The Search for a Nuclear Sanctuary (I)

Millions of dollars are pouring into a series of programs that might one day recapture U.S. strategic superiority

Obviously, if we are able to destroy incoming missiles effectively, I don't think it's destabilizing. I think it would be extremely comforting.—Secretary of Defense Caspar Weinberger

If a small group of scientists is successful, the United States will by roughly the year 2000 have the capability to attack the Soviet Union without fear of devastating nuclear retaliation. It will do so by erecting a shield of sophisticated antiballistic missile systems, while simultaneously exploiting ingenious mechanisms designed expressly to ruin antiballistic missile systems erected by the Soviets.

President Reagan, in a speech last March, lent his blessing to this effort, calling it "a vision of the future which offers hope." As a result, the Pentagon is likely to add hundreds of millions of dollars to the existing annual research budget of $2.5 billion. The technical directors of the program will decide by late summer exactly how much, and how it will be spent. But more funds will certainly be applied to the development of optical sensors, high-speed projectiles, mirrors, lasers, missile interceptors, ablative materials, and warhead decoys—which together might permit the United States to wield both a sword and a shield.

Yuri Andropov, the Soviet leader, is incensed about the program. Speaking of the United States, he said recently that "the intention to secure for itself the possibility of destroying with the help of the ABM defense the corresponding systems of the other side, that is of rendering it unable to deal a retaliatory strike, is a bid to disarm the Soviet Union in the face of the U.S. nuclear threat." Similar conclusions have been drawn by politicians and newspapers in Europe, as well as by a substantial portion of the U.S. scientific community.

Several prominent Administration officials, including Secretary of Defense Caspar Weinberger, have attempted to allay this concern by suggesting that the deployment of missile shields by both countries will lead to peace, not war. "I would hope and assume that the Soviets, with all the work they have done and are doing in this field, would develop about the same time an effective defense, which would completely remove these missiles and the fears they cause," Weinberger says.

What Weinberger does not admit is that in many of the key technologies necessary for an effective defense, the United States may be years ahead of the Soviets. Many authoritative but less visible Pentagon officials admit substantial U.S. superiority. More important, Pentagon efforts in this area are not confined to peaceful defense. A series of low-profile government programs has been established to anticipate Soviet defensive technologies and prepare the means to defeat them. The managers of these programs openly predict that Soviet defenses will be useless if deployed simultaneously with U.S. defenses.

The first task in pursuing this strategy is to develop a foolproof antiballistic missile system—an achievement that will require many billions of dollars, as well as nearly miraculous technological breakthroughs. Although the precise components of such a system will not be determined for a decade or so, top military officials favor a three-tiered approach. Robert Cooper, director of the Defense Advanced Research Projects Agency (DARPA), recently told the Senate Armed Services Committee that "the only way of accomplishing the President's purpose" would be to erect a system capable of assessing and attacking Soviet ICBM's repeatedly, throughout their flight. Officials say that the initial missile defense gauntlet will probably be a laser capable of attacking Soviet missiles within a few minutes after their launch; the second defense will be a long-range interceptor that will collide with warheads just outside the earth's atmosphere; and the third will be a short-range interceptor, with either a nuclear or nonnuclear warhead, to knock out Soviet warheads that leak through the other defenses.

Many imaginative ideas for a laser system have been put forward, but only two seriously interest weapons officials at the moment. One, which is highly touted by presidential science adviser George Keyworth, would consist of several hundred enormously powerful lasers, each operating at or near the visible light spectrum, dispersed throughout the countryside. The lasers would be fired at huge flexible mirrors, which would be launched in hundreds of missiles on warning of a potential attack. The mirrors would refocus the beams, making corrections for atmospheric disturbances, and refract them onto the skins of Soviet booster rockets. Neither the mirror nor the lasers nor the deployment system has yet been designed or constructed.

A second concept, which has been suggested to President Reagan by Edward Teller, involves the construction of hundreds and perhaps thousands of lasers powered by low-yield nuclear bombs. Like Keyworth's mirrors, the lasers would be positioned atop missiles and launched into space on warning of a potential Soviet attack. When the bombs are detonated, the radiation they create would supposedly slice through Soviet boosters shortly after their launch. Hans Bethe, a Nobel laureate at Cornell who is generally critical of antiballistic missile concepts, says that "this is the one and only one proposal that scientifically makes sense." At Teller's invitation, Bethe recently visited Lawrence Livermore National Laboratory, where the idea is under investigation, and discovered that "the physics they have done—the purely theoretical studies and designs—seemed very well done. But of course such a device is a long way from actually working, even in a test circumstance, and to translate this into an operational device is a fantastic business." To name just a single drawback, each laser would self-destruct upon detonation, so there would be no prospect of firing a second time.

A third concept, which has attracted a great deal of publicity but excited little or no interest in the weapons bureaucracy, is advanced by a group known as High Frontier, directed by Lieutenant General Daniel Graham, a former director of the Defense Intelligence Agency. Graham envisions more than 400 satellites in permanent orbit, each armed with missile interceptors that use infrared sensors to home in on Soviet boosters and destroy

them through high-speed collisions. Graham claims that this system could be deployed within a decade, using equipment available now. But John Gardner, the director of defensive systems at the Pentagon, says that he and others have serious reservations about its vulnerability to Soviet attack or relatively simple countermeasures. Teller also dislikes it. "Pre-deployment in space will not work," he says.

According to existing plans, the Pentagon will spend roughly $2.6 billion over the next 5 years, investigating a variety of laser systems as well as less promising particle beam ideas. On 23 March, Major General Donald Lamberson, who manages the Defense Department's directed energy weapons technology program, told the Senate Armed Services Committee that "a great amount of thought went into [this] plan" and that he "would not recommend an acceleration at this point." Later that day, President Reagan, who had neglected to consult with Lamberson—or even to give him advance notice—suggested on national television that the program needed more attention. Consequently, there will be a substantial acceleration anyway.

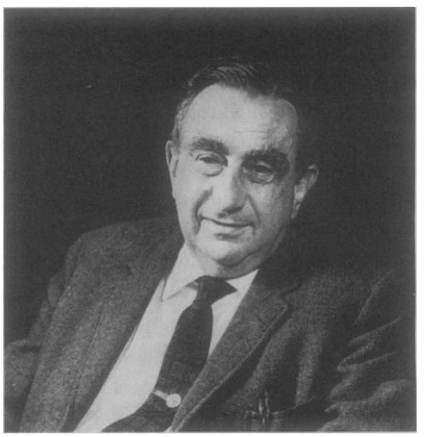
Millions of dollars are also being spent on the Pentagon's High Altitude Defense System Program, which would form the second tier of a missile defense. Under this program, the Army is conducting a series of Homing Overlay experiments, in which an interceptor attempts to collide at high speed with a simulated warhead above the earth's atmosphere, using ground-based radar and longwave infrared sensors aboard a series of specially equipped aircraft roving beneath the projected warhead path. The first two tests, on 7 February and 28 May, were failures, but additional tests are scheduled for later this year.

The third and final tier of an antiballistic missile system will probably be a series of short-range interceptors, each capable of emerging from concealment to destroy enemy warheads within seconds of their impact. Although it would be fairly straightforward to arm the interceptors with nuclear bombs, the Pentagon is investigating the possibility of nonnuclear warheads that could dispense a hail of pellets or shrapnel. At present, the Pentagon plans to spend $7.2 billion on the second and third tiers of a potential antiballistic missile system over the next 5 years, with the bulk of it intended for the design and engineering of better computers, radars, optical sensors, and short-range nonnuclear interceptors. Major General Grayson Tate, who manages the ballistic missile defense program for the Army, notes that "there is a specific pot of money that is allowing us to go forward with . . . [preparations] to have a system in the field in the near future," using existing technology. The money was appropriated by Congress in response to Defense Department fears that the Soviets could on short notice abrogate a treaty barring antiballistic missile systems, signed in 1972.

Each of the ideas for such a system suffers from technical defects that may render a perfect or near-perfect defense impossible. Short-range interceptors may be incapable of destroying more than half of the missiles in a potential Soviet attack. Some scientists claim that long-range interceptors, which operate outside the earth's atmosphere, may be easily fooled by decoys. Critics such as Richard Garwin and Sidney Drell assert that more advanced systems—such as Teller's x-ray lasers or Keyworth's mirrors, intended for quick deployment on warning of a Soviet attack—will be unable to reach a sufficient altitude above the earth to be effective; the systems might also be vulnerable to Soviet spoofing, which would result in their deployment when no real aggressive action is threatened. As to the High Frontier idea, Daniel Graham acknowledges that his system "is designed to go automatic if there is a massive attack," and that "you always have to worry about a mechanized device somehow malfunctioning." The worst that could happen, he says, is that "one day you might shoot down something that would annoy the hell out of the Soviets. But what a better situation than today's world where if somebody fires a nuclear missile, there is nothing that can happen until it hits where it's going." Obviously, the Soviets may disagree.

Major General Donald Lamberson

"We do not know what these systems will look like . . . [or] cost."



Edward Teller

Believes that "pre-deployment in space will not work."

All of the concepts rub up against technical uncertainties in the area of tracking and pointing, as well as operational uncertainties stemming from the speed at which they need to operate. Cooper says that "currently we have no way of understanding or dealing with the problem of battle management in a ballistic missile attack ranging upward of many thousands of launches in a short period of time." Major General Donald Lamberson, who manages the Defense Department's directed energy weapons technology program, acknowledged last March in congressional testimony that "we do not know what these systems will look like; we do not know what they would weigh; [and] we do not know what they would cost." The only estimates made thus far range between astronomical ($100 billion) and horrific ($500 billion).

Uncertainties such as these have led experts such as George Rathjens of MIT to suggest that "the President is ill-informed on military matters, perhaps out of touch with the scientific community." Noel Gayler, a former director of the National Security Agency and former deputy chief of naval operations, recently told a congressional subcommittee that "what we are observing is the will to believe, and it is irreducible. People will believe in hopeful things. Cancer sufferers still go to Mexico and get a shot full of laetrile, and this is that kind of operation."

Weinberger, on the other hand, says that he sees no reason why a total missile defense cannot be made to work if sufficient effort is applied. "I think it's a noble cause and one that certainly needs doing and one that I'm confident American ingenuity can solve. . . . Whether or not we have a majority of scientists at the moment who say it can be done

within a number of years is unimportant."

Some of Weinberger's confidence may stem from the substantial advantage that the United States has over the Soviets in the technologies critical to an effective defense. According to a recent report by Richard DeLauer, the under secretary of defense for research and engineering, the United States is equal to the Soviets in directed energy technology, but superior in virtually every other technology needed to fashion a working antiballistic missile system, including computers, optics, automated control, electro-optical sensors, microelectronics, propulsion, radar, signal processing, software, telecommunications, and guidance systems.

George Keyworth, the President's science adviser, lists this superiority as a principal justification for developing an antiballistic missile system. "I see this shift [from offensive to defensive weapons] as a decided advantage to the West in maintaining a stable peace," he recently told an aerospace manufacturers convention. "The reason stems from the superiority we and other Western countries have over the Eastern bloc in terms of industrial capacity and industrial base." He went on to say that the Soviets "have to play catch up when it comes to advanced technology"—a circumstance that the United States can exploit by continually operating "at the knowledge frontiers. In that way, by the expedient of always staying several steps ahead, we can thwart even the most aggressive attempts by adversaries to keep up."

The U.S. advantage in short-range antiballistic missile systems, which operate within the atmosphere, is particularly large. At present, the Soviets depend on a system that was first deployed around Moscow in the 1960's, consisting of several dozen interceptors with nuclear warheads, and a series of large, outmoded radars surrounding the city. Because the system is obviously of little value in defending against a U.S. attack, Western intelligence experts have long expected that the Soviets would improve it by constructing newer, more survivable radars and other components. They were astonished several years ago when the Soviets instead decided to construct a single, enormous, highly vulnerable radar at Pushkino, 35 kilometers north of Moscow. Richard Ruffine, a Pentagon analyst who specializes in antiballistic missile systems, says that "initially there was speculation that it was a pyramid, or perhaps Brezhnev's tomb—it was so unlikely. It is not a good way to build a system." Ruffine says that the radar, together with other modest improvements, makes the Soviet system only slightly better than what the United States developed 15 years ago under the Safeguard program. Everyone concedes that U.S. scientists have made significant progress since then.

The U.S. effort might be damned whether it succeeds or not. If a workable defense is never constructed, a lot of time and money will have been squandered. If by some stroke of luck it eventually proves successful, the Soviets will undoubtedly be at an enormous strategic disadvantage. Knowing this in advance, the Soviets might be tempted to initiate a preemptive strike, so as to eliminate the prospect of nuclear subjugation. And finally, a danger always exists that an ineffectual system would be deployed anyway, providing a leaky umbrella for more provocative U.S. behavior.

—R. JEFFREY SMITH

Next week: The U.S. effort to ruin a potential Soviet missile defense.

Organ Shortage Clouds New Transplant Era

Organs are used from only one in ten potential donors; some say legislation is needed to make more organs available

Surgeons have recently begun to talk of a new era in organ transplantation, brought about by technical advances and new drugs to prevent rejection of transplanted tissue. But the application of this new technology is likely to be constrained by an old problem: an acute shortage of transplantable organs. Last year in the United States, out of some 20,000 potential donors—young or middle aged patients classified as brain dead—only 2500 actually gave their organs.

The supply of organs is already grossly inadequate. About 6000 to 8000 patients whose kidneys have failed and who are being kept alive by dialysis are on waiting lists for kidney transplants. And that may be only the tip of the iceberg. According to Richard Rettig, a social scientist at the Illinois Institute of Technology who has spent the past 15 months studying kidney transplants and organ procurement, about 22,500 dialysis patients are suitable candidates for transplants. But the dialysis patients are the lucky ones. At least they can be kept alive while they wait. For other patients who need hearts, lungs, or livers the search for donated organs is a life-or-death proposition.

Moreover, the need for organs is expected to increase dramatically when the new drug Cyclosporin is approved by the Food and Drug Administration. Cyclosporin prevents organ rejection and has revolutionized the field of organ transplantation (see page 40). Currently, only a few medical centers are licensed to use the drug. But experts predict that the number of centers doing heart and liver transplants will double as soon as Cyclosporin becomes generally available—whether or not Medicare and insurance companies decide to pay.

Suitable organ donors must not only be brain dead but must also be fairly young. The cutoff age for heart donors is usually 35 for men and 40 for women, liver donors cannot be much older than 40, and kidney donors must be under 55.

The problem of how to relieve the organ shortage was the topic of hearings in April before the House Committee on Science and Technology, chaired by Representative Albert Gore (D–Tenn.). In June Surgeon General C. Everett Koop held a meeting near Winchester, Virginia, on the subject. So far, however, no agreement has emerged on the best course of action. Some say the emphasis should be on educating doctors about identifying and referring potential donors. Others place the emphasis on better informing the general public. Suggestions range from public information campaigns to passing legislation allowing doctors to assume they can take a brain-dead person's organs unless he specifically stated during his lifetime that they cannot.