SPECIAL EDITION

NEWSLINE

Published weekly for employees of Lawrence Livermore National Laboratory *Friday, August 3, 2001* *Vol. 26, No. 31*

Celebrating the centenary of Ernest Orlando Lawrence

‘Atom Smasher’ taught science world to think big

By Ali Carrigan
NEWSLINE STAFF WRITER

He was called the “Atom Smasher.” The man who “held the key” to atomic energy. Before the nation knew of the Fat Man and Little Boy, there was the “little man and his giant cyclotron.”

In reality, Ernest Orlando Lawrence was not a little man — in physical size as well as scientific stature. Standing over six feet tall and with a “shock of blond hair,” most of his colleagues and friends agreed that it was impossible to miss the South Dakota native when he entered a room.

One hundred years after his birth — the actual date is Aug. 8, 1901 — colleagues still remember E.O. Lawrence as the man who revolutionized science through his work and the manner in which he pursued that work. Lawrence integrated both theoretical scientists and engineers into his projects. While this was a foreign idea in the 1930s, it paved the way for the breadth seen at modern national laboratories.

“He saw physics as a kind of adventure,” Herb York remembered. York first worked with Lawrence on the Manhattan Project, and went on to become the director of the Livermore Radiation Lab, which was, of course, Lawrence Livermore National Laboratory in its early years. “He wanted to do ‘big physics,’ the kind of work that could only be done on a large scale with a lot of people involved.”

Ernest Orlando Lawrence shows off his first cyclotron, a contraption of brass and sealing wax that cost approximately $25.

“He cared about his staff like they were family,” Director Emeritus John Foster said, recalling a story about his days as a graduate student under Lawrence. “I had a very fast motorcycle at the time, and I rode it everywhere — including across the country. One day, I was parking and Lawrence walked up to me and asked me how long I’d been riding this motorcycle. I told him, ‘About 100,000 miles.’ And

See **LAWRENCE,** *page 4*

Slate of special events to honor Lab’s namesake

Today’s issue of *Newsline* covers the life and times of Ernest Orlando Lawrence. August 8 marks the 100th anniversary of the birth of Lawrence, the inventor of the atom-smashing cyclotron, the 1939 Nobel Prize winner, and the namesake and co-founder of Lawrence Livermore National Laboratory.

In this issue you will read about Lawrence’s myriad accomplishments, as well as his approach to “big science.” There are also recollections from his son, Robert, as well as his colleagues: former LLNL directors Edward Teller, Herb York and John Foster.

Over the next few months, the Lab will continue to pay tribute to Lawrence through several events. Displays on Lawrence’s achievements will be available next week at the Visitors Center (Bldg. 651) and at the entryway to Bldg. 111. The Visitors Center will also present an exhibit in honor of the Lab’s winners of the E.O. Lawrence Medal, given to scientists and engineers for their contributions to the development, use or control of nuclear energy.

The Visitors Center is open Monday-Friday, 1-4 p.m.

In September, the Visitors Center will feature displays on loan from Lawrence Berkeley National Laboratory, the site where he conducted most of his scientific accomplishments.

Other events include a video documentary on Lawrence, which will be shown on CTV Channel 28 (also known as cable channel 30), as well as Lab TV.

The broadcast times for cable are Monday, Aug, 6, 7 and 9 p.m.; Tuesday, Aug. 7, 10 a.m.; and Sunday, Aug. 12, 2, 6 and 8 p.m.

On Lab TV Channel 4, the video will air at 10 a.m., noon, 2, 4 and 8 p.m. and 4 a.m. Aug. 6-10.

Lawrence’s faith, foresight gave Laboratory confidence to find success after faltering

By Edward Teller
DIRECTOR EMERITUS OF THE LABORATORY

Our Laboratory rightly and proudly carries the name Lawrence Livermore National Laboratory. Without Ernest Lawrence’s foresight and help, the second weapons Laboratory would not have come into existence. Beyond that, Ernest provided crucial assistance to the Laboratory during its early years of operation.

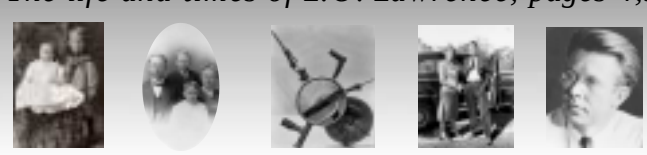
The Laboratory was founded in early September 1952, and began at once to design and test novel ideas about nuclear and thermonuclear explosives. Barely six months later, the Laboratory conducted two tests of small nuclear devices in Nevada, and the following year, we had third and fourth larger tests in the Pacific. Unfortunately, all of the first three tests failed, and we were aware that the upcoming fourth test might also

See **TELLER,** *page 8*

In the early days of the Livermore Lab, E.O. Lawrence met regularly with its directors and managers, including Edward Tellller and Herb York.

New polices for hardware, software — Page 3

The life and times of E.O. Lawrence, pages 4,5



Robert Lawrence remembers his dad — Page 5

LAB COMMUNITY NEWS

Weekly Calendar

Saturday 4

Power outages are scheduled for this weekend. Trailers 1632, 1677, and 1680 will lose power from 7 a.m. to 3:30 p.m.

Monday 6

Demonstrators are expected to gather at the corner of Vasco Road and East Avenue in observance of the World War II bombing of Hiroshima, Japan. During the hours of 8 to 10 a.m., employees using Vasco Road should be cautious of the demonstrators walking toward West Gate Drive and expect the closure of West Gate Drive as well as Mesquite Way during the morning hours.

Tuesday 7

Several openings are still available for the **"HTML Hands-On-Coding" class,** scheduled for Aug. 7, 9 and 10, from 9 a.m. to noon each day. The class is taught by TID instructors and will be held in Trailer 4181. The topics to be covered include headings, horizontal rules and graphics, lists, tables, hypertext links, forms, helpful URLs, tools and other aids to publication. Call 3-2736 or send email to: snd-training@llnl.gov.

UP & COMING

The Pleasanton Leadership Program, sponsored by the Pleasanton Chamber of Commerce, is accepting applications for participation in the 2001-02 Leadership Training Program. The fee is $700, and the program requires a one day a month commitment. Applications are available from Lisa Hyman at (925) 846-5858 (ext. 251) or via email at lhyman@home.com. More information is available at www.pleasanton.org. All applications are due by Aug. 3.

The LLNL Women's Association **annual membership drive** and **scholarship fund-raiser luncheon** will take place on Thursday, Aug. 23, 11:30 a.m. to 1:30 p.m. at the Retzlaff Vineyards. Speaker Moyna Lane will discuss progress following the November 1999 conference in support of the Commission for the Advancement of Women and Minorities in Science, Engineering and Technology. The lunch costs $15 and the deadline to register is Monday, August 13. Contact Lara Daily at 2-6932 for more information.

BROADCAST SCHEDULE

LAB TV

Lawrence Krauss' DDLS lecture, **"The Atoms Inside Us: Restless Galactic Travelers,"** will be broadcast on Lab Channel 2 Thursday, Aug. 9, at 10 a.m., noon, 2, 4, and 8 p.m., and Friday, Aug. 10, at 4 a.m.

Diversity Day celebrates 'One World, One People'

The third annual Diversity Day on the Green, featuring a multitude of multicultural food and entertainment, takes place Thursday, Aug. 9, 11:30 a.m.-1:30 p.m., at the LLESA pool and picnic area.

Food will be provided by the American Indian Activity Group, the Armed Forces Veterans Association, the Women's Association, Amigos Unidos, the Asian Pacific American Council and the Association of Black Laboratory Employees. For more information on food and prices, see the flier that was mailed earlier this week.

Entertainment includes performances by the Young Eagle Singers and Dancers, tango performances by Tango A Media Luz, a drum jam by Global Rhythm Conspiracy, and dance and music by the Kiki Raina Polynesian Revue.

The day will close with a cultural clothing contest, in which employees will compete for the most colorful, elaborate, unique or authentic outfit.

Technical Meeting Calendar

Friday 3

MATERIALS SCIENCE & TECHNOLOGY
"Planning and Analyzing Successful Experiments: With Thanks to Drs. Fisher and Mahalanobis," by Steven A. Steward. 3:30 p.m., Bldg. 235, room 1090 (Gold Room, uncleared area). Coffee and cookies will be served at 3:20 p.m. Foreign nationals may attend if an appropriate security plan is on file. Contact: Thomas E. Felter, 2-8012.

H DIVISION
"Structural Topography of Water and Aqueous Solutions," by Alan Soper, Council for the Central Laboratory of the Research Councils. 10 a.m., Bldg. 219, room 163 (uncleared area). Contacts: Giulia Galli, 3-4223, or Darlene Klein, 4-4844.

PHYSICS AND ADVANCED TECHNOLOGIES V DIVISION
"Tracking and Imaging of Gamma-Rays With Large Volume Semiconductor Detectors," by Lucian Mihailescu, Institute for Nuclear Physics Institut für Kernphysik. 10 a.m., Bldg. 312, room 205. Contact Linda Ely, 2-8247.

Monday 6

CHEMISTRY & MATERIALS SCIENCE/MATERIALS SCIENCE & TECHNOLOGY
"Center for the Accelerated Maturation of Materials" and "An Overview & Microstructural Evolution in Titanium Alloy Friction Stir Welds," by Mary Juhas, Ohio State University. 10 a.m. , Bldg. 235, Gold Room (uncleared area). Contact: Wayne King, 3-6547, or Roberta Marino, 3-7865.

PHYSICS AND ADVANCED TECHNOLOGIES
"Experiments Toward a Hard-X-ray Laser," by E.E. Fill, Max-Planck-Institut für Quantenoptik, Garching. 10 a.m., Bldg. 219, room 163 (uncleared area). Contact Alan Wootton, 2-6533.

Tuesday 7

LIVERMORE COMPUTING
The monthly customers meeting will share information about LC software and hardware issues and get feedback from customers about issues or plans. 9:30-11 a.m., Bldg. 111, Poseidon Room (Q-cleared).

Wednesday 8

H DIVISION
"Excited Electronic States and Optical Spectra of Solids, Surfaces and Molecules," by Michael Rohlfing, Universitaet Muenster. 10 a.m., Bldg. 219, room 163 (uncleared area). Contacts: Jeffrey Grossman, 3-6991, or Darlene Klein, 4-4844.

AUG. 8-10
MATERIALS RESEARCH INSTITUTE LECTURE SERIES
"Cluster Chemistry," by Mark Pederson, NRL. 9 a.m., Bldg. 661, room 13 (UC Davis DAS). For more information see http://education.llnl.gov/mri/

Thursday 9

MATERIALS RESEARCH INSTITUTE
"Spintronic Materials and Their Applications," by Charlie Cerjan. 4-6 p.m., Bldg. 661 (UC Davis, DAS). Contact: Alex Hamza, 3-9198, or hamza1@llnl.gov

Friday 10

H DIVISION
"Optical Excitations of Semiconductors from the Exact-Change Density-Functional Theory," by Yong-Hoon Kim, Technische Universitaet Muenchen. 10 a.m., Bldg. 219, room 163 (uncleared area). Contacts: Giulia Galli, 3-4223, or Darlene Klein, 4-4844.

The deadline for the next Technical Meeting Calendar is noon, Wednesday, Aug. 8.

Send your input to tmc-submit@llnl.gov. For information on electronic mail or the newsgroup llnl.meeting, contact the registrar at registrar@llnl.gov.

Newsline

Newsline is published weekly by the Internal Communications Department, Public Affairs Office, Lawrence Livermore National Laboratory (LLNL), for Laboratory employees and retirees.

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Layout: Julie Korhummel, 2-9709

Distribution: Mail Services at LLNL

Public Affairs Office: L-797 (Trailer 6527), LLNL, P.O. Box 808, Livermore, CA 94551-0808
Telephone: (925) 422-4599; Fax: (925) 422-9291
e-mail: newsline@llnl.gov or newsonline@llnl.gov
Web site: http://www.llnl.gov/PAO/

Printed on recycled paper

AROUND THE LAB

Integrated safeguards, security build on group feedback

Thanks in large part to employee input, the Integrated Safeguards and Security Management (ISSM) program has reached another milestone.

Members of the ISSM team recently finished hosting a series of focus groups that allowed employees throughout the Laboratory to share their thoughts and ideas about security.

Feedback received from employees who did not serve in the focus groups was also very valuable.

"We received several phone calls and e-mails with ideas," ISSM co-coordinator Edwin Tippens said. "Some employees also spoke with people who were in the focus groups about security concerns, and we're taking all those suggestions into account as well."

The information collected in those focus groups and other feedback processes will be examined in a one-day gap analysis workshop on Aug. 6.

"We're consolidating all the comments to provide to the workshop participants," Tippens said. "At the workshop, the employee input will provide an important perspective in evaluating ISSM criteria against current Laboratory mechanisms to determine 'gaps' in our security activities."

The goal of the ISSM program is to examine and improve security measures in several different areas. It is also a key element of Appendix O of the UC contract, which sets standards for improvement in several areas of the Lab's operations, including security.

Several groups will be represented at the gap analysis workshop, including security points of contact from each Laboratory directorate, Safeguards and Security subject matter experts, the National Nuclear Security Administration (NNSA), Los Alamos National Laboratory and the University of California.

"There were some areas that we knew were going to be of concern to employees – like foreign national access and computer security," Tippens said. "The discussions were broad ranging and raised many good issues that will help us in preparing the ISSM assessment document."

Once the gap analysis is complete, the ISSM team will draft an action plan to address the gaps. According to Tippens, ISSM is on target to meet the next UC milestone.

"We will have a completed gap analysis to the NNSA by Aug. 23," he said.

Tippens said, "Our plan is to provide responses to the comments received from the focus groups after submitting the Lab's action plan later this year. The input will be posted on the ISSM web site."

Streamlining how Lab buys desktop computers, peripherals, software

CIO UPDATES

BY TED MICHELS

LLNL has signed a contract on behalf of the chief information officer (CIO) establishing a new way to purchase commonly used computer desktop configurations. The contract will deliver typical desktop platforms, pre-configured with the operating system and software directly to the customer's specified location.

Pre-installed operating systems and software will be those identified by LLNL's Information Architecture Desktop Advisory Group as the Laboratory's Core Operating Environment (COE).

This contract will reduce costs, streamline the purchasing process, speed up the arrival of hardware and software to each user's desktop, and provide some other important benefits as well. Purchases of computer hardware and software outside of the COE can still be made through the existing purchase order process.

The contract

The contract, jointly implemented by the Laboratory Services Directorate and the CIO, calls for a Value-Added Reseller (VAR) to purchase hardware and software from vendors. The VAR will install the COE software and deliver the desktop computer to the customer's specified location.

On July 10, Government Micro Resources (GMR) was selected to implement this contract for the Laboratory. GMR will consolidate the steps needed to acquire computing products by providing electronic order entry, configuring operating systems and software, property tagging, testing, and delivering to the customer's specified location. The nominal fee charged by GMR for these services will yield a significant savings when compared to the cost of providing similar services using Laboratory resources.

LLNL's desktop standard configurations

Currently 92 percent of all desktop computers purchased at LLNL are either Dell or Apple computers. The desktop standards specified in this contract include three desktop configurations and two laptop configurations for each. These configurations will be updated every three months. The contract provides for increased memory and disk-capacity options as well as various peripherals.

Again, hardware and software for other configurations, manufacturers and models may continue to be ordered outside this contract through the purchase-order process. So, the flexibility to accommodate alternate programmatic requirements is still fully available.

Timetable

The Aug. 8 meeting of technical release representatives (TRRs) will be devoted to user training for this process. At that meeting, the desktop standard configuration, value-added services, ordering options, and related pricing information will be explained in detail. On Aug. 13, the purchase of Dell and Apple desktop computers will begin exclusively through the new contract. Until that date, existing blanket agreements can still be used to order computers and related products. After that date, those blanket agreements will still be available to acquire other products, including workstations and servers. More detailed information is available on the Web at: http://www.llnl.gov/cio/.

To simplify implementation of the new contract, an interim, Web-based Electronic Ordering System, using a combination of Online Requisition and Unicard, will be available on Aug 20, and a full-featured system will be available in January 2002.

This contract, along with other business innovations like the recently announced Microsoft Enterprise Agreement, is part of a series of successful efforts to position the Laboratory to leverage its purchasing power and streamline the way it acquires information technology. With these effective business practices, the Laboratory can consolidate the purchase of typical computing tools while preserving the flexibility needed to enable continued innovation.

LLNL signs three-year cost-saving Enterprise Agreement with Microsoft

As the technology that drives computer hardware and software evolves, so do the business practices associated with them. Large institutions like LLNL, with thousands of computer users, are developing more efficient ways to purchase and upgrade the software tools that their employees depend on to do their work. This Enterprise Agreement is a significant innovation in the way LLNL does business with Microsoft.

On June 28, LLNL purchased a three-year Microsoft Enterprise Agreement covering the rights to the operating system (OS), Microsoft Office for Macintosh and Windows, and Client Access Licenses (CALs). This agreement will save LLNL and other DOE sites from an impending increase in the cost of using these products.

Motivated by a change in pricing

The impetus for this agreement was Microsoft's announcement on May 10 of a new licensing strategy that would have significantly increased LLNL's cost of using Microsoft products. The change moves from the old perpetual license concept to subscription-based licensing for all Microsoft customers. Without LLNL's Enterprise Agreement, this approach would have ended all old software upgrade programs beginning Oct. 1, and LLNL users would have to own the rights to the latest version of the Windows XP operating system, and Office (i.e., Office XP for Windows and Office 2001 for the Macintosh).

In addition, by Jan. 31, 2002, LLNL users would have been expected to purchase software assurance at 29 percent of list price annually to receive upgrades and patches and avoid paying full license costs when choosing to upgrade. This would have translated to a substantial increase in pricing and would have severely hampered efforts under way to automate software and operating system upgrades at the Laboratory.

Details of the agreement

LLNL's Enterprise Agreement is the only cost-effective way for the Laboratory to deal with Microsoft's new licensing strategy. Senior management was briefed on the need for the agreement and made the institutional investment that will benefit the entire Laboratory. Under the agreement, the approximate cost of these Microsoft products is $158 per desktop for an annual cost to the Laboratory of $1.179 million and three-year cost of $3.537 million. Projecting the number of LLNL systems that would require upgrades, costs under Microsoft's new pricing plan without the Enterprise Agreement would have been approximately $2.752 million per year, for a three-year total of $8,257,500. LLNL's Enterprise Agreement with Microsoft will result in a three-year savings of approximately $4.7 million.

As part of the agreement, three products will be available after Aug. 1, for electronic download at: http://snd.llnl.gov/soft/esdserver.html:

Microsoft Office 2001 for the Macintosh
Microsoft Office 2000 Pro for Windows
Microsoft Office XP Pro for Windows

These products are also available on CD at the SND Computing Resource Center (CRC), Bldg. 141, Bay 2, or CRC Online, https://crc.llnl.gov/ at $6 per CD.

As always, users should consult their local support personnel to determine which upgrades are appropriate for the systems they are using.

This is part of a Department of Energy agreement in which several sites have joined together to get this advantageous pricing. Clearly, the Laboratory's participation in collaborations of this kind with other institutions is an important cost-saving innovation in the business of information technology.

Ted Michels is the principal deputy associate director for Computation and LLNL's acting chief information officer (CIO).

The life and times of E.O. Lawrence

Ernest Orlando Lawrence is born in Canton, South Dakota on **Aug. 8, 1901.**

1901

1922

Lawrence first attends St. Olaf's College in Minnesota, but transfers to the University of South Dakota after his first year. He studies chemistry with the intent to go to medical school, and earns his bachelor's degree in **1922.**

1925

At the pressing of a dean of the university, Lawrence earns his Ph.D. in physics at Yale University in **1925.**

1928

In **1928**, Lawrence is offered a position as an associate professor of physics at UC Berkeley. He accepts the job, hoping to have "elbow room" to experiment.

1929

From **1925 to 1927,** Lawrence does research on the photo-electric effect at Yale, supported by a National Research Council Fellowship. In **1927,** he is hired as an assistant professor on the Yale faculty.

One evening in **February 1929,** Lawrence finds an article by German physicist Rolf Wideroe, which details a theory for ion acceleration. After looking over one of Wideroe's diagrams, Lawrence sketches out the basic cyclotron.

1930

The first cyclotron — a "chamber of brass and sealing wax" — is built in late **1930.** It is first tested on **Jan. 2, 1931** and gives very positive results.

1931

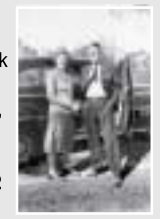
Needing to expand in order to build bigger cyclotrons, Lawrence moves in **October 1931** to another building on the Berkeley campus – this is christened the UC Radiation Laboratory, or "Rad Lab."

1932

On one of his many trips back to the East Coast, Lawrence is introduced to Mary Blumer, a family friend and graduate of Vassar College. The two are married on **May 14, 1932** and return to Berkeley.

1934

Using the cyclotron, Lawrence produces radioisotopes for the first time in **1934.** He sends some to a colleague in Copenhagen who uses them to perform the first tracer study with an artificial isotope.



1937

In **1937,** Lawre completes the cyclotron. He v his brother Joh the machine's treat cancer pa

LAWRENCE
Continued from page 1

he said, 'That's too many mean free paths. Get rid of it,' " Foster laughed, explaining that a mean free path is the path a particle takes before it collides with something.

"He was looking out for me," Foster said. "He didn't want this kid getting killed. So I got rid of the motorcycle."

It was this caring attitude that nearly led Lawrence to medical school — he graduated from the University of South Dakota in 1922 with a bachelor's degree in chemistry. However, toward the end of his time at the university, Dean Lewis Akeley pressed Lawrence to pursue physics, and Lawrence responded with enthusiasm. He received his master's from the University of Minnesota and his doctorate from Yale University — both degrees in physics.

Beginning of 'Big Physics'

After spending three years on the Yale faculty, Lawrence was offered a position at the relatively young UC Berkeley campus as an associate professor of physics. While the move from well-known Yale to young upstart Berkeley was considered a waste of an otherwise brilliant career by many of his colleagues, Lawrence wanted to make a name for himself. He started to do so when he was made the youngest full professor on the faculty by age 29. He married Mary "Molly" Blumer in 1932, and the two of them returned to Berkeley where Lawrence was heading up the new Radiation Lab on campus.

"I hated Berkeley at first," Mary Lawrence once remarked in looking back on her first days in California. "I was used to the East Coast, and everything in Berkeley seemed dry and cramped compared to that." But by the time Lawrence was offered a job at Harvard University a few years later, Mary Lawrence was sufficiently rooted in Berkeley to hope he would turn the job down.

"Molly was involved in [Lawrence's] work in the classical sense of providing support for him," York said of Lawrence's wife. "But she always seemed to know what was going on at the Rad Lab — she kept up with what was happening."

Foster remembered Mary's presence as well.

"One night, probably around 1:30 in the morning, I was in the lab working," Foster explained. "And Lawrence and Mary were walking around as if it were 1:30 in the afternoon, just talking about some of the work going on. It seems strange now, but that was the way we worked."

The Lawrence Family

Clockwise from left: father Carl, Ernest, mother Gunda and brother John.

The invention that would rocket Lawrence to international fame started out modestly as a sketch on a scrap of paper. While sitting in the library one evening, Lawrence happened to glance over a journal article by German physicist Rolf Wideroe. Lawrence did not actually read the article — "It was in German, and I didn't read German well," he recalled — but was intrigued by one of the diagrams. The idea — of producing the very high-energy particles required for atomic disintegration by means of a succession of very small "pushes" — put forth in the article was not new, but Wideroe was the first one to apply it successfully.

In his work, Wideroe had used two hollow cylinders, lined up on the same axis. Lawrence sketched a series of such cylinders, but decided that the necessary length of the apparatus would be too great to work well. He next thought of the possibility of using a curved path, and noted this by writing down a very simple mathematical equation. The essential features of the cyclotron were on paper minutes after he saw the diagram.

The next morning Lawrence told his colleagues that he had found a method for obtaining particles of very high energy, without the use of any high voltage. The idea was surprisingly simple, but Lawrence double-checked his theory with physicists from Yale to make sure he had not overlooked a critical detail.

"My father worked with Lawrence when he was building the small cyclotrons in the early '30s," Foster said. "The first model [of the cyclotron] was made out of wire and sealing wax and probably cost $25 in all."

And it worked — when Lawrence applied 2,000 volts of electricity to his makeshift cyclotron, he got 80,000-volt projectiles spinning around. He had discovered a way to "smash" atoms, and in doing so he unwittingly paved the way for the nuclear weapons program that would follow a decade later.

"Lawrence couldn't have foreseen nuclear weapons. He invented the cyclotron as a tool for pure science," York explained. "He had always known that atomic energy could be useful, but no one could get it out of the atom. He solved that problem."

Lawrence's biggest problem after his early successes was getting the funding to build another, larger cyclotron. A nine-inch cyclotron was built, and an 11-inch model followed, which accelerated hydrogen particles to over one million volts.

Up to that point, all of Lawrence's experiments had been conducted in a lab with standard equipment. When he began planning larger cyclotrons, the physics department at Berkeley moved him into another building — this became Lawrence's famed Radiation Laboratory.

"The construction of the larger [cyclotrons] meant moving from the realm of physics into engineering," Professor Raymond Birge, then the chairman of the Berkeley physics department, remembered. "Most physicists would have stopped with what they knew, but not Lawrence. He fished for the big ones."

See **LAWRENCE,** *page 6*

In 1940, Lawrence's "Rad Lab" employs 54 scientists and has an annual budget of $66,000 – a very large sum for the day.

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In honor of his achievements with the cyclotron, Lawrence is awarded the British Duddell Medal on **Dec. 27, 1940.**

On **Nov. 1, 1946,** the 184-inch cyclotron is completed at Berkeley. It yields the best results to date.

President Eisenhower asks Lawrence to travel to Geneva, Switzerland, in **July 1958** to negotiate the suspension of nuclear weapons testing with the Russians. Lawrence becomes ill while in Geneva and is forced to return to Berkeley.

After an operation in Palo Alto, Lawrence does not regain consciousness. He dies surrounded by his family on **Aug. 27, 1958.**

In **1980,** Lawrence Livermore is named a national laboratory.

1939 | **1940** | **1941** | **1945** | **1946** | **1952** | **1958** | **1959** | **1980**

After much speculation among friends and in the media, Lawrence is notified on **Nov. 9, 1939** that he is the winner of the 1939 Nobel Prize in Physics. The award comes with a $40,000 prize that Lawrence hopes to use to finance larger cyclotrons. He is presented with the award in **January 1940** in Berkeley, as World War II made it unsafe for Lawrence to travel to Sweden.

In **1941,** the United States becomes involved in World War II. Lawrence lends his support and expertise as a team of men including Robert Oppenheimer and Edward Teller begin building the atomic bomb.

By **1945,** the war was drawing to a close. Lawrence favored a bloodless demonstration of the atomic bomb that he helped the United States create.

Lawrence chooses the Livermore site for his new laboratory, and in **1952** the UCRL – Livermore Site begins doing research in support of the nuclear weapons program at Los Alamos National Laboratory.

On **Sept. 19, 1958,** just 23 days after his death, the University of California Board of Regents votes to rename the Radiation Labs at Berkeley and Livermore after Lawrence. They become the Lawrence Berkeley Lab and the Lawrence Livermore Lab, respectively.

To ensure that future generations would focus scientific efforts on atomic energy, President Eisenhower and the Atomic Energy Commission established the E.O. Lawrence Memorial Award in **November 1959.**

Lawrence was as much a father as he was a scientist

By Ali Carrigan
NEWSLINE STAFF WRITER

Everyone knew about the cyclotron and the Nobel Prize. Everyone knew about the race to build a bomb. But according to his son, E.O. Lawrence was as much a father as he was a scientist.

"There was a side that the public didn't see," Robert Lawrence said. "He would go out and play tennis every weekend. He loved to go out on his boat, or down to Balboa Island."

Born in 1941, Robert was the fourth child born to Ernest and Mary. He has one older brother, Eric, two older sisters, Margaret and Mary, and two younger sisters, Barbara and Susan.

"One scientific stereotype was true — my dad was absent-minded," Robert laughed. "We went to see a movie in Oakland, and he forgot one of us kids at the theater. We got home, and we realized that we were missing one of my sisters. We drove back to Oakland in a hurry, and found her standing in front of the theater, just waiting."

By the time Robert was born, Lawrence's work was not a topic of conversation in the household.

"We used to ask him what he was doing at work, what he was building," Robert remembered. "And he would say 'I can't tell you, because it's a military secret.' So we stopped asking." During the war, Robert remembered a secret service agent living with the family.

"I don't think he was there for our protection, really, but to make sure my dad didn't say anything he shouldn't," Robert said. "I remember being really impressed, because this guy used to hang his gun on the curtain rod and then sit down for dinner with the family."

The Lawrence home was constantly filled with scientists and dignitaries from around the world who became good family friends.

"Edward Teller was there all the time, of course," Robert said. "And in the 1950s, we had these Russian and Japanese generals and scientists over all the time for cocktails. Dad would make a tray of Manhattans — those were his favorite drink — and pass those around to these visiting dignitaries sitting in our living room."

The Lawrence children, clockwise from top left: Eric, Mary, Margaret, Robert, Susan and Barbara.

> ***My dad was a tinkerer. He built us all sorts of things growing up — scooters, wagons, other toys.***
>
> – Robert Lawrence

As Robert grew older, the family spent summers on Balboa Island more frequently.

"My dad loved being outdoors, playing tennis, sailing, just driving in his convertible," Robert said. "That was his trademark — he always drove a Cadillac convertible with the top down."

Robert recounted one trip in the convertible that almost landed father and son in trouble.

"We were in Newport Beach, and my Dad was teaching me to drive in the convertible," he laughed. "We ended up driving all the way into Mexico, and then I turned around to come back across the border. Usually, they don't even give you a look at the border, but this time, they pulled us over to take a second look at my dad because he was so tan. Once they saw his name was Lawrence, they let us go."

Even though Lawrence won the Nobel Prize before Robert was born, he recalls growing up in the shadow of a famous father.

"I wasn't a serious student when my dad was alive," Robert said. "It was almost like because he was very academic, I didn't want to be."

But the Lawrence family prided itself on being educated, and Robert remembered some pressure to do well in college.

"Our parents pressed us to finish at least an undergraduate degree," Robert remembered. "And mom and dad always told us that if we wanted to go on and earn an advanced degree, they'd support that too." Robert went on to earn his medical degree and currently practices in Stockton.

"My dad was a tinkerer," he said. "He built us all sorts of things growing up — scooters, wagons, other toys." One of the more famous inventions Lawrence built was a color television tube that Sony still uses in its televisions today.

"He asked us one day what he should build next, and we all said 'build a color TV!' " Robert said. "And so he would play with the tube on weekends, and he came up with a better, cheaper TV tube than the ones on the market. And he did it for fun, on the weekend."

His father was a scientist, a tinkerer, an avid outdoorsman, and most of all, Robert remembered, not afraid of the unknown or a challenge.

"My dad and I were going to Catalina on our boat one afternoon, just the two of us, and the fog closed in all around us so we couldn't see more than a few feet off the boat," Robert said. "I was really scared, but my dad told me to point the boat toward a certain compass heading and hold it there. And sure enough, we pulled into the harbor later. He wasn't afraid — he trusted the compass and kept moving through the fog."

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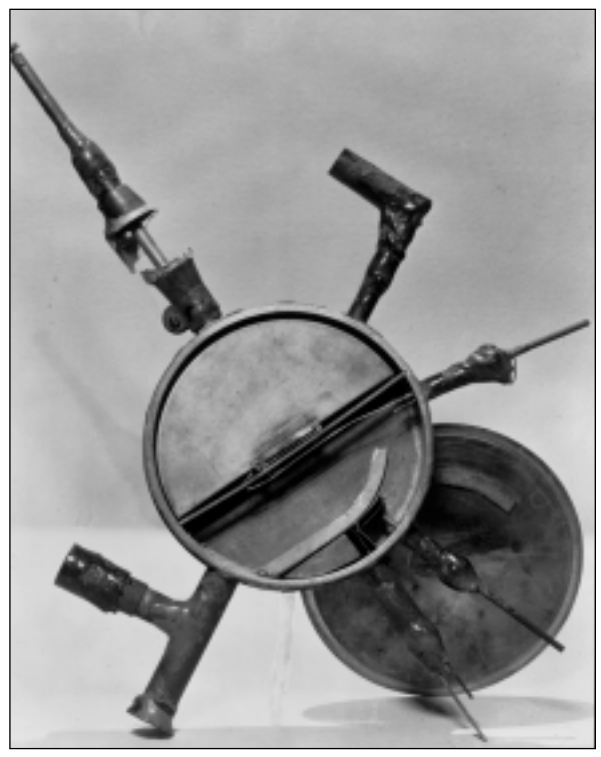
The big ones

Lawrence soon realized that his cyclotron could be used for more than "pure" physics. He worked alongside medical doctors, chemists, biologists and engineers to create uses for the radioisotopes that the cyclotron was churning out.

"Without a doubt, Lawrence's finest achievement was inventing the cyclotron and creating the 'Rad Lab' in the process," York said. "The cyclotron impacted future scientific advances, and the Lab created a new way to do that science."

By early 1939, the "Rad Lab" at Berkeley was the model that was being emulated around the world — according to Lawrence, this interdisciplinary approach was how to do research on a grand scale. He had brought engineering and science together and created new technology with new applications, and it was in looking at the impact of those applications that the Nobel Committee traced a path back to the cyclotron.



From his first cyclotron, built in 1930 (above) came much bigger versions, all with increasing levels of success. The invention brought instant fame to E.O. Lawrence, making him a popular subject for press, radio and newsreel interviews, such as the one conducted with CBS during the 1930s. Lawrence would also wind up on the cover of *Time* magazine.

As the year wore on, speculation grew that Lawrence would indeed capture the Nobel Prize in physics. He preferred to wait until the announcement was official, even telling newspaper reporters that he thought fellow physicist Enrico Fermi would win the prize.

On Nov. 10, 1939, Lawrence slipped out of his office to play tennis, and to get away from all the congratulatory phone calls coming in — he said that he felt awkward taking congratulations when he wasn't sure yet that he'd won the Nobel Prize. When he returned from the courts, he was informed that there was another call for him — this one from Stockholm, Sweden.

"I guess I'd better take that," he told waiting reporters. Lawrence was told — officially, this time — that the Nobel Prize in physics was his. But even in a statement to the press made that afternoon, Lawrence had his eye on bigger and better science.

"Naturally, I'm pleased and honored, especially for the increased opportunities this will make possible," he said. "I am sure it will accomplish one of its real purposes in encouraging fundamental scientific research."

Both York and Foster agreed that winning the Nobel Prize only made Lawrence more focused on doing bigger, better science.

"Winning something that big changes you. Lawrence was already a self-confident person, and this just made him even more self-confident," York said.

"I think that the Nobel helped Lawrence continue to attract the best people to work with him," Foster said. "It also helped him persuade the men in Washington, D.C. to support his ideas and his work, and that became very important during World War II."

In May 1932, Ernest Lawrence married Mary Blumer, a Vassar College graduate and the daughter of a Yale medical professor.

At the time of the Nobel announcements, World War II had just broken out in Europe. Instead of the usual gala surrounding the presentations, the Nobel committee found themselves with very few winners to congratulate. Lawrence did not attend the ceremony because he deemed it unsafe to travel, and two German winners were not allowed out of the Reich to accept the awards. Lawrence was presented his award in a ceremony in Berkeley in 1940, and it wasn't until 1951 that he traveled to Stockholm to finally give his Nobel lecture.

Aiding the war effort

Lawrence had no time to rest on his laurels after winning the Nobel Prize. He and several other prominent scientists felt that it was only a matter of time until the United States became involved in the war. Lawrence helped establish the radar program at the Massachusetts Institute of Technology, and then returned to the West Coast to work on the sonar development program for anti-submarine warfare in 1941.

But while doing that work, Lawrence was also growing concerned about the slow progress of the atomic weapons project, and by March 1941, he was ready to ask questions about the lack of direction shown by some of the atomic weapons committees.

"The stakes envisaged are fantastically high," he said to project leaders. "There is a tendency to emphasize the uncertainties, and this, to my mind, is very dangerous. I feel strongly that anyone who hesitates on a vigorous, all-out effort assumes a grave responsibility."

That grave responsibility was not something Lawrence was going to pass by — he immediately began working with teams of scientists to produce plutonium. He also converted some of his smaller cyclotrons into mass spectrographs that could separate natural uranium from U-235. By the end of the year, his method was working so well that he received permission from the University to convert his 184-inch magnet into a spectrograph. Lawrence's ideas, in conjunction with the work of Robert Oppenheimer, were one of the major factors that helped create the Hiroshima bomb — a bomb which he felt was necessary for multiple reasons.

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"The atomic bombs will surely shorten the war, and let us hope that they will effectively end war as a possibility in human affairs," he said in 1945, mere months before the first bomb was dropped. "The successful realization of the atomic bomb is a great human achievement. It is a striking example of fundamental science and technical teamwork on a vast scale."

Fundamental science, technical teamwork

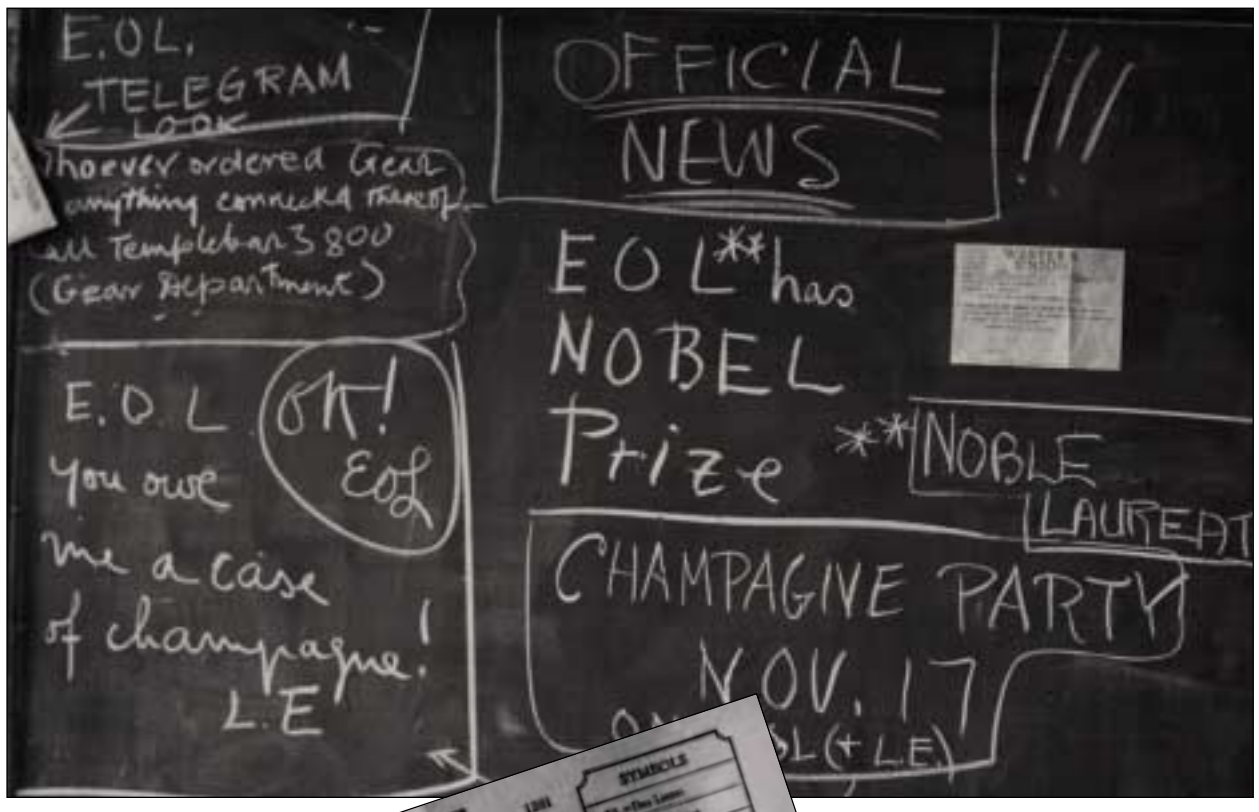
After the war, Lawrence was convinced that his "Rad Lab" needed to continue its weapons research in support of Los Alamos, but he was out of space in Berkeley. After looking at several options for expansion, Lawrence eventually chose an abandoned naval air station in the Livermore valley.

"I remember Lawrence came out to the Livermore site once, and we were riding along in his Cadillac convertible," Foster recalled. "And out of nowhere, he said, 'Here we are in the best country in the world, in the best state, and in the best part of the state.' "

In 1952, the Livermore Radiation Lab was in business — the business of sustaining the American nuclear program. Lawrence split his time between Berkeley and Liver-more while York oversaw the daily operations on the Livermore site. Edward Teller also remained in Livermore and worked with scientists there to sustain the nuclear program.

"The Lab was really born out of a controversy about whether we should be pursuing nuclear weapons," Foster said of the early days. "We had to establish a lab that was balanced, that focused on several objectives but had all the science and engineering tools to pursue them."

"Lawrence was motivated, in part, by this feeling that America needed to remobilize science in the cause of national defense," York said. "When we all got together, we were reading from the same music – the goal was to create a lab that would develop nuclear weapons."



The blackboard at the Berkeley "Rad Lab" announced to the staff what many predicted would happen long before the telegram arrived, as well as the celebration that would follow. The outbreak of war in Europe kept Lawrence from traveling to Europe to accept his award. Instead, it was presented to him in Berkeley in 1940.

The early days were stressful for the Livermore team; they faced pressure from the government to produce nuclear research and tensions were evident between Livermore and Los Alamos.

"When we ran our first tests, in Nevada and Bikini, it didn't go well," York remembered. "And some of those Los Alamos scientists filled the air with laughter at our expense."

There were also personality clashes among the founders of the nuclear program. Oppenheimer continued to feel that the United States should not pursue nuclear weapons, and that was a point of contention between Lawrence and his old friend "Oppie."

"They were the closest of friends, but they were so very different," Mary Lawrence once said, remembering her husband's relationship to Oppenheimer. "Oppie was a theorist, and Ernest was very pragmatic. But Ernest never tackled a project without talking it over with Oppie."

Lawrence continued to oversee both sites of his Radiation Lab despite declining health. He had been diagnosed with ulcerative colitis in 1952, and tried to decrease his activity. But according to York, that was not Lawrence's style.

"He was so involved at both labs that he knew every nook, every project going on," York remembered. "He wanted the employees to focus on science, so he took care of all the administration at the Lab, and that probably contributed significantly to his poor health."

Lawrence spent the years up to his death in 1958 trying to control the nuclear arms buildup that he helped begin. President Eisenhower asked him to serve on a three-man committee negotiating arms control with the Russians in Geneva, but Lawrence was

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forced to leave the talks early when the colitis flared up again. He died just days later in Berkeley, with his wife at his side. One newspaper reporter wrote, "He could not escape the deep sense of obligation, the vision of the important things to be done, and the conscience that compelled him to be involved."

Vision of the important

"I think if Lawrence were to visit the Lab today, he'd take the same 'gee whiz' attitude that he took 50 years ago," York said. "His lab has evolved in a perfectly natural way — the scope is wider, but the science is still an adventure, and that's an important attitude to maintain here."

"Almost 50 years after the beginning of this Laboratory named in his honor, we are still following the multidisciplinary philosophy that epitomized Ernest Orlando Lawrence," said Lab Director Bruce Tarter. "Through Lawrence's methods of building technical teams with focused objectives, Lawrence Livermore National Laboratory has become one of the premier institutions in the world."

Within months of his death, the University of California Regents renamed both the Berkeley Lab and the Livermore Lab in honor of Lawrence. Congress made Livermore a national lab in 1980.

"E.O. Lawrence was a pathfinder not just for Lawrence Livermore and Berkeley laboratories," Tarter said of the accolade. "He created the model for large-scale science throughout the world."

E.O. Lawrence at the controls of his cyclotron, with Glenn Seaborg and Robert Oppenheimer.

"I remember one time working on an ion source. [Lawrence] came around one day and said, 'Look, I know this is important to you, but I have this other thing I'd like you to take a look at,' " Foster said, recounting one of his meetings with Lawrence. "It was in later years that I came to realize that if you want someone to stop doing something that is not going to be a winner, what you have to do first is create what it is that you want them to do. Then you go to them and say, 'Look, I've really got a problem, and I wonder if you could help me.' Lawrence didn't tell me that he thought my project was going to flop. He redirected me in such a way that I wasn't discouraged or upset about changing projects."

In 1958, just weeks after his death, the chairman of the Atomic Energy Commission asked President Eisenhower to establish the E.O. Lawrence Memorial Award for contributions in the field of atomic energy. Eisenhower replied that "such an award would be most fitting, as a recognition of what Dr. Lawrence has given to our country and mankind, and as a means of helping to carry forward his work through inspiring others to dedicate their lives and talents to scientific effort." Foster and York were among the first winners of the award.

"Lawrence was a man who took bold steps and set challenging objectives," Foster said. "He attracted the best people, gave them a good climate to work in. And I guess he provided us with a lot of the science, didn't he?"

TELLER

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fail.

On each disappointing occasion, Ernest came out to Livermore and listened to our results and their interpretation. Even on the third occasion, he took no position in public. But when he and I rode back together to Berkeley, I suggested that the remaining fourth shot should be called off. Montgomery Johnson had rapidly worked out the reason for the third failure and gave convincing arguments that the fourth would also fail. Maintaining preparations for the test while waiting for appropriate weather is expensive, and that money caused by the delay should not be wasted.

E.O. Lawrence

To my surprise, Ernest refused to make the decision. Accepting my positive statements about the quality of the people at Livermore, he proposed that I take the first plane to the Pacific to persuade the two people who were responsible for the remaining test, Herb York and Harold Brown, to call it off.

That was a difficult assignment, but I was overjoyed with it. Ernest thereby demonstrated that he had unqualified confidence in the Laboratory, supported the leading Laboratory scientists, and wanted them to determine the future course of our work. What was needed at that time was encouragement, and that is what Ernest gave.

Indeed, I promptly took a plane to the Pacific and spent half an hour convincing Herb York that we should call off this test and start again. Together, Herb and I went to talk with Harold Brown, who, as a good scientist, stuck to his idea that we should go ahead. But after an hour of listening to our arguments (which were really the flaws that Montgomery Johnson had found), he agreed that the second part of the experiment would go no better than the first.

Yet, not much more than a week later, in the face of all that failure, Ernest, through his attitude and encouragement, had completely rejuvenated the spirit at Livermore. His only question was: What had we learned? Indeed, we had been too quick in accepting new ideas. We should convert the post-mortem program to a pre-mortem program, where a committee would do its best to predict in detail any reasons for failure. (That committee was set up and most happily, the early failures in the Pacific were the last of their kind.)

All this illustrates the remarkable nature of the leadership that was characteristic of Ernest O. Lawrence. Lawrence was exclusively and effectively interested in two qualities in those who served in his laboratories: ability and enthusiasm. When he found those qualities in people at the Laboratory, Ernest gave those people his wholehearted support. The administrative methods Ernest Lawrence used were justified to a remarkable degree by the accomplishments of his laboratories.

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