Livermore Faces Forces of Change

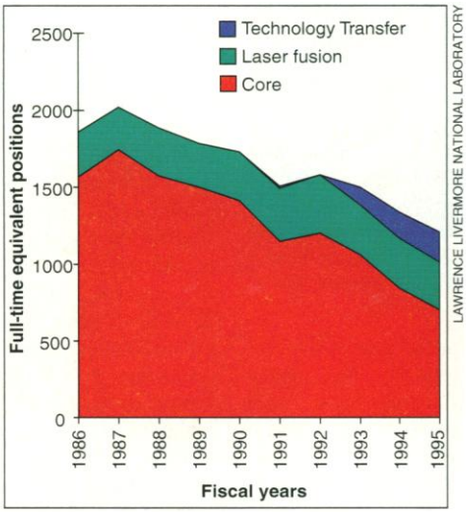
Livermore's director was forced out last week, its budget is taking a nose dive, and the Department of Energy is considering its future. What's a defense lab to do?

Nuclear physicist and weapons researcher George Craig calls himself a "displaced person" at Lawrence Livermore National Laboratory. Hit hard by budget cuts in its defense program, Livermore has given Craig 3 months to find a new job within the lab, or be placed at risk of being laid off. "I'm trying to row my boat as fast as I can" to a new line of research, he says.

Craig is not alone: By some estimates, nearly a hundred weapons scientists are looking for new jobs at Livermore. Indeed, their plight mirrors that of the lab itself, which faces the most uncertain future of the three weapons labs operated by the Department of Energy (DOE)—Livermore, Los Alamos, and Sandia. Last week John Nuckolls, Livermore's director, resigned under pressure from the University of California (UC), which manages the lab and was dissatisfied with Nuckolls' administrative practices (*Science*, 8 April, p. 195).

Nuckolls had hoped to remain director until next year, when a task force assembled by DOE Secretary Hazel O'Leary expects to complete its review of 10 DOE labs. But UC wouldn't wait, and starting next month it will be up to acting director Bruce Tarter to lead Livermore during a time when the question of whether the U.S. should continue to operate three weapons labs is being debated.

Livermore is a creature of the Cold War. It was founded in 1952 by Ernest Lawrence with lobbying from hydrogen bomb pioneer Edward Teller, who wanted a counterweight to Los Alamos. In the mid-1980s its annual budget soared to more than a billion dollars thanks to Star Wars research and the Reagan Administration's nuclear modernization program. And weapons still account for the majority of its work. In 1983, defense or defense-related work for DOE and the Department of Defense represented 76% of Livermore's funding; today the figure is 67%, despite a presidential order that has halted nuclear testing and most nuclear weapons design and development. As one Livermore scientist puts it, "people want to know why the world has changed yet Livermore still looks the same."



Going down. The last half of a decade has been hard on Livermore staff.

One possible expanded role for the future—to maintain the nation's existing nuclear stockpile—is expected to go increasingly to Los Alamos, which designed most of the weapons scheduled to be retained. In fact, Livermore's proximity to the heavily populated and politically liberal San Francisco Bay area places it at a disadvantage in most battles with its older, desert sibling, which enjoys stronger support from its congressional delegation and is under less pressure to minimize environmental risks.

Head-to-head competition

"Everyone feels at this point that Los Alamos is likely to be the principal nuclear weapons lab," says Herbert York, a former Livermore director now a member of a council advising the UC president, Jack Peltason. "The political support for Los Alamos is really there in a way it isn't for Livermore."

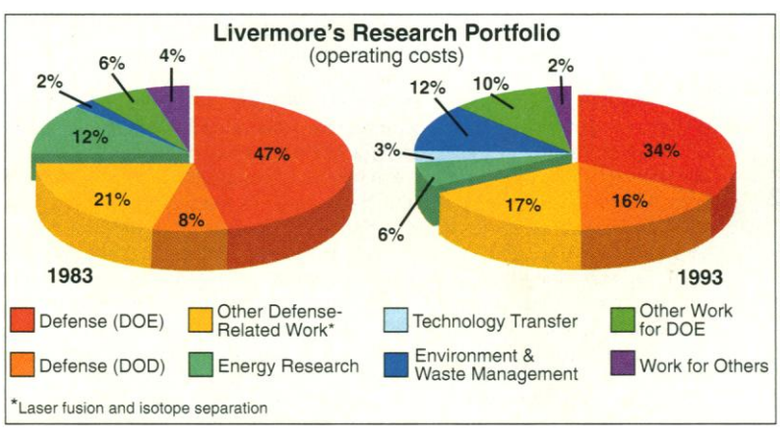
Those political realities are likely to shape the conclusions of a task force, headed by former Motorola CEO Robert Galvin, that was asked to recommend what parts of the labs DOE should keep as well as how to measure their value to U.S. industry. The 19-member task force has just gotten underway, but task force members say they plan to pay close attention to Livermore's status.

When the task force visits Livermore in June, its members will be able to see first-hand the effects of the changes underway in the government's weapons program. Here are some of the key issues for the task force as it ponders the future of this billion-dollar federal facility:

■ **Budget cuts:** Livermore expects its $904-million annual budget to drop next year by 6.5%, more than twice the decline of the other weapons labs. The $204-million nuclear weapons research and development program funded by DOE will contract by more than 11%, to $182 million. By comparison, Los Alamos's overall $1.05-billion budget is projected to shrink by 3%, with its $227-million nuclear weapons research and development program declining by 5%.

These cuts are already decimating Livermore's scientific ranks. More than 740 took a UC early-retirement offer late last year. Next year, Livermore expects to employ between 780 and 800 scientists and engineers in its nuclear weapons research and development program, down from 950 this year and less than half the 1,740 on staff just 8 years ago. Layoffs are possible for the first time in more than 20 years.

■ **Reconfiguration:** The budget cuts reflect the most significant transformation of DOE's nuclear weapons program in its 52-year history. Starting in 1992, when congressional legislation forced then-President George Bush to halt the testing of nuclear weapons, the DOE weapons complex has been shrinking at a dizzying pace. The nation's stockpile of 21,000 weapons in 1990 is projected to drop to 3,500 by 2003. For Livermore, the test ban means a loss of three or more



Funding sources. Weapons work remains Livermore's bread and butter.

Countering Nuclear Terrorism

For most of the past 40 years, nuclear weapons experts at Lawrence Livermore National Laboratory have spent their time worrying about threats to U.S. security posed by the Soviet Union. But the most menacing current threat to national security, says John Nuckolls, outgoing director of the Lawrence Livermore National Laboratory, is not from another nuclear state but from individuals—nuclear terrorists.

The peril, Nuckolls points out, comes chiefly from two sources: the huge amounts of fissile material from surplus bombs in the former Soviet Union, and the nuclear programs of countries such as Iraq and North Korea. Nuckolls believes that Livermore, with its expertise in bomb design, should be at the forefront in combating this threat. Most other weapons experts agree that the threat should be taken seriously, but some are not persuaded that it should be the government's top weapons priority or that Livermore should lead the way.

In his 6 years as director, Nuckolls has tried to draw attention to his concerns. Last year, appearing before the House Armed Services Committee, Nuckolls described how terrorists could use a nuclear warhead from the former Soviet Union to bring the U.S. government to its knees. He said terrorists could use a Radio Shack burglar alarm to booby-trap the warhead and carry it in the trunk of a car to the World Trade Center, where they could hold the nation hostage, or worse. Last month, before the same committee, he repeated his warning that this "incalculable and catastrophic" threat "put[s] at risk the building blocks of Western civilization." By not spending more to address this problem, he said, the United States risks "failing its constitutional responsibility to 'provide for the national defense.'"

One of the scariest features of such a scenario, say nuclear terrorism experts, is that traditional sensors may not be able to determine at long range whether the threat is a bluff. And even if the threat is deemed real, how could the device be disabled without setting it off? Before Nuckolls resigned, he lobbied hard for the Department of Energy, which funds Livermore, to give the lab enough money to allow many of its nuclear weapons designers to ponder these issues.

Nuckolls told Congress that Livermore researchers have an "explosion" of new ideas for solving the problem, including a "color" gamma-ray camera that could detect weapons at 10 times the distance now possible. And he testified that what Livermore has learned from Star Wars research about how to destroy incoming warheads without setting them off could be applied against terrorist weapons. One catch, however, is that testing these technologies might require an exception to the current ban on nuclear testing. Theories must be verified, Nuckolls points out, and "if the disablement fails, a small nuclear explosion will occur." Arms-control experts point out that conducting such a test would seriously undermine progress toward a Comprehensive Test Ban treaty.

Robert Kupperman, a nuclear weapons analyst at the Center for Strategic and International Studies and external adviser to Livermore's sister weapons lab, Los Alamos, agrees with Nuckolls that it is "incredibly important that research continue" into ways to combat nuclear terrorism. But he notes that DOE already has a Nuclear Emergency Search Team dedicated to the problem, and he says it's unclear "whether one can go from being a [weapons] designer to developing sensors." He adds that some simple and inexpensive shielding can defeat even the highest technology sensors.

Paul White, director of the special projects division of Los Alamos' nuclear weapons program, says research on advanced weapons-detecting sensors "is worthy of attention, and some advance may be possible." But keeping tabs on weapons in the former Soviet Union is a more pressing problem, he says, and he's "reluctant to see terrorism get out of balance in the overall effort to combat proliferation." Still, sources close to Nuckolls say he felt strongly enough about the threat—and Livermore's ability to help erase it—that he wanted to remain as director in part to ensure that Livermore devotes sufficient resources to countering threats from terrorism.

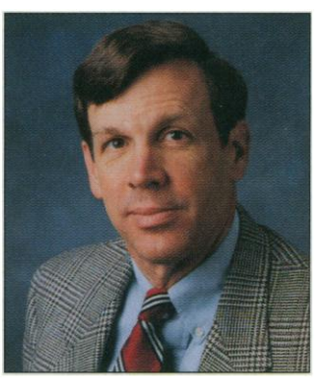
–C.A.

multi-million-dollar tests each year. Design work has been virtually halted, too.

Only a few years ago, Livermore expected its saving grace would be an ambitious DOE project, named Complex 21, to create the nuclear weapons production complex of the future. Livermore was designated the "lead lab" for research and development for the plutonium component of the new facility. But early this year, DOE quietly killed Complex 21. "We've come to the conclusion that there really is no requirement for new weapons in the near future," says Stephen Sohinki, acting director for DOE's office of reconfiguration.

What's worse, Los Alamos is expected to increase its role in "stockpile stewardship"—the studying of existing weapons to avoid problems as they age. Defense experts estimate that more than 85% of the nuclear warheads in the planned permanent stockpile after START treaty reductions have been designed by Los Alamos, reflecting the lab's emphasis on the submarine-launched weapons that will make up most of the future stockpile.

■ **The UC contract:** One of the lab's strongest selling points to researchers has been its UC affiliation, which gives lab scientists academic freedom, university benefits, and opportunities for collaboration. UC accepted the task of operating Los Alamos on a nonprofit basis during World War II as an act of civic duty, but in recent years the arrangement, which was extended in 1952 to include Livermore, has come under fire from Representative John Dingell (D–MI). Dingell wants the contractors to bear more risk, and take more responsibility, for their management of the labs. In turn, DOE has said it may demand that UC accept liability for new environmental cleanup problems or third-party lawsuits in its next contract, to replace the one that expires in 1997.



Acting director. Bruce Tarter will keep Livermore on a post–Cold War focus.

That clause, says UC lab liaison Robert Kuckuck, could be a tough pill for UC to swallow. Indeed, York says it would be "impossible," adding "I think the days of the contract are numbered." If UC backs out, Livermore is likely to suffer more than Los Alamos because it is counting on increased research collaborations with UC faculty to bolster its future.

At the moment, Livermore is waiting on pins and needles. Tarter, who takes over as acting director in 2 weeks and is considered a strong candidate to take the job permanently, says the lab is focusing on "post–Cold War national security" including non-proliferation and counter-proliferation, environmental and biomedical

research, and work with industry. "Livermore has always done best when it is working on the nation's 'A-list,' " he says. It is up to the Galvin task force to decide if Livermore's strengths are on that list today.

Plotting the future

UC officials note that Tarter is the first Livermore director not to have been an integral part of the weapons program, improving his chances to be named permanent director. But lab officials worry about running a lab without a clear mandate from Washington. Tarter rues the seemingly endless political head-scratching over the labs that has left Livermore under a cloud (the Galvin panel is the third such panel in 5 years, and there have been several congressional hearings on the subject). "It has become almost a cottage industry in Washington," he says. Some in Congress have called for a redirection or consolidation of the weapons labs, although none of the proposals has come close to passage.

As the debate goes on, lab officials are divided over which path to follow. Some are pushing technology transfer, while others talk optimistically about being the site for the National Ignition Facility, a large laser fusion project that would follow on from Livermore's Nova laser facility. Nuckolls' own preference is work on technologies to combat nuclear terrorism (see sidebar). O'Leary, meanwhile, has emphasized that she would like Livermore to work more with industry; indeed, more than half of the members of the Galvin panel are industry representatives.

Whatever Livermore does, it is difficult for lab scientists to imagine its not having a role in nuclear weapons and national security. Indeed, the Clinton Administration —from the president on down—endorses the continuing need for some number of nuclear weapons laboratories. The question is whether three labs is one too many. (Sandia is focused on weapons engineering and is generally considered safe from any consolidation or closure threats).

As pressure for change mounts, many lab scientists are simply trying to roll with the punches. Craig, for example, is teaching himself biology. Other weapons scientists are spending their time documenting what they and their colleagues know so that their skills will not be lost forever. But many agree with astrophysicist Hugh DeWitt that basic physics and chemistry research outside the weapons program is evaporating. "Los Alamos still has it, but Livermore does not," he says. "It's just fading away." What the Galvin panel must decide is whether DOE should fight that trend both within and outside Livermore's weapons program—or accelerate it.

–Christopher Anderson

ATOMIC BOMB SURVIVORS

Rising Yen Threatens Key Cancer Study

Next year will mark the 50th anniversary of the atomic bombing of Japan, and it may also mark the decline—perhaps even the end—of a unique program to study the effects of radiation on the bomb's survivors. The reason: The U.S. Department of Energy has served notice that its support for a U.S.-Japanese institute called the Radiation Effects Research Foundation (RERF) will no longer keep pace with the soaring value of the yen against the dollar. As a result, the program is heading for a fiscal crisis.

Begun under a different name in 1945, RERF followed 120,000 bomb survivors' medical histories, gathering data on cancer and other diseases caused by ionizing radiation. Japanese citizens regard RERF as a symbol of compassion; researchers view it as a unique source of data on radiation risks. Now, cancer researcher Charles Land of the National Institutes of Health (NIH) worries that, because of the fiscal crisis, "the whole thing could fall apart," cutting short studies of late-developing cancer in people who were children when the bombs fell. To Seymour Jablon, a former NIH researcher who serves as one of three U.S. members on RERF's board, this would be "a disaster" for biomedical researchers interested in the health effects of radiation.

Harry Pettengill, deputy assistant secretary for health at the Department of Energy (DOE), the responsible government official, says cost reduction is necessary because Congress has frozen DOE's overall budget. In the past, the United States has been willing to increase its contribution, currently $18 million, to cover changes in the exchange rate—but not this year. Already, RERF has spent its reserves to accommodate the falling dollar, and now it's surviving from cash supplied month-to-month by the two governments. Pettengill has met with the Japanese government twice since last summer to negotiate a solution, but concedes that "we're still looking for about half a billion yen ($5 million)" to keep RERF afloat in 1994.

"We're looking at a train wreck down the road, and it's pretty close."

—Charles Eddington

"We're looking at a train wreck down the road, and it's pretty close," says Charles Eddington, a staff officer at the National Academy of Sciences, which manages the U.S. half of the program. Indeed, Jablon and the two other U.S. board members—Warren Sinclair of the National Council on Radiation Protection and J. Edward Rall of NIH—have written to *Science* warning that the entire institution is "in jeopardy."

Back in 1974, when RERF was created out of the Atomic Bomb Casualty Commission, the United States and Japan signed an agreement to split the costs 50–50. At the time, the dollar was worth more than 300 yen, and RERF was a scientific bargain for the United States; now it has become expensive. Last summer, when the dollar's value dropped to less than 120 yen, Pettengill asked the RERF board to prioritize its programs and consider cutbacks in the 400-person staff. The board delivered a report in October, which Pettengill says "didn't identify much in terms of cost savings."

Since then, the dollar has dropped further, to around 103 yen. The U.S. side suggested that Japan might pick up more of the local operations costs. But the Japanese government has declined, insisting that the 50–50 arrangement is part of a solemn treaty that cannot be changed without negotiations, which take time. Japan says it plans to match any U.S. cut on a yen-for-yen basis. This is making it difficult to deal with the 1994 shortfall, which ranges from 10% (Pettengill's estimate) to 35% (Jablon's).

In addition, says Eddington, DOE doesn't seem to appreciate that under the Japanese system, accelerating the rate of retirement would make the problem worse. In Japan, retirees don't receive a pension, but a single lump sum equivalent to several years' pay. Pettengill has urged RERF to trim its staff, but RERF does not have the funds needed to speed up the pace of retirement. And even if it did, Japanese employers don't like to push employees out the door. The result, says one U.S. observer, is that "people are sitting around with their heads in their hands," unable to find a solution.

While some scientists worry about the impact on specific projects, NIH cancer expert Curtis Harris worries about the "moral issue," saying "it could be front-page news in Japan" if it seems that "we've decided to walk away from this group of people." Pettengill, in response, says he expects the United States to continue supporting RERF for at least another decade—even if its contributions don't keep up with the soaring yen.

–Eliot Marshall