

Linear Accelerator Center (SLAC), pointed out the technical problems posed by an effort to create an impenetrable space shield against nuclear warheads.

"We do not know how to build an effective nationwide defense, nor is there any chance of achieving one in the foreseeable future. . . ." Drell argued after Reagan publicly challenged US scientists to put the nuclear genie back in the bottle. Drell and his Stanford colleague Wolfgang (Pete) Panofsky note that even a small hole in the Star Wars shield would lead to a disaster.

"Each nuclear warhead is a potential holocaust," agrees Abrams, who sees his arms control organizing efforts as a natural outgrowth of his responsibilities as a physician. "Physicians have an obligation to follow up on their patients' well-being," he observes. "There is no room for indifference on the most important health issue of our times: the prevention of nuclear war."

**T**he desire for protection against atomic weapons is hardly new. Initially, the public barely understood the effects of radioactive fallout from a nuclear explosion. Hiroshima and Nagasaki were destroyed in World War II, but only a handful of scientists comprehended the distinction between radiation burns and garden variety flame, gas or chemical burns.

A highly publicized episode during the 1954 BRAVO nuclear tests in the South Pacific heightened public concern about the dangers. A "controlled" hydrogen blast showered fallout on the Marshall Islands, sickening inhabitants and killing a Japanese fisherman whose boat came within 85 miles of the blast site.

Shortly thereafter the Atomic Energy Commission issued a report detailing the dangers of radiation; other reports and articles followed. By 1957, a public opinion poll showed that 52 percent of the US public was aware that nuclear fallout posed a "real danger."

President Eisenhower responded to the public clamor for protection from nuclear weapons by issuing his National Shelter Policy in 1958. Under Eisenhower, the federal government built prototype bomb shelters, which were hauled around the country and displayed at shopping centers. The shelters were to serve as models for citizens to follow in constructing their own backyard shelters.

Soon afterward, advertisements began popping up in magazines for prefab "H-Bomb Hideaways" which could be bought for \$1750 to \$3895 (for the deluxe model with room for an extra one-week supply of food).

President Kennedy gave added support to the search for holes to hide in if the Soviets dropped the big one. Shortly after his tense confrontation in Vienna with Soviet Premier Nikita Khrushchev in 1961, Kennedy returned to the US and requested \$207 million from Congress to provide temporary nuclear blast shelters for 50 million Americans in already existing tunnels, subways and basements.

Congress allocated the money, and some of the fallout shelter signs posted in various locations during that period can still be found today. A few new shelters around Washington were actually constructed, but most of the money went for

signs. Defense against nuclear war has always been costly.

Immediately after the Cuban missile crisis, Kennedy proposed an additional five-year, \$3.5 billion dollar project to construct fallout shelters in major metropolitan areas around the country. When Congress balked, Kennedy ordered the distribution of 25 million copies of a federally produced booklet, *Fallout Protection: What to Know and Do about Nuclear Attack*. The booklet stated that 97 percent of the population could be saved by fallout shelters, and urged their construction.

IBM Chairman Thomas Watson offered his employees free loans to construct bomb shelters. Various religious organizations recommended that new churches and synagogues include bomb shelters for the faithful.

Finally sanity began to emerge. Norman Cousins of *Saturday Review* fame, C.S. Pickett from the American Friends Service Committee and entertainer Steve Allen came together to form a new public education group called SANE. SANE raised money and consciousness by proclaiming the futility of nuclear shelters, pointing out that the effective half-life of nuclear radiation far exceeded the amount of time people could conceivably live in shelters. Clearly, if freedom from the prospect of nuclear annihilation were to occur, it would have to happen by some other method than climbing into a hole.

This realization led the US and Soviets to negotiate a ban on atmospheric tests. Although the pace of nuclear weapons development and deployment remained steady, the late '60s and early '70s did see progress toward achieving arms control agreements, mostly relating to the permissible size and power of nuclear arsenals.

One US politician, however, way out on the conservative fringe for several decades, consistently opposed all arms control agreements with the Soviets during this time. And when that politician, Ronald Reagan, was inaugurated as president, his lifelong opposition to arms control became a centerpiece of his negotiating strategy with the Soviets.

Reagan's apparent naivete about the consequences of nuclear war was shocking at first. Early in his presidency, Reagan jolted the European community when he declared that a nuclear war could be "contained" and even won in Europe. He eventually backed away from this argument, but comments by Undersecretary of Defense T.K. Jones added to public concern about the Reagan Administration's grasp of basic physics.

Jones said the nuclear defense problem was mainly a shortage of shovels. "Dig a hole, cover it with a couple of doors and throw three feet of dirt on top," he suggested. "It's the dirt that does it . . . . If there are enough shovels to go around, everybody's going to make it."

**T**hose scientists who view SDI as merely a high-tech version of Secretary Jones's crude hole-in-the-dirt solution are in deep trouble if they rely on the federal government or large industry for support of their basic science research. In what is the most sweeping consolidation of scientific research funding in the nation's history, SDI is radically changing the very way that US scientists

and scholars practice their craft.

A small hand-lettered sign reading "SDI" in an old Washington office building marks the focus of operations for SDI's planners. There, millions of dollars of federally supported research is being pursued under the administrative guidance of 51-year-old Lieutenant General James A. Abrahamson.

Abrahamson makes no bones about his objectives. By late 1986, he plans to select two companies to construct prototype space shield systems based on academic research conducted at places like Stanford, Carnegie-Mellon, Berkeley's Livermore Lab and MIT.

The funding level of SDI research dwarfs all other previous federal programs. In addition to funding new research, SDI's Abrahamson has taken over the administration of dozens of basic science projects that relate to SDI.

Locally, Stanford's Synchrotron Radiation Laboratory (SSRL) has been required to participate in SDI research despite the objections of 280 SLAC staff members who petitioned to be exempted from the research. Nationwide, other resources in computer imaging, high speed data processing, laser physics, morphology and telecommunications are being diverted from basic science tasks to SDI-specific contracts.

As Galileo discovered centuries ago when he suggested that the Earth wasn't the center of the universe, it is not enough for a scientist to be right. Progress has occurred though; while Galileo was jailed for his heresy, no scientists opposed to Star Wars have been incarcerated.

However, the federal government appears unenthusiastic about funding the research projects of Star Wars opponents. The effects of this political homogenization of the federally-funded science community has yet to be calculated.

**T**he 280 SLAC staffers who likened their work at Stanford on SDI to "involuntary servitude" found little solace in the response of Stanford President Donald Kennedy.

Kennedy, who acknowledges that his career has been advanced by federal and Department of Defense research grants over past decades, maintains that permitting SDI research on campus is a matter of "academic freedom." Describing the self-proclaimed "involuntary servitude" of SLAC staffers as a form of "freedom" for their superiors has angered many of the topnotch physicists at Stanford. Some have found other jobs, and others are looking.

Kennedy, however, defends his decision. "Research is like speech in every important way," Kennedy said recently. "Our society places extraordinary value on freedom of speech, surrounding it with all kinds of protection. And nowhere is it more thoughtfully or thoroughly surrounded than in universities."

Kennedy acknowledges that "a lot of scientists are uncomfortable" about SDI. "Scientists frequently collect themselves together and express strong views about what research they wish to do and do not wish to do. They should be applauded for this and do it more often."

Still, Kennedy refuses to intercede on behalf of SLAC staff members who object to the end results

of SDI research. "Today's benign restriction might become tomorrow's suffocation," Kennedy warns in arguing against considering the end uses of any of the research conducted at Stanford.

"Once you begin making value judgments about the possible outcomes of scientific work, there is no place to stop."

Other institutions, notably the University of Michigan, dispute Kennedy's conclusions. Michigan's new research policy prohibits any research whose "clearly foreseeable end is to destroy human life or incapacitate humans."

Although Michigan's new policy has yet to be applied to Star Wars, many scientists hope that Michigan can lead the way in allowing scientists and their staff members an opportunity to control the practical applications of their individual intellects.

**M**eanwhile, in communities across America, a new anti-nuclear movement is emerging. Not satisfied with the progress of the nuclear freeze strategy, which has resulted in hundreds of demonstrations in support of a bilateral nuclear freeze, the new tactic involves legislating local "nuclear free zones."

In Palo Alto, voters will soon be asked to decide if nuclear weapons-related work should be banned within city limits. Proponents of this legislation argue that weapons-related work makes Palo Alto a prime target in the event of nuclear war and should be discontinued in the name of public safety.

According to *Peace Works*, published by the Midpeninsula Peace Center in Palo Alto, the Nuclear Free Zone network is the largest anti-nuclear organization in the world. It was founded in Japan in 1958.

There are currently 3000 nuclear-free zones in the world, including 17 countries, all of Latin America, outer space and the sea bed. There are 120 nuclear-free zones in the US, encompassing 15 million people. Fifty percent of Japan's population lives in nuclear-free zones, and there are 180 nuclear-free zones in Great Britain.

In 1984, the California cities of Claremont and Sausalito banned nuclear weaponry, and next week Marin voters will have the chance to declare their county nuclear-free.

"It would be wonderful if Marin County went nuclear-free," says Connie Kuruppu, a volunteer at the Midpeninsula Peace Center who has been active in circulating a petition to bring the same question to Palo Alto voters. Kuruppu reports that organizers have already obtained 1500 signatures for the proposed Palo Alto ordinance, which would prohibit research, development, production, deployment, launching, maintenance or storage of nuclear weapons or components. Kuruppu says she hopes the issue will reach Palo Alto voters sometime in 1987.

Abrams supports the strategy. "Although they are largely symbolic," he says, referring to local nuclear free zones, "they place people's focus on the meaning of annihilatory weapons. When people concentrate on the issue of a nuclear free zone they begin to understand that these are not weapons of war we are talking about. They are weapons of annihilation."

*Craig Carter contributed to this article.*