't trying hard enough. York says that he consciously modeled himself on Lawrence's style and ran the Lab as he believed Lawrence would have done.

Because personalities were so important to the early lab and its development, I want to introduce a fourth figure, not a founder, but extremely important to the Lab's development and culture. Duane Sewell was working on his Ph.D. in physics at Berkeley when Lawrence asked him to come to

Livermore. Going to Livermore meant that he would not finish his Ph.D., but Lawrence persuaded him that if he joined the new lab staff, Lawrence would make sure he always had a job.

Sewell was advisor and deputy to Lab directors until his retirement. He was an early advocate for safety and managed all of the engineering functions. And like all of the early managers, he knew how to get things done. Sewell was part of the steering committee that Herb York set up, even before the Lab opened. York recalls:

We organized a steering committee right from the start. ... One special characteristic was that the people were not necessarily responsible for something. ... We met fairly often, certainly once a week, and argued and planned and shouted at each other -- it was a very informal group -- about what we should be doing, and who should do it, and so on.

There are a couple of things that I'd like to highlight in this quote. The committee was based not on hierarchy but on who was needed to get the job done. From the beginning, projects were set up across departments, bringing together whomever was necessary to get the job done.

According to Jim Carothers, one of the physicists who came to Livermore on the first day:

People who knew Lawrence well, ones I've talked to, have said, "Ernest did not believe in organization charts. He just got the best person for the job, had them do the job, and when that was done, had them do something else. He believed that if you give a person a title, and then asked them to do something else, they would think they had been demoted, and that wasn't the case." So, for the first few years, ... there were no organization charts at the Lab because Lawrence wouldn't have them.

Second, "they yelled at each other." That's probably literally true. Frank and heated debate has been a hallmark of the Lab. This free debate continued throughout the Lab. And it helped make the science better and prevent failures at the test sites. Before tests, scientists and engineers held "pre-mortems" at which designs and planning were thoroughly discussed to try to identify what might go wrong and correct it before wasting valuable resources on a failed shot.

A third outstanding characteristic of the early Lab is that activities were built around outstanding people. If you ask an early Lab employee where he worked, he will usually say whom he worked for, not which department he worked in. The early Lab was a very special place according to all the early staff members that I've talked to. Invariably, the early employees talk about the commitment, the fun, the hard work, the camaraderie. A few quotes:

Wally Decker: ...In those days the personal alliances were very strong. ... Another thing, too, is the fact of Lawrence's personality, and the fact that he was in charge. He was a very dynamic and possessive leader, and he was like the founder of a company. ... so everybody was very committed to Lawrence's goals, and his personality was everywhere. ... and he could come around and overrule your boss. He could talk to anybody and fire them on the spot.

There is a story told by many, in various forms, about Lawrence happening one day on a guy who was sitting with his feet up, reading the paper. Lawrence said: What are you doing. The guy said:

Nothing. Lawrence said: You're fired. They guy said: you can't fire me. Why not? I work for the phone company.

Charlie Blue: The best thing about it was the camaraderie that that existed between the people that they were all purpose oriented. I don't know of a person that put self above purpose.

Rich Wagner: The Lab has learned how to make it so that eccentric people can make a difference.... That people, if the eccentric person is good, you know, and he has good ideas occasionally, people kind of rally around the eccentric person and take his good ideas and make them practical.

Bob Schock: When I came to the Laboratory, Polaris had been done, but the Polaris story was legendary. I mean the Laboratory had a mission. The mission was to put a nuclear warhead on top of a missile that could be put in a submarine and carried around and then deliver it successfully and the Laboratory did it. That was the mission they got the mission done. There was never this sense that you have a retirement fund in the mission. The mission was something, it was like going to the moon, you know? You knew that when you got to the goal, you were going to then look for another mission.

One of the first orders of business for the new lab was to order a computer to help with the difficult physics problems. Teller strongly pushed acquiring a computer and the first one, a Univac I, was ordered before the Lab opened. It was delivered in early 1953 in several moving vans. The Lab has always stayed at the forefront of computing, working with vendors to design more and more powerful computers. The first Univac could perform 1000 operations per second. By 1963 Lab computers were performing 1,000,000 operations and by the end of the 1990s 10 to the 12th operations per second. Livermore scientists, in fact worked with vendors regularly to design faster and faster hardware and improve software.

Carl Haussmann, scientist and deputy to the directors said:

I always made sure [computer manager, Sid Fernbach] had more money in his account than he could spend, just to make sure we got the maximum quantity and quality of those computers in that era. Betting on supercomputers and supercomputer utilization has never let me down.

Bill Lokke, physicist, and later Associate Director of the Computation directorate wrote:

At the heart of the approach was the axiom that designs must be thoroughly computationally modeled before being detonated in the Nevada or South Pacific test sites. Since the arrival of the Univac, and accelerated by the availability of the [IBM] 701 and 704, the goal of the theoreticians and code builders was to create a set of physics design codes that, through ever improved approximations and repeated testing and comparison with experiments, would be as complete and accurate a set of tools in the hands of the designers as possible.

With the aid of computers, the young staff wasted no time in designing a device based on their new ideas. Livermore tested its first device seven months after its founding. The shot March 31, 1953, was code-named Ruth, apparently after Teller's secretary. The new Lab had rushed to field the test and it was a fizzle. The Los Alamos scientists were not altogether sympathetic and took this photo

of the tower on which the device had been fired, which still stood after the nuclear explosion. They suggested that for the next test, perhaps Livermore should build a shorter tower and send the photo to Livermore. There was some discussion about whether the new Lab was necessary or whether it simply drained resources from Los Alamos.

But the Livermore culture took the failure in good part. Lawrence's philosophy was that failures were proof of outstanding effort. If you don't have failures, you're not thinking creatively enough. York reminisced about Ruth:

In some sense we felt as though we were just right; the reason ours didn't work was because we were bolder. ... The basic policy that we had was to make technology as interesting as pure science by pressing the extremes, whether there was any interest for them in Washington or not. ... The policy was to push extremes in order, consciously, to make technology as interesting as pure science, as challenging as pure science.

Livermore's second shot, Rae, apparently named after another secretary, also fizzled. And so did the first thermonuclear shot, Koon in April 1954 in the Pacific. Once again, the necessity of a second laboratory was seriously questioned. The director of Los Alamos suggested that Livermore become simply a supplier of ideas, scientific data, and other data relevant to nuclear design to Los Alamos. He worried that Livermore was draining resources that could be used more effectively at Los Alamos. It's interesting to compare the viewpoint of the Lab staff at the time with our view today of the Lab as an institution. The new Lab, for many years, was on very shaky ground; it was not at all certain that it would survive.

There are a number of different opinions about how helpful Los Alamos scientists were to their new Livermore colleagues. The Los Alamos director opposed the new Lab with leaders in Washington, but continued to work cooperatively with the new lab management. Wally Decker summed it up:

And in general [Los Alamos staff's] help was courteous and useful, and nothing tricky about it at all, but what you found in those early years in dealing with the Los Alamos people was that if you didn't ask a question, you might not find out something. Nothing was volunteered.

Success followed. One of Livermore's talents was working with the various military services to find out what they needed and wanted. The Air Force wanted bombs they could drop from an airplane. But the Army was interested in small artillery weapons and Livermore was working on smaller devices. By 1955 Livermore had designed and was ready to test two smaller weapons for the Army. Approval was required from the AEC for the tests, and the AEC had reservations. In the end, they approved one of the tests, which was a success. The Lab staff were thrilled and relieved. Edward Teller wrote to the AEC that everyone at Livermore was "proud and grateful that we had the chance to work to the point where our work needs no further elaborate justification."

The Tesla Event (March 1, 1955) in Nevada demonstrated the possibility of small sized devices. The device for that shot was delivered in two suitcases, heavily reinforced and with two handles as it required two men to lift it. The designer, Johnnie Foster, who became the Lab's 4th director, had packaged the device specially, perhaps to tease Los Alamos. Foster reminisced:

Yeah, [delivering the device in two suitcases] was outrageous, wasn't it? That's true. But the device wasn't done for PR. It was done to look at the limits. [We] didn't send it down in

a crate. [We] flaunted those suitcases. That's true. I exhibited certain arrogance about the whole thing.

The test was successful and laid the foundation for the Lab's coming of age with the Polaris.

In the summer of 1956, the Navy held a seminar on antisubmarine warfare at Nobska Point in Woods Hole, Massachusetts. Edward Teller and probably Johnny Foster attended. The discussion centered on arming submarines with warheads. Technology at the time made necessary very large missiles to carry very heavy warheads. Teller says:

The Navy asked if we could make a nuclear explosive of such and such dimensions and such and such a yield. What they wanted was a small, light, nuclear warhead in the 1-megaton range. Everyone at the meeting including representatives from Los Alamos, said it could not be done—at least in the near future. But I stood up and said, “We at Livermore can deliver it in five years and it will yield one megaton.” On the one hand, the Navy went away happy, and the program got approved. On the other hand, when I came back to Livermore and told them of the work that was in store for them, people's hair stood on end. They said, “what have you done? We can't get a megaton out of such a small device, not in five years!”

Lab scientists set to work using ideas for designs that had been working on and new ideas. They tested the concept in 1958, just before a testing moratorium began. The development of the warhead was extremely important to Livermore. The new Lab had come of age. It established Livermore's reputation as a major nuclear weapons design facility and spurred further innovation. The development was also important to the nation. According to John Nuckolls:

The creation of Polaris ... changed the whole nature of the Cold War. Well, you know, by going to submarines you removed the first strike threat essentially. But the difference in vulnerability of retaliatory capability created by the institution of the submarine launched ballistic missile system was a very, very big change. I mean, once that was in there, ... the delicate balance of terror really didn't make sense any more.

In 1958 the Soviet Union had declared a moratorium on testing and the U.S. stopped testing as well. In the same year Ernest Lawrence died and Herb York resigned as director, taking a job in Washington. Before the testing moratorium, scientists and citizens had begun to worry about the effects of radiation for nuclear explosions on people. In September 1957 the Lab detonated the first contained underground nuclear explosion—the Rainier shot—in Nevada. This shot was important for a number of reasons. It demonstrated the possibility of using nuclear explosions to do excavations, thus helping along the Plowshare Program, which was investigating peaceful uses of nuclear energy, such as building canals and dams. It also provided seismic data that was useful in determining if nuclear tests could be detected.

Also in 1958 Edward Teller became the Lab's second director in 1958. But Teller's interests lay not in management but in activism and he stepped down and Harold Brown became director from 1960 to 1961, during the testing moratorium.

When the Soviets began testing again in 1961, the Lab launched the Dominic series, the largest US nuclear testing operation ever conducted. It included 36 atmospheric tests in the Pacific including testing of weapons introduced during the moratorium. Tests included Frigate Bird, which was a fully operational test of the Polaris system.

Treaty talks were also underway to limit testing. It was in fact, it was in Geneva at testing treaty talks in 1958 where Lawrence became fatally ill. Lab scientists acted as consultants throughout the test ban talks. In 1963, the Limited Test Ban Treaty, which banned atmospheric testing of nuclear weapons would be signed.

The moratorium ended in 1961 and Harold Brown resigned the directorship in 1961 and went to Washington. Johnnie Foster became director in 1961 as testing resumed. John Nuckolls, who was Lab director from 1988 to 1994, remembers something Foster said that he always remembered.

We want to run so fast, that anything the Russians build will be obsolete. And so a lot of us took that very seriously at the time. [By the time I was at the Lab five years,] by 1960 almost, and I'd already gotten the habit of working 80 hours a week, and this went on for 40 years, essentially.

By 1961 Laboratory staff had climbed to some 5,000. Livermore had become successful enough that Los Alamos scientists began to feel they were playing second fiddle. The laboratory had become established and institutionalized.

Foster proposed Michael May as his successor and gave him a briefing on running the Laboratory on an airplane on the way to Washington. It was the only introduction to the job that May got. He was the last director to be selected in the "old way" as E.O. Lawrence would have done it. "Who's the best person for this job? I know the job, I know the people. Who is the best person?"

The brash teenage years had ended. May had been among the original group of young, brash Berkeley graduates from Berkeley. The Vietnam War was now in progress and the country was developing an activist mentality. The Lab, which had always been "the good guy" was now put in a position of being associated with "the bad guys." With the large staff, the director could no longer know everything that was going on as York had, and management needed to consider things like performance reviews, personnel issues, and efficiency. It was the end of the beginning.

Instead of ending with a bang, I want to end with a quick list of projects and programs at the Lab, each one of which could be a complete history in itself. I mentioned only very briefly the computer programs at the lab. This is a fascinating history, following, really informing the history of computing itself. The history of nuclear testing is also a great subject as well as the history of controlled thermonuclear research. The lab has also been involved with the Pluto program, a project to develop a reactor which would be the power source for an unmanned, supersonic, very low altitude ramjet aircraft with exceedingly long range. The Plowshare program that researched peaceful uses of nuclear explosions – digging harbors and canals and extracting oil and gas; the biomedical program, begun initially to investigate the effects of radioactivity on living organisms and now working on cancer research, sequencing genes and other fields; energy research, climate research and modeling; and now in the news, laser research.

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