from the far right. "He is giving the program away piece by piece," says Sharon Camp of the crisis committee.

Last year AID, without waiting for congressional prompting, withheld $12 million from the International Planned Parenthood Federation when it refused to withdraw support from clients that offer abortion services. This year, AID withheld $10 million of its $46 million donation to the United Nations Fund for Population Activities (UNFPA). This was done in response to coercive birth control practices in China, even though UN money in China is only applied to demographic work and not family planning services. An amendment to the foreign aid bill, introduced by Representative Jack Kemp (R–N.Y.), would allow the fiscal year 1986 donation to UNFPA to be eliminated if the President officially determines that China operates "a program of coerced abortion or involuntary sterilization."

The immediate future does not look bright for AID's population program, which is likely to see a budget reduction of $30 to $40 million (from $290 million) in fiscal year 1986. Family planning is likely to get even further sucked into the political maelstrom as the next presidential election heats up, with Kemp and Bush, now seen as the main Republican contenders, battling for the right-to-life vote (ironic in view of Bush's sponsorship, in 1966, of the original legislation for international population aid). The matter of China will make for additional conflict if the United States withholds funds from the UN while trying to smooth the way for a new nuclear exhange agreement (*Science*, 23 August, p. 737). As a House committee staff member put it, "the overall family planning policy is a mess."—CONSTANCE HOLDEN

Weapons Labs Influence Test Ban Debate

Professional pride and scientific challenge both play a role in the labs' determination to continue testing weapons

Livermore, California. Situated on the first floor of a large building at the weapons laboratory here, past the barbed wire and the armed guards, is perhaps the world's most sparsely attended yet interesting museum. Arranged in artful displays throughout a series of alcoves are scale models of dozens of nuclear bombs, all designed by Livermore's scientists. Many of them are light enough to pick up, and some can be disassembled to display their inner workings.

Aside from the security precautions, the museum is no different from similar galleries at major corporations throughout the country. The purpose is both to display variations of the firm's principal product and to demonstrate the technical prowess of its employees. Visitors to the museum, chiefly a small group of senior defense officials, typically depart with a sharp appreciation of the fundamental and continuing changes in weapons design, as well as a keen awareness of the laboratory's pride in its own work.

These two factors—the unceasing interest in weapons modifications and the enormous professional enthusiasm of those involved—each play a major role in the stout resistance of the nuclear weapons laboratories to a comprehensive ban on nuclear testing, commonly known as a CTB. For if such a ban were agreed upon with the Soviet Union, life at the laboratories would be drastically changed, and the evolution of modern weapons would probably come to a halt.

In the past, the opposition of the weapons labs has been widely known but rarely openly stated. One reason was that, officially at least, Presidents Kennedy, Nixon, Ford, and Carter considered the CTB a major foreign policy goal. Under the Reagan Administration, however, the laboratory scientists feel that their views have achieved sufficient stature in Washington for them to be frank.

"A comprehensive test ban is the wrong way to go," says Paul Robinson, the principal associate director for national security programs at Los Alamos National Laboratory. "In fact, testing is not even a proper subject for arms control limitations. It serves as a distraction from the more important business of sharply reducing the number of nuclear weapons." Similarly, George Miller, the deputy associate director for nuclear design at Livermore, says that "the case for and the value of a CTB, in a political sense, should be overwhelming before entering into it. For us, the situation is exactly the opposite. In terms of maintaining stability, engaging in real arms control, and moving toward a more peaceful world, continued nuclear testing plays a very positive role."

The Reagan Administration's sympathy for this view was demonstrated by its refusal several weeks ago to join a nuclear test moratorium begun by the Soviet Union. Instead, it suggested that Soviet scientists take direct yield measurements at the U.S. test site, thereby enhancing the verification provisions of an existing treaty that limits explosions to 150 kilotons (*Science*, 16 August, p. 631). Al-

A nuclear bomb is lowered into a hole at the Nevada Test Site. The cables relay detailed information that is then used to modify and improve bomb designs.

though there was never any possibility that the Administration would follow the Soviets' lead, the moratorium, as well as the attention it attracted, were discomfiting to the labs, which have done their best in recent years to dampen any public enthusiasm for a CTB.

A major reason for this anxiety stems from the simple fact that the task of improving upon existing weapons designs is considered a fascinating scientific challenge. As a result, their employees look upon the dismantling of the Nevada Test Site in much the same manner that a particle physicist would react to a decision not to construct any more supercolliders. "I am an experimentalist," says Robinson, 43, who came to the laboratory directly out of graduate school, as did most of his colleagues. If the most important experiments are prohibited, he adds, little productive research can be performed.

Moreover, if a CTB were signed tomorrow, it would halt one of the richest periods of experimentation that the labs have enjoyed. Under Reagan, the number of tests—particularly those that involve basic weapons physics—has dramatically increased, although no one will say exactly how much. "At present, the nuclear weapons program in total, both in offensive uses, defense suppression, as well as defense, is more exciting than I've ever known it," Robinson says. "There are lots of new ideas, lots of new things being looked at. The list . . . has blossomed a lot since the narrow views that we had for a long time."

The Administration has been candid in describing the fruits of continued nuclear testing. A host of nuclear-driven missile defense technologies are depicted as unusually promising, including an x-ray laser, a particle beam, and a microwave weapon. Future nuclear weapons can be made smaller, lighter, and cheaper. Blast and radiation can be kept under better control. More safety features can be incorporated, such as inert high explosives in bomb detonators. Innovations are possible in both the fission and fusion constituents of a bomb. As Miller says, "There are things that technology can do for national security across the board."

The problem is not that all weapons design work would cease without testing, but that the most *interesting* work would be severely constrained. "We know that we can design bombs that work the first time out. We did it at Trinity and we did it again with the plutonium bomb, the weapon we used at Nagasaki," Miller points out. Hence, additional bombs—derived from older, thoroughly tested designs—could still be added to the arsenals on both sides, but they would clearly be large and primitive, not compact and state of the art.

"There would be a lot of pressures to build anyway, using new designs," Miller explains, "but my position is that modernization would stop." Donald Kerr, the Los Alamos director, agrees. "Basically, I wouldn't offer anything that hadn't been previously tested . . . to the point where you had simulated the flight of the delivery vehicle." In short, the basic practice of the last 30 years—in which bombs are created to fit aboard weapons invented by the military—would be reversed, and any future weapons would have to be made to fit around the bombs.

The reason is that although the labs have made tremendous progress in reducing their testing requirements to an absolute minimum, they have not succeeded in eliminating the need altogether. Over the past two decades, for example, they have purchased the world's most advanced computers and developed extensive computer codes capable of modeling the dynamics of bomb detonations and faithfully depicting the implosion and explosion in three dimensions. They have constructed elaborate nonnuclear test ranges with powerful accelerators for flash radiography, research into collateral nuclear effects, and investigations of controlled nuclear fusion. The ultimate goal is to be able to design weapons based on "first principles" knowledge of the fundamental physics of a nuclear weapons explosion. But this moment is "optimistically at least a decade away," Miller says.

Scientists at the lab fear that as the most interesting work dwindles, some of the brightest researchers will inevitably drift away. Miller, who has been at the lab since 1972, says that this would probably become noticeable after 5 years,

White House Remarks Worry Nuclear Weapons Designers

Although many scientists at the weapons labs are gratified by the Reagan Administration's enthusiasm for nuclear testing, they are disappointed by a series of recent misstatements coming from the White House. When the Soviet Union's offer of a moratorium on testing first became public on 29 July, for example, a senior Administration official who insisted on anonymity was widely quoted as saying that "we've noted in recent weeks a significant acceleration in the number" of Soviet tests. "It would appear to make it unnecessary for them to test what would normally have been at the anticipated pace for the next 5 months," the official said.

These claims are clearly contradicted, however, by the government's official classified data on Soviet tests. The Soviets actually conducted only one more weapons test from the beginning of the year through the start of the moratorium than they had in the previous year—hardly a "significant acceleration." Moreover, this total was well within the range for previous years. And from 1979 to 1984, the Soviets conducted an average of nine tests between 6 August and the end of the year, the period covered by the moratorium.

A week later, at the end of a press conference in the Oval Office, President Reagan was asked why the United States had declined to join the Soviet moratorium on nuclear testing. In his reply, he confused tests of ballistic missiles with tests of nuclear bombs, misstated the history of both SALT I and the Limited Test Ban Treaty, and promised to adhere to a "permanent moratorium" once the Midgetman missile had been deployed.

"Yes, that would be fine," Reagan said, only to be corrected the following day by White House spokesman Larry Speakes. "The President was not proposing any new initiatives," Speakes said. "The United States has long supported the objective of test ban negotiations in the context of achieving deep and verifiable arms reductions, substantially improved verification capabilities, expanded confidence-building measures and the maintenance of an effective deterrent."

At a subsequent press briefing, however, Speakes also confused missile and bomb tests. At the weapons laboratories, some scientists fear the White House ultimately will lose its credibility on the issue, and undermine the position of the laboratories as well.—**R.J.S.**

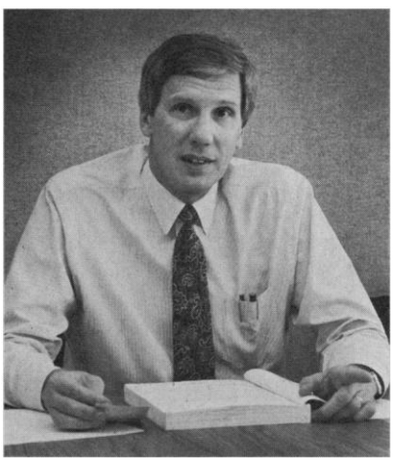
and that "the replacements will be good, but they won't have any experience. It'll be a losing battle." Although this would ultimately be felt by the weapons program, the most immediate impact would be on the quality of life at the labs themselves. To advocates of a CTB, a diversion of talent elsewhere is a healthy phenomenon; to those who have devoted their careers to weapons design it is a stifling prospect.

Scientists at the labs assert that 15 years or so after a ban has taken effect, not only the competence of the lab but also the reliability of the arsenal will have degraded. As Kerr told Congress last May, "Nuclear weapons are affected signficantly by aging and obsolescence; over an extended period the materials used in warheads deteriorate physically." Nuclear testing is needed to verify that bombs will still work, he asserts, and without it there will be substantial pressures to ensure an adequate deterrence either by expanding the size of the nuclear arsenal or by initiating a massive buildup of conventional armaments.

No other claim about the drawbacks of a CTB has aroused as much controversy. "The laboratories are guilty of vast quantities of misleading information on this subject," says Spurgeon Keeny, executive director of the Arms Control Association. Similarly, Wolfgang Panofsky, director emeritus of the Stanford Linear Accelerator Center and a former scientist at Los Alamos, describes the laboratory concerns as "greatly overblown." Along with Hans Bethe, Norris Bradbury, Richard Garwin, George Rathjens, the late Herbert Scoville, and Paul Warnke, they recently wrote a letter to Congress, which asserts that "continued nuclear testing is not necessary in order to ensure the reliability" of the stockpile, and that nonnuclear tests, as well as periodic weapons disassembly, are adequate to uncover any flaws.

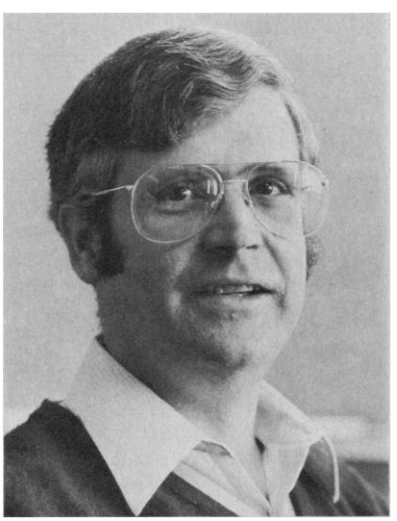
The debate is difficult for an outsider to assess because both arguments depend in part on highly classified data and the participants accuse each other of being factually incorrect. In particular, the weapons designers argue that nuclear tests have been required in the past to fix various weapons defects, and the critics say it isn't so. The only detailed public study of the subject, prepared for the Energy Department by Jack Rosengren of R&D Associates in Marina Del Ray, lists a number of bomb repairs made with the assistance of nuclear tests.* But the critics argue forcefully that equivalent repairs could have been made without this assistance.

In part, the debate is a reflection of the laboratory's intrinsic and appropriate conservatism. A written certification that any given weapon will produce its rated yield is required from the lab directors before it may enter the stockpile,



Paul Robinson

"I am an experimentalist."



George Miller

"Testing plays a very positive role."

and they take their responsibility extremely seriously. More fundamentally, however, the debate is a reflection of the fact that long-term weapons reliability is not at present the paramount goal of a designer, and probably won't be until a CTB has been signed.

As Kerr explains, "If you ask the question could we come up with a basic design or class of designs that would basically be very insensitive to anything you could imagine happening . . . I think the answer probably is yes, there is no *a priori* reason to say why that's impossible. Right now, it's not a thing that we do because from the point of view of delivery systems, it's not a particularly interesting path to go along." Bombs that are relatively impervious to aging would inevitably be larger and weigh a good deal more, Kerr explains, because they would probably need more fissile material and more high-energy explosive. Such bombs could only be deployed on less capable yet more expensive weapons systems, he adds.

To Ray Kidder, an associate division leader at Livermore who is frequently at odds with laboratory policy, the fact that the labs have never designed such super-reliable weapons, even though a CTB has long been under consideration, is "a real scandal." Hugh DeWitt, another internal lab critic, suggests that it is part of the lab's deliberate anti-CTB strategy. But a more plausible explanation, offered by Miller, is simply that economic constraints have precluded any other approach.

In any event, the problem is not a permanent one; no one doubts that more reliable weapons can be developed if politicians so direct. And some CTB advocates even argue that degraded reliability is good, because it will give both sides pause during planning for a first strike. The labs, of course, have a response here as well. They claim that the burden of uncertainty may fall unequally on U.S. and Soviet shoulders, creating a worrisome recipe for strategic instability. The basis for this argument is that Soviet bombs already are larger and heavier than ours, and therefore might be more "robust" and "less susceptible to degenerative changes," as Miller puts it. But he acknowledges that "I can't prove it because I don't know what's in their bombs." Robinson agrees that the United States can only speculate. "I would say we're ignorant" of Soviet bomb designs, he says.

In the end, the debate between test ban advocates and laboratory officials brings into sharp relief several key features of a CTB. By itself, it will clearly not end the arms race. Bomb designs would indeed be frozen, but enough are available on the shelf to keep arsenals on both sides well stocked in the absence of further limitations. Confidence in the reliability of bombs may be diminished, but this might be offset by "super-reliable" weapons designs. Given the professional enthusiasm of the labs' employees it is hardly a surprise that the CTB is one experiment they don't wish to try.

—R. JEFFREY SMITH

*The first warhead for the Polaris missile was extensively modified in the 1960's, for example, after its fissile material began to corrode and its arming mechanism malfunctioned. Corrosion of a high-energy explosive forced replacement of the Poseidon warhead in the late 1970's, and corrosion of a fissile material forced replacement of the W45 warhead, which is used in two tactical missiles as well as an "atomic demolition munition."