News & Comment

SDI: Testing the Limits

The dispute over SDI testing will soon move out of the theoretical realm; the Soviet Union could hold an arms reduction treaty hostage to its own interpretation of the ABM treaty

SHORTLY before President Reagan leaves office, if all goes according to current plans, a modified Boeing 767 flying near the Kwajalein Test Range in the Pacific will track some dummy warheads as they streak through space and reenter the earth's atmosphere. An infrared telescope mounted aboard the aircraft will monitor heat radiating from the warheads.

According to some critics, this seemingly innocuous experiment will be the first test to be conducted under the Strategic Defense Initiative (SDI) that raises serious concerns about compliance with the 1972 Antiballistic Missile (ABM) Treaty. John Pike, an SDI critic with the Federation of American Scientists, has argued, for example, that the experiment appears to violate the treaty's prohibition on testing mobile ABM systems or their components. Last year, Representative Les AuCoin (D–OR) sought unsuccessfully to have the test put off until the next Administration.

The Reagan Administration maintains that the experiment involves no conflict with the treaty because neither the telescope nor the aircraft would be capable of performing as part of an ABM system. In fact, the Administration says it has deliberately tailored the test, known as the Airborne Optical Adjunct (AOA), to fit into what it regards as the unduly narrow confines of the so-called traditional interpretation of the treaty.

The dispute over the AOA has not received much public attention in part because, as even many of those who have questioned its legality admit, the conflict with the treaty is far from clear cut. It resides in the gray area of what is permissible. Nevertheless, as the first SDI test to push against the limits set by the ABM treaty, it symbolizes the fact that the debate that has been raging over how to interpret the treaty will soon move out of the theoretical realm.

For the past 2 years, the debate has centered on the Administration's contention that the treaty does not prohibit the development and testing of ABM systems and components based on technologies developed since the pact was negotiated. This "broad" interpretation prompted a furor since it ran counter to the judgment of every previous administration, from Nixon's on. They had all concluded that, while the treaty permits some development and testing of fixed, ground-based ABM systems, any other ABM work that goes beyond research is outlawed—irrespective of whether the technology existed when the treaty was written (*Science*, 9 October 1987, p. 147).

Congress last year voted to force the Pentagon to keep the SDI program within the traditional interpretation of the Treaty, and the Administration reluctantly agreed to do so during fiscal year 1988. It also accepted a 1-year ban on the purchase of equipment for future treaty-busting experiments. The stricture will have little practical effect, however, since no tests that would breach the traditional interpretation of the treaty were planned for FY 1988 anyway, and the Administration still insists that its broad reading of the treaty is legally correct.

Last year's compromise was thus simply a temporary truce that did nothing to settle the issue of what SDI testing is permissible under the treaty. Some key Senators and members of Congress are talking with Administration officials in an effort to find a way to avoid a repeat of last year's bitter arguments, but the chances of achieving harmony are considered slim.

The Administration is at odds not just with Congress over SDI testing. The Soviet Union, which has consistently sought to keep SDI bottled up as much as possible, has also objected to the notion that the ABM treaty permits a broad array of ABM testing.

At the 1986 Reykjavik summit meeting, Secretary General Mikhail Gorbachev insisted that strict limits be placed on SDI experiments as part of a potential agreement under which the superpowers would sharply reduce their strategic nuclear arsenals. The summit collapsed when Reagan refused to accept this condition. And last month's Washington summit also ended in an impasse on the issue, although both sides did agree to press ahead with negotiations on strategic arms reductions in spite of the continuing discord on SDI.

The summit communique papered over the disagreement by stating that both sides would agree to observe the ABM treaty "as signed in 1972" and would not withdraw from it for a period of time that has yet to be determined. However, in a letter to Senator Carl Levin (D–MI), Reagan's national security adviser Colin Powell has acknowledged that the Soviets made it clear that they may refuse to implement a strategic arms reduction agreement—or even increase their strategic nuclear forces—"if the U.S. were to conduct activities that were incompatible with the Soviet Union's understanding of the ABM treaty." Powell's letter "should drive home the point that if we don't reach a [strategic arms reduction] agreement, the likely cause will be the unresolved conflict

U.S. Army

Airborne Optical Adjunct. *An infrared sensor mounted in the aircraft will be used to track warheads in a controversial test.*

over the ABM treaty and SDI," says Levin.

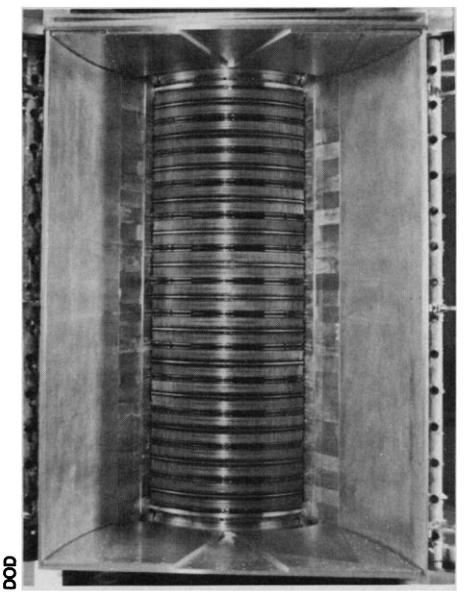
Although the dispute over SDI testing has been cast mostly in terms of the broad versus traditional interpretation of the treaty, as the concern over the upcoming AOA experiment illustrates, there is far from universal agreement on what is permitted even under the traditional interpretation.

The Administration has, in fact, mapped out an extensive series of SDI tests over the next few years that it says do not require the broad interpretation. Some of these experiments have, however, raised concerns among critics in the United States about treaty compliance, and they are sure to prompt Soviet protests. "The Administration has defined away the problem of the broad interpretation," by classifying a lot of questionable tests as consistent with the traditional interpretation, contends Pike of the Federation of American scientists.

Virtually all the contested experiments are, like the AOA, in the gray area of the treaty. The treaty clearly permits research on ABM systems and technologies, and it allows development and testing of fixed ground-based systems at designated test ranges—the U.S. sites are Kwajalein and White Sands Missile Range. But it outlaws development and testing of mobile systems and space-based systems, and it bans testing of non-ABM items such as warning satellites and radars "in an ABM mode." The arguments over which specific tests are permitted under the traditional interpretation therefore turns on what constitutes research as opposed to development and testing, how to define an ABM component, and what testing in an ABM mode means.

The Administration argues that the AOA is permissible because the Boeing 767 could not stay aloft long enough to be much use as part of an ABM system, and the infrared telescope will not be able to track the warheads accurately because it lacks rangefinding capabilities. The AOA therefore "will not be capable of substituting for an ABM component," says a Defense Department report delivered to Congress last April. Eventually, however, a laser rangefinder will be added to provide greater tracking ability, and a system based on these technologies could be used to guide ground-based rockets to intercept incoming nuclear warheads. At some point, therefore, testing of this system will breach the traditional interpretation of the treaty. The dispute essentially boils down to where that point lies.

Another planned experiment that has raised concern is a test code-named Zenith Star, which could fly as early as 1990—although one congressional staff member calls that a "heroic schedule," which will almost certainly slip. It will be the first major



DOD

ALPHA *will be the first laser to be tested in space.*

test in space of a chemical laser. Laboratory tests of the laser, a hydrogen fluoride device known as ALPHA, were begun late last month. The laser will be lofted into space and its beam will be focused by a mirror onto distant targets.

According to a report prepared for Congress early last year and released in unclassified form in September, if the Pentagon were permitted to adopt the broad interpretation of the treaty, the laser would be used to destroy a booster rocket. Under the traditional interpretation, however, the laser would have to be less capable and it would be directed at simulated targets. Even this scaled-down test may violate the treaty's prohibition on testing space-based ABM components, according to critics inside and outside the government, however.

Zenith Star has been attacked not only on legal grounds. The House Armed Services Committee, for example, sought at one point to terminate funding for the ALPHA laser because of doubts that such devices could ever be made powerful enough to be militarily useful, and the American Physical Society, in a report published last year, noted that such space-based systems would be vulnerable to attack.

Other planned experiments that have raised concerns are a test, currently scheduled for 1991, of the Boost Surveillance and Tracking System, a space-based sensor that would monitor the launch of Soviet missiles and help guide interceptor rockets to them; a series of tests in space of the interceptor rockets themselves, scheduled for the early 1990s; and a test, currently scheduled for 1993, of the Space Surveillance and Tracking System, a satellite that would monitor warheads after they have been released in space.

If the Administration were permitted to adopt its broad interpretation of the treaty, uncertainties over the compliance of these tests would vanish (although some of the space-based interceptor tests would still be of dubious legality since the Administration would have a hard time arguing that the technology is post-1972). But the Pentagon, in a report to Congress last year, argued that it wants to move to the broad interpretation anyway, in order to conduct some tests in the next 3 or 4 years that clearly lie outside anybody's definition of the traditional interpretation. These include shooting down actual missiles with a space-based interceptor, guiding an interceptor to a target by an orbiting laser radar, and the space-based laser test mentioned earlier.

The report was, however, derided by Senators William Proxmire (D–WI) and Bennett Johnston (D–LA), who argued that the proposed experiments are "either unrealistic in their schedule or of dubious military value." The Senate was not persuaded to let the Pentagon begin work on the experiments.

The next few months are therefore likely to see continuing dispute not only over the broad interpretation of the treaty but also over how to apply the traditional interpretation, with the Soviet Union in essence suggesting that it will hold a strategic arms reduction package hostage to its own understanding of what the treaty means.

Some arms control advocates argue that the only way out of this uncomfortable situation is to begin talking with the Soviets in an effort to reach some common understandings of what is permissible. For example, Sidney Graybeal, a former arms control negotiator in the Nixon and Ford administrations, says negotiating a set of commonly agreed limits "would defuse the debate over the narrow versus broad interpretation; it would be in the best interests of the United States and the SDI program."

Last summer, the Soviet Union did, in fact, propose negotiations aimed at prohibiting testing in space of ABM components that exceed certain performance levels. The proposal, which has not been made public, would, for example, have set limits on the brightness of lasers, the size of mirrors, and the speed of interceptors that could legally be tested in space.

Paul Nitze, a senior arms control adviser to the Administration, reviewed the proposal and subsequently circulated a critique that concluded that the specific limits the Soviets proposed would have been unacceptably restrictive. Nitze has, however, continued to

advocate the desirability of negotiating directly with the Soviets on what is permissible under the treaty. At a AAAS arms control symposium last September, for example, he said "the whole theory of the treaty was that when something like this arises, we would talk to the other side about it."

The Department of Defense has, however, been vehemently opposed. Frank Gaffney, who was nominated by former Defense Secretary Caspar Weinberger to succeed Richard Perle as an assistant secretary of defense for arms control, was among the more forceful foes. Gaffney, who is now a resident fellow at the American Enterprise Institute, said in an interview, "we have the right under the treaty to conduct a wide range of research, development, and testing activities. There is no way but that these rights would be circumscribed by negotiating limits." Moreover, because it would be difficult to verify adherence to the kind of performance limits proposed by the Soviets, Gaffney contends that "we would be accepting limitations that would apply unilaterally to the United States."

Ashton Carter, a physicist at Harvard's Kennedy School of Government who has been advising Nitze, argues, however, that a regime establishing limits under the traditional interpretation of the treaty need not be unduly restrictive. "People don't adequately appreciate what can be done within the treaty for testing space weapons," Carter says, noting that tests can be configured to fit into the permissible categories of work on fixed ground-based systems or antisatellite weapons.

An example is a test planned for 1990 in which a small heat-seeking interceptor launched from a rocket at Kwajalein will home in on a second rocket and destroy it in a fiery collision. This would be the first major test of the ability to use a space-based missile to hit a rocket in its boost phase—while its engines are still firing and before it releases its warheads. Unlike the AOA experiment, however, this test has prompted little concern about potential violation of the ABM treaty because it is a ground-based test at a designated test range.

Carter points out that the determination of what SDI testing is permissible rests on unilateral U.S. definitions of the treaty's terms. Like Graybeal, he argues that it would be in the best interests of the SDI program to negotiate what is permissible. "My own view is that such an approach is inevitable," he says.

Any movement toward establishing such limits is, however, not considered likely until the next Administration, when most of the tests that have raised concerns would take place. ■ COLIN NORMAN

Texas Wins R&D Center

Texans may brag that their state capital is also becoming the capital of U.S. electronics R&D after Austin was chosen as the location for a national semiconductor manufacturing research venture. Austin is already the site of the Microelectronics and Computer Technology Corporation (MCC), an electronics industry research cooperative.

The new undertaking, with the acronym Sematech, for semiconductor manufacturing technology initiative, is intended to insure U.S. capabilities in producing advanced semiconductors for military and civilian purposes and bolster U.S. competitiveness in world markets. It is sponsored by a consortium of 14 major semiconductor industry companies with funding from industry, the Department of Defense (DOD), and state and local sources.

An annual operating budget of $250 million is projected for Sematech, half from member companies and half from federal, state, and local governments. The Sematech board selected the site on 5 January after federal funding of $100 million this year was voted 2 weeks earlier by Congress.

Sematech will have three main missions: to carry out R&D on advanced semiconductor manufacturing techniques, test them on a demonstration production line, and transfer the techniques to U.S. producers. Members of the consortium will have first call on Sematech developments.

National security considerations persuaded DOD to take the unusual step of directly funding a partnership with industry (*Science*, 6 November 1987, p. 748). DOD is concerned that the loss of markets by U.S. semiconductor firms to Japanese competitors could result in the erosion of U.S. technological leadership, making the U.S. military dependent on foreign suppliers for advanced microelectronics components.

The Texas proposal was chosen from among 12 finalists. Originally, 135 sites in 34 states had been proposed. The head of the site selection committee, Sanford L. Kane, IBM general technology division vice president, declined to discuss the comparative merits of the competing proposals. He was quoted, however, as saying "Texas had the most solid proposal across the board, in all areas of our criteria."

Last fall, Kane said that, in addition to financial incentives offered by the states competing for the award, criteria for selection would be adequate facilities and utilities, ties with nearby universities to provide research support and educational opportunities for Sematech employees, and quality of life considerations.

The financial inducements offered in the Austin proposal were valued at more than $60 million. Included in the offer was use of a plant built in Austin by Data General but never occupied. The University of Texas played a central role in the Texas drive to land Sematech by making $15 million in university funds available and agreeing to guarantee $35 million in bonds which the state legislature authorized. Asked why Sematech chose Austin, University of Texas provost Hans Mark noted that the university has a strong electrical engineering program and said he thought "another reason they liked us was that we had recognized the problem and made our own investment." He said the university planned a facility for electronic device packaging research and the regents had approved $20 million for a building. Mark also observed that the presence of MCC in Austin offered a unique opportunity for "synergism."

Snaring Sematech with its $250-million annual budget is viewed as a significant boost to Austin and the Texas economy in general. The direct yield is estimated at 800 to 1000 jobs and Sematech is expected to attract more firms to the area.

American electronics companies have traditionally competed fiercely with each other and resisted collaboration on research. James Meindl, provost at Rensselaer Polytechnic Institute and a member of the Defense Science Board task force that called for an initiative in the Sematech mold, notes that the U.S. semiconductor manufacturing equipment industry is "extremely fragmented," and the cost of research is escalating.

This trend is likely to give incentive for U.S. companies to support Sematech, says Meindl, since "Tooling costs for a semiconductor manufacturing line are getting so large that," that even the biggest American companies will be "pleased to continue in Sematech." ■ JOHN WALSH