STOCKPILE STEWARDSHIP

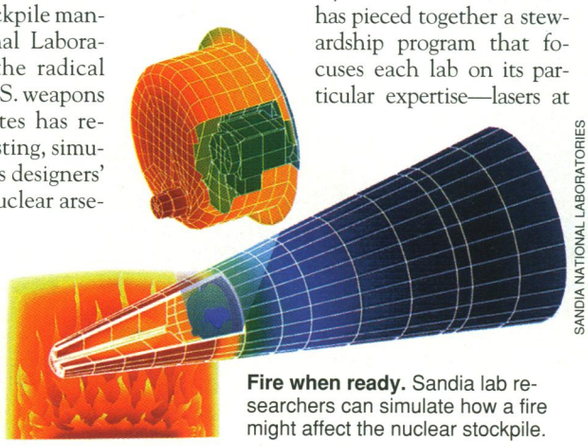
Big Projects Could Threaten Weapons Labs' Research Base

LOS ALAMOS, NEW MEXICO—Every few seconds, a mushroom cloud explodes on Paul Cunningham's computer screen. The unsettling image is a screen saver in the office of the chief of nuclear materials and stockpile management at Los Alamos National Laboratory—and a wry reminder of the radical changes under way at the three U.S. weapons labs. Now that the United States has renounced underground nuclear testing, simulations are becoming the weapons designers' chief tool for ensuring that the nuclear arsenal is reliable.

The new approach to testing, called stockpile stewardship, has triggered a fierce debate within the defense community. At issue is how to keep a balance between financing such new and costly stewardship projects as the $1.1 billion National Ignition Facility (NIF), which will simulate the conditions of nuclear detonation, and maintaining a critical mass of experienced weapons designers.

Officials at the three Department of Energy (DOE) national weapons labs fear that those designers and their research will lose out to the new initiatives if the government fails to provide enough money for the overall program. And their concerns were sharpened earlier this year when the Administration briefly proposed cutting back the program's budget. Yearly budgets are less of an issue for Defense Department officials, who are focused instead on developing new tools and a concise plan to keep the stockpile at the ready.

Caught in the middle of the debate is Victor Reis, chief of DOE's defense programs. "I'm trying to avoid internal squabbling," he says. And he wins high marks from those he works with. "He's done a very good job," says Bruce Tartar, director of Lawrence Livermore National Laboratory. In recent months Reis has pieced together a stewardship program that focuses each lab on its particular expertise—lasers at Livermore, neutron-scattering research at Los Alamos, and pulsed-power work at Sandia National Laboratories. While he acknowledges that the labs are concerned with their immediate future, he insists the program's long-term initiatives will provide the high-tech tools needed to perform advanced research well into the next century. "If I don't provide an exciting place for people to work in the future, I am not doing my job," says Reis, an engineer who last served as director of defense research and engineering at the Pentagon.



SANDIA NATIONAL LABORATORIES

Fire when ready. Sandia lab researchers can simulate how a fire might affect the nuclear stockpile.

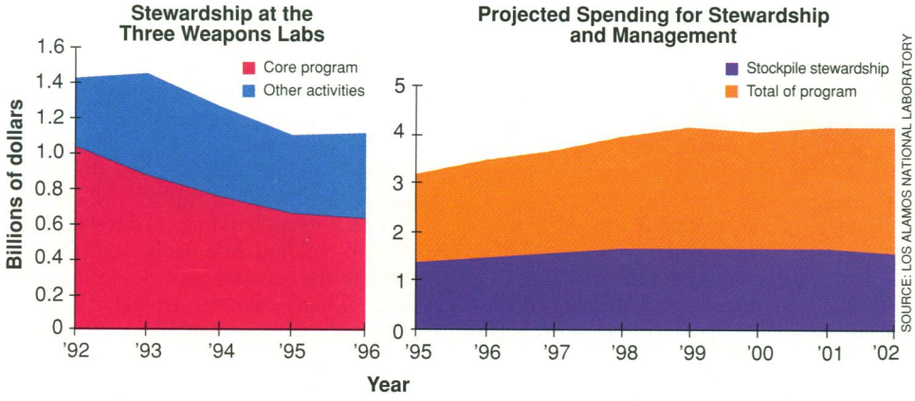
Reis's classified plan, which was given to Congress on 16 April, has won grudging acceptance from both the labs and the Defense Department. Tartar, for example, gives the plan a grade of 75–80 out of 100. But that tenuous consensus may not hold if the government can't come up with the cash to keep everyone happy.

Ribbon-cuttings vs. research. Although the labs have always been involved in making sure the country's nuclear arsenal is ready if needed, the effort only recently acquired a formal name. In 1993, a year after President Bush ordered a halt in the production and design of nuclear weapons as well as underground testing, President Clinton proposed a stockpile stewardship and management program to preserve both the weapons and their teams of designers. The program helped to mute criticism of the test ban from the defense community. The Administration pledged to spend about $4 billion a year on the effort in the coming decade—about $1.5 billion for stewardship and $2.5 billion for revamping DOE's weapons production facilities.

Clinton's announcement of a permanent test ban last year and congressional concern about a lack of direction in the program prompted DOE to begin work on a more detailed plan (*Science*, 6 October 1995, p. 20). The document Energy Secretary Hazel O'Leary gave Congress last month tries to shift the nation's nuclear weapons effort from one that relies heavily on an engineering philosophy using underground tests to an approach that focuses on materials science. "You can't burn and bang everything as we did before," says Roger Hagengruber, Sandia's vice president for defense programs.

Instead, lab teams must use complex computations and physics analyses to determine how long the weapons will remain viable and if there are ways to extend their lives. Most of the weapons, which have an average age of 12 years, are designed to last 20 or 25 years. DOE has already proved that its science-based plan can work, says Reis: Faced recently with evidence of aging in a particular component of a nuclear weapon, scientists at Los Alamos and Livermore independently showed that the effect was relatively minor and determined at what point it would affect performance.

Within the stewardship program, about $1.1 billion is set aside for the scientific core program, which consists of a wide variety of R&D activities. But funding for this sector is declining at the same time the department has launched a host of initiatives at the labs that will not be completed until well into the next century. The most expensive would be Livermore's NIF, an advanced laser facility to model nuclear explosions and to conduct inertial fusion experiments. The $61 million set aside for NIF in 1996 grows to $191 million in the 1997 budget request. Other projects would include a $400 million hydrotest facility at Los Alamos and a $240 million pulsed-power machine at Sandia. The Accelerated Strategic Computing Initiative, a joint project of all three labs, will cost nearly $1 billion over the next several years.



SOURCE: LOS ALAMOS NATIONAL LABORATORY

Follow the money. Core research programs make up a shrinking share of the national labs' stewardship program, which is only part of DOE's overall efforts to manage nuclear weapons.

It is the growing annual cost of these initiatives that worries many lab officials, who fear there won't be enough money left to conduct research or retain talented scientists. "There is no way we should sacrifice human expertise to brick and mortar," says Hagengruber, referring to the potential loss of talent if research budgets are cut. "One thing is certain," he says: "People die and you can't replace them" unless they pass along their knowledge. "But it's hard in Washington to sell the core program." Adds one lab manager: "Remember, politicians like ribbon-cuttings."

While the lab chiefs fret about taking on new responsibilities at the expense of personnel and research, defense officials want DOE to have modern tools and a clear plan to maintain the viability of the stockpile well into the next century. During discussions last fall about Reis's draft plan, defense officials complained that it lacked details and adequate benchmarks. Retired Air Force General Larry Welch, a member of a defense advisory panel that examined the program, complained that the rationale for NIF seemed to be its ability to attract and retain personnel, rather than its contribution to stewardship. Defense officials finally accepted Reis's revised plan in March, but warned that it would likely need frequent adjustments.

Keeping the numbers up. At the laboratories, meanwhile, budget fears became acute when the Administration proposed only $3.7 billion for the overall stockpile program in 1997 and about $3 billion annually starting in 1998. That proposal brought howls of protest. Los Alamos director Sig Hecker and Livermore's Tartar complained in letters to Reis that an inadequately funded stewardship plan would hurt the staff and research at the labs. The directors also reminded Reis that the Administration had agreed just months earlier to the full $4 billion a year funding. Cunningham and John Immele, program director of nuclear weapons technology at Los Alamos, warned Reis in a 31 January letter that the core program has already been cut by 25% since 1993.

Last month DOE convinced the White House Office of Management and Budget (OMB) to restore the program to its $4 billion level. But OMB officials say that they do not know where the additional money would come from. Such a hedged promise leaves lab managers nervous about their future budgets. "They face tough choices," says Sidney Drell, deputy director of the Stanford Linear Accelerator Center and chair of an advisory panel on stockpile stewardship. "The challenge is to balance the current work with a vision for the future."

Lab officials say they agree that today's initiatives are tomorrow's core programs. And they are quick to add that they don't want to look a gift horse in the mouth—thanks to stockpile stewardship, their budgets are stabilizing after falling sharply in the aftermath of the Cold War. But they are wary of politicians' promises of future funding levels. "It's got to be close to $4 billion if it's going to work," says Tartar.

That message is being heard on Capitol Hill. Concerned that the Administration is skimping on the program, House and Senate authorization committees earlier this month boosted the $3.7 billion request to $3.9 billion, within a whisker of the figure desired by the labs. Such support, they say, could mean that the lab directors will not have to choose between their staffs and new facilities. But they also know that it will be a struggle to maintain a $4 billion program as fears of Armageddon fade and politicians instead battle the deficit.

–Andrew Lawler

SPACE BIOLOGY

Surgery Confounds Mission Review

NASA officials have got themselves caught in a time warp. Last month, NASA Administrator Dan Goldin set up an independent panel to review a controversial U.S.–Russian project that involves sending monkeys into space. But the launch is scheduled for September, the panel can't meet until July, and surgical procedures must begin on the monkeys before the panel even holds its first session.

As a result, NASA is left in the awkward position of agreeing to the surgery even though it hasn't yet decided to continue supporting the mission. And the panel, instead of quieting opposition to the project, has become another rallying point for critics.

Goldin has asked the panel to examine the scientific and ethical standards of the $33 million Bion program. The move was a response to concerns from Congress and animal rights activists about the treatment of the animals and the overall value of the program (*Science*, 5 April, p. 26). The panel is led by Ronald Merrell, who chairs Yale University's surgery department, and its findings are due by the end of July.

But medical personnel can't wait that long to prepare the two monkeys for their 14-day flight, the first of two missions. Any substantial delay would set back the mission for nearly 2 years, says Joseph Bielitzky, NASA's new chief veterinarian. The weather on the steppes of Kazakhstan, where the launch and retrieval would take place, is too cold after September for the animals. Waiting until spring is also not an option: By then, the current group of monkeys will be too large, and a new group would have to be selected and trained. "That means a 20-month delay," Bielitzky adds. "If we stop the surgery, we don't fly the mission."

The first surgery, by a Russian team later this month, will implant head rings on the monkeys; at the end of June, a U.S. surgeon is slated to implant electrodes in the monkeys' bodies. Additional sensors will be implanted in July. The experiment is expected to generate a wealth of data on how microgravity affects the body.

"If we stop the surgery, we don't fly the mission."

—Joseph Bielitzky

People for the Ethical Treatment of Animals (PETA) has campaigned against the program, in particular the surgical procedures and conditions aboard the capsule. The group has argued that the project is cruel and of no scientific value, and the latest developments have added fuel to their fire. "It is worse than disingenuous to put together a so-called independent task force only to undermine its power by going ahead with the surgery," says Mary Beth Sweetland, director of PETA's research, investigations, and rescue department. "It's pulling the wool over the eyes of congressional representatives." A staffer for Representative Steve Stockman (R–TX), who opposes Bion, charges that the task force "is just for show." He adds that while he and others may be too late to halt the September launch, they hope to block a second mission planned for 1998.

NASA officials defend the program, and Bielitzky says that during a recent trip to Russia he was impressed by the high quality of animal care: "They're basically treated like cosmonauts—they're even called cosmonauts." The monkeys would suffer no permanent damage from the mission or the surgeries, he adds.

Merrell says the panel won't comment on the controversy until it holds its first meeting. And that won't occur until 1 July because of federal rules that require giving 30 days' public notice of an upcoming meeting. "We need to meet first in public—we can't do a straw poll in ethics," he says. However, he notes the panel will still have time to advise NASA to withdraw from the project if that is its conclusion.

If NASA were to pull out, Russia could proceed on its own, says Joan Vernikos, director of NASA life and biomedical sciences: "If they can afford to do it, they will. It's their animals and their capsule."

–Andrew Lawler