Appendixes

Appendix A

Ballistic Missile Defense and the ABM Treaty

Introduction

This appendix examines the provisions of the 1972 Anti-Ballistic Missile Treaty,[1] the limitations these provisions place on development, testing, and deployment of ABM systems, and the sometimes conflicting interpretations that have been applied to the key elements of the treaty. In addition, this appendix discusses the SDI program (as presented in the fiscal year 1986 authorization request) and the issues that this program raises with respect to ABM Treaty compliance.[2] Soviet compliance with the ABM Treaty and Soviet ballistic missile defense programs are not discussed.[3]

This appendix concludes that if one accepts the Defense Department's current interpretation of key terms of the ABM Treaty, one may also conclude that the current SDI program is treaty compliant. Applying a more restrictive interpretation to key treaty terms could have the opposite result.

Treaty Overview

Purpose

The ABM Treaty is an agreement of unlimited duration between the United States and the Soviet Union which places restrictions on the development, testing, and deployment of ballistic missile defense systems. The purposes of this treaty, as stated in Article I, are to "limit anti-ballistic missile (ABM) systems, "[4] and to prevent either party from deploying "ABM systems for a defense of the territory of its country. "[5] Although the treaty does allow limited ABM deployments, such deployments are restricted so that they could neither provide a nationwide ABM defense nor serve as the basis for deploying one. The effect of the ABM Treaty is to leave essentially unimpaired the penetration capability of either side's ballistic missile forces.

Major Provisions

Article III of the ABM Treaty prohibits all ABM deployments except those which are explicitly permitted. This article, as amended,[6] allows one fixed, land-based ABM site in each country to be located either at the nation's capital or at an ICBM field. No more than 100 interceptor missiles and 100 launchers can be deployed at the allowed site. If the national capital is chosen as the ABM site, no more than six radar complexes—each having a radius of no more than 3 kilometers-are allowed. A site to defend ICBM fields may have 2 large ABM radars and 18 smaller ABM radars, These provisions were designed to accommodate existing U.S. and Soviet ABM systems.

The United States originally elected to deploy its ABM system at the ICBM field at Grand Forks, North Dakota. This system is no longer operational, although the acquisition radar is still used for early warning purposes. The Soviets elected to deploy their ABM system around Moscow. This system is operational and is being modernized within the limits of the treaty.

Article IV permits testing, at designated test sites, of certain systems not deployable under Article III. However, systems permitted at test sites, as well as deployments, are severely constrained by Article V, in which "each party undertakes not to develop, test, or deploy ABM systems or components which are sea-based, air-based, space-

Treaty Between the United States of America and the Union of Soviet Socialist Republics on the limitation of Anti-Ballistic Missile S}. stems, which entered into force Oct. 3, 1972 App. B contains the full texts of tht '1 reaty, its agreed interpret ations, and its 1976 Protocol.

[2] The Reagan Administration's view on compliance of the S1)1 program with the ABM Treaty is described in detail on pp. B-1 to B-9 of *Report to the Congress on the Strategic Defense Initiative, 1985*, issued by the Department of Defense in April 1985

Other views on this issue are discussed in.

- Ahram Chayes, Antonia Chayes, and I+; liot Spitter, "Space Weapons and International Law," *Daedalus*, summer 1985.
- Thomas K Longstreth, John E. Pike, and John B Rhinelander, *The impact of U.S and Soviet Ballistic Missile Defense Programs on the ABM Treaty* (Washington, DC: National Campaign to Save the ABM T reaty, M arch 1985)
- A Ian B Sherr, *Legal Issues of the "Star Wars" Defense Program* (Host on, MA: Lawyers Alliance for Nuclear Arms Control, Inc, June 1984)
- f{. Jeffrey Smith, " 'Star Wars' Tests and the ABM Treaty, " *Science,* July 5, 1985, pp. 29-31

[3] For two different views on these subjects, see: *Soviet Military Power, 1985*, U s Department of I Defense (Washington, I) C': U.S. Government Printing Office, April 1985); and Longstreth, et al., op. cit. Soviet BM I) research is also discussed briefly in chs. 3 and 10 of this study.

[4] [bid., Article I (1).

[5] Ibid., Article 1 (2).

[6] originally., the treaty had allowed each side one A B M site to defend its capital and another site to defend one ICB M field The treaty was amended by a 1976 Protocol to allow only one ABM site on each side.

based, or mobile land-based. " Only fixed, land-based systems can be developed or tested, and only the fixed, land-based systems specified in Article III can be deployed. The second part of Article V prohibits launchers capable of firing more than one interceptor as well as launchers capable of being rapidly reloaded. Agreed Statement E, approved by U.S. and U.S.S.R. delegation heads at the same time that the treaty was signed, makes clear that Article V prohibits development, testing, or deployment of ABM interceptor missiles carrying more than one independently guided warhead.

Giving non-ABM systems ABM capabilities is prohibited in Article VI(a), as is the testing of non-ABM systems "in an ABM mode."[7] Part (b) of Article VI restricts ABM battle management radars by requiring early warning radars to be on the periphery of the country and oriented outward. Agreed Statement F excludes radars used "for the purposes of tracking objects in outer space or for use as national technical means of verification" from the location and orientation restrictions in Article VI(b).

Article XII prohibits interference with verification of the treaty, both by banning interference with the national technical means used for verification and by prohibiting "deliberate concealment measures" which would impede verification by national technical means.

Article X1X1 establishes the Standing Consultative Commission (SCC) to handle questions relating to treaty compliance, to consider possible amendments, and to consider proposals for further limiting strategic arms.

Agreed Statement D reaffirms the parties' intentions not to deploy ABM systems or components except those specifically allowed in Article 111. The Statement notes that ABM components based on "other physical principles" and capable of substituting for interceptors, launchers, or radars would be "subject to discussion" in the Standing Consultative Commission. "Specific limitations" on such new systems and their components would require amendment of the treaty. In the absence of amendment, Article III of the Treaty would prohibit the deployment of such new components. Article V would prohibit their development, test or deployment if they were to be space-, air-, sea-, or mobile land-based.

[7] Although the treaty does not define "non-ABM systems, " these could include air defense systems, anti-tactical ballistic missile systems, strategic offensive missiles, or anti-satellite weapons.

Definitions

Ballistic missile defense involves a complicated and rapidly evolving set of technologies. Recognizing this, the drafters of the ABM Treaty tried to use language that was precise enough to effectively limit then-existing ABM systems, yet flexible enough to constrain technologies which might be developed in the future. This attempt to control potential ABM systems unavoidably introduces an element of ambiguity. The treaty language discussed below has been the focus of continued legal and technical scrutiny since the ABM Treaty was drafted; however, recent interest in advanced ABM systems has caused these discussions to take on increased significance. The relationship between these terms and the current SDI research program is discussed in the following section.

The drafters of the ABM Treaty recognized that ambiguities would arise, particularly with regard to new technologies (the so-called "other physical principles" mentioned in Agreed Statement D), but they assumed that such ambiguities would be dealt with in the context of the SCC or through treaty amendment. The reason for this assumption is a practical one. Treaty language is the expression of the agreed expectations of the parties. Put simply, a treaty means what the parties have agreed that it means. Unilateral determinations of compliance-although essential to the domestic political debate–do not bind other parties. To the extent that such determinations are inconsistent with the expectations of other parties to a treaty, then the basis of the treaty is eroded. This issue of compliance is, of course, separate from broader considerations such as the U.S. determination of the present and future value of the ABM Treaty.

"ABM Systems"

Article II of the ABM Treaty defines an anti-ballistic missile system as "a system to counter strategic ballistic missiles or their elements in flight trajectory. " This definition is followed by the words "currently consisting of" and then a list of three items: ABM interceptor missiles, ABM launchers, and ABM radars. However, the treaty is not restricted to these specific systems. This subject is discussed in greater detail below.

The ABM system definition is limited to *strategic* weapons. Systems to counter *tactical* missiles are not covered at all. It is important to note that the treaty defines an ABM as a system *to counter* strategic weapons. It does not say "sys-

tern designed to counter, " as the Soviets would have liked, nor does it read "system capable of countering, which was the United States' preferred wording. The United States was concerned that, by upgrading surface-to-air missiles (SAMs), the U.S.S.R. would be able to deploy a considerable ABM capability. The Soviet Union, on the other hand, was concerned that it would be forced to classify some 10,000 SAMs as ABM interceptors.[8] The current treaty language is, therefore, a compromise between the Soviet and U.S. positions. The treaty lists the components of a then-existing ABM system but is silent on the question of how to characterize future technologies as ABM systems or components. Neither the U.S. "capabilities" test nor the Soviet "intentions" test is sanctioned by Article II of the Treaty.[9]

Some of the problems caused by the lack of a clear definition in Article II are solved by the prohibition in Article VI against giving non-ABM systems ABM capabilities. As a result, all systems which are ABM-capable, whether or not they were designed for that purpose, are either considered ABM systems under Article 11 or else are in violation of Article Vi(a), which prohibits giving ABM capability to non-ABM systems.

Testing "in an ABM Mode"

Although Article VI prohibits the testing of non-ABM components "in an ABM mode, " the ABM treaty does not define these terms. The United States, in a unilateral statement attached to the treaty, provided its interpretation of this phrase.[10] By the U.S. definition, a launcher was tested "in an ABM mode" if it was "used to launch an ABM interceptor missile"; a missile was "tested in an ABM mode" if it was ". . . flight tested against a target vehicle which has a flight trajectory with characteristics Of a strategic ballistic missile flight trajectory . . . "; and a radar was tested "in an ABM mode" if it "makes measurements on a cooperative target vehicle [with a strategic ballistic missile flight trajectory] . . . or makes measurements in conjunction with the test of an ABM interceptor missile or an ABM radar at the same test range.

In 1978, the United States and the Soviet Union reached an agreement in the SCC regarding the interpretation of the phrase "in an ABM mode' ';ll however, the text of the 1978 Agreed Statement remains classified.

"Development"

Because the path between research and deployment of any sophisticated weapon system is long and complicated, considerable effort has gone into determining precisely what is meant by the treaty s ban on specific types of ABM development. Perhaps the clearest definition of the words "development" and "develop," as referred to in Articles IV and V of the ABM Treaty, was provided by Gerard C. Smith, the chief U.S. negotiator of the ABM Treaty. In testimony before the Senate Armed Services Committee in 1972, Ambassador Smith stated:

> The obligation not to develop [ABM] systems, devices or warheads would be applicable only to that stage of development which follows laboratory development and testing. The prohibitions on development contained in the ABM Treaty would start at that part of the development process where field testing is initiated on either a prototype or breadboard model. It was understood by both sides that the prohibition on 'development' applies to activities involved after a component moves from the laboratory development and testing stage to the field testing stage, wherever performed. The fact that early stages of the development process, such as laboratory testing, would pose problems for verification by National Technical Means is an important consideration in reaching this definition. Exchanges with the Soviet Delegation made clear that this definition is also the Soviet interpretation of the term 'development'.[12]

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[8] U.S. Congress, office of Technology Assessment, ***Arms Control*** *in Space: Workshop Proceedings* (Washington, DC: U.S. Government Printing Office. May 1984), OTA-BP-ISC-28, p. 33.

[9] The compromise language of the treaty does not resolve this still current and controversial issue. The ***Report*** to *Congress on the* ***Strategic*** *Defense Initiative. 1985*, op. cit., states on p. B-2 that "Compliance [with the ABM Treaty] must be based on objective assessments of capabilities which support a single standard for both sides and not on subjective judgments as to intent which could lead to a double standard of compliance. " (Emphasis added.)

[10] On Apr. 7, 1972, the U. S. Delegation made the following statement:

> To clarify our interpretation of "tested m an ABM mode, " we note that we w ould consider a launcher, missile or radar to be 'tested m an ABM mode if, for example, any of the following events occur (1) a launcher is used to launch an ABM interceptor missile, (2) an interceptor missile is flight tested against a target vehicle which has a flight trajectory with characteristics of a strategic ballistic missile flight trajectory, or is flight tested in conjunction with the test of an A BM interceptor missile or an ABM radar at the same test range, or is flight tested to an altitude inconsistent with interception of targets against which air defenses are deployed, (3) a radar makes measurements on a cooperati v e target vehicle of the kind referred to in item (2) above during the reentry portion of its trajectory or makes measurements in conjunction with the test of an ABM interceptor missile or an A BM radar at the same test range Radars used for purposes such as range safety or instrumentation would be exempt from application of these criteria

[11] "U.S. Senate Committee on Foreign Relations, *SALT II Treaty: Background Documents;* "Miscellaneous Agreements Relating to the Standing Consultative Commission" forwarded from J. Brian Atwood, Department of State, to Senator Frank Church, Nov. 13, 19'79.

[12] Senate Armed Services Committee, July 18, 1972.

ABM "Component"

The limitations of the ABM Treaty apply to "ABM systems or their components" and, under the terms of Agreed Statement D, to future systems and components which might be substituted for these. This raises two related questions. First, how does one distinguish between an ABM component, the testing or deployment of which is prohibited, and a subcomponent or adjunct, the testing or deployment of which is allowed? Second, how does one determine whether a system, component, or subcomponent is capable of substituting for a missile, a launcher, or a radar? The treaty language and the Agreed Statements which accompany the Treaty are silent on this point.

It is the Defense Department position that the entire SDI research program as submitted in the fiscal year 1986 authorization request is treaty compliant. In its 1985 Report to Congress on the Strategic Defense Initiative, DOD acknowledges that Ambassador Smith's definition of "developmerit, " combined with the limitations of Article V, would prohibit the "field testing" of "ABM systems" and "components," or their "prototypes" and "breadboard models, " which are other than fixed land-based. " However, the Defense Department maintains that the experiments currently planned for the SDI program "are designed to demonstrate technical feasibility that can be established without involving ABM systems or components or devices with their capabilities. "[14] DOD is arguing that since they are testing subcomponents and not components, and since the specific systems they are testing cannot be substituted for an ABM missile, launcher, or radar, then this research is allowed under Ambassador Smith's interpretation of the Treaty.

Others disagree with DOD's interpretation. They argue that this line of reasoning ignores the history of the treaty negotiations which clearly suggests that the individual parts of an ABM system need not perform the complete range of battle functions to be considered an "ABM component, " A report by the National Campaign to Save the ABM Treaty recently made the following argument:

> [The] early Nike-Zeus [U.S. ABM] system had not one or two, hut *four* separate types of radars, for target acquisition, decoy discrimination, target tracking and interceptor tracking. Under . . . [the DOD] . . . interpretation of the difference between a "component" and an "adjunct," all of these radars would be considered to be adjuncts to one another, and none of them would be considered to be a component.[15]

The debate on this issue reflects disagreement as to whether the classification of something as an ABM system or component should be based solely on its capabilities in isolation, or whether other factors should be examined, such as its capability when combined with other devices or the apparent intentions of the parties (whether declared or evidenced by a clear pattern of activities). DOD is arguing that one looks to the capabilities of the tested systems alone to determine whether they can substitute for ABM systems or components; if they can, then they are banned by the Treaty, if they cannot, then they are allowed. Others maintain that this view is too restrictive. They argue that although capabilities are important, one must also examine the apparent intended application of a technology. Standing alone, individual technologies may have no ABM capability; however, in combination, they may have a significant ABM potential.

In addition, the tested capabilities of specific systems may not always be an adequate measure of potential. Lack of ABM capability may result from true technological limitations, or from "treaty compliant" design features that could be easily altered (e.g., putting on wheels, inserting a few additional electronic devices, or readjusting some control parameters). The distinction between these two cases must ultimately be made by the other side with the help of its national technical means of verification. It is unlikely that either side will be content to rely on the word of the other that a given experiment is treaty compliant; presence or absence of ABM capability must be manifested in ways which are amenable to verification. According to the report of the National Campaign to Save the ABM Treaty:

> The clear intention of Article V was to limit the development of new types of ABM technology at the earliest possible stage, that is, at the time that they would become detectable by national technical means.[16]

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[14] *Report to Congress on the Strategic Defense Initiative, 1985*, op. cit., p. B-4.
[15] Ibid., p. B-2.
[15] Longstreth, et al., op. cit , p. 29.
[16] Ibid., p. 30.

U.S. Research Programs and the ABM Treaty

The SDI Program

The purpose of this section is to examine specific elements of the current U.S. BMD research programs and to determine whether they raise important questions of ABM Treaty compliance. However, there is no simple formula for deciding what is and what is not banned by the 1972 ABM Treaty. Previous sections have examined the language of the treaty and described the controversy surrounding such terms as "ABM system, "component, " and "capable of substituting for. " As this discussion makes clear, the inherent limitations of language and the rapid pace of technology make it impossible to develop clear, unambiguous, and objective standards by which to measure all possible research programs. As noted earlier, the general conclusion of this appendix is that if one accepts the Defense Department's current interpretation of key treaty terms, one may also reasonably accept the conclusion that the current SD I program is treaty compliant. Applying a different interpretation to these key terms could have the opposite result.

With these caveats in mind, it is useful to examine the actual elements of the SD I program. Current SD I program plans call for 15 major experiments designed to demonstrate technologies which may eventually have ABM applications. Three of the experiments will examine sensor technologies, four will involve directed-energy technologies, three will study kinetic-energy technologies, and five will involve the testing of fixed, ground-based ABM components.

Sensor Programs:

Boost Surveillance and Tracking System (BSTS).–BSTS is a space-based experiment to demonstrate technology for upgrading the current satellite early warning system. If successful, the experiments will permit a decision to proceed with similar but more advanced technologies for ABM purposes. BSTS will be capable of performing early warning functions; however, DOD asserts that it "will be limited in capability so that it cannot substitute for an ABM component. In particular, it will not be given the capability to process launch detection data in real time. For this reason, DOD claims that this system does not violate Article V(1) of the ABM Treaty which bans the development, testing, or deployment of space-based ABM components. [17]

DOD is correct in arguing that the currently proposed BSTS system would be limited to an early warning role. However, the issue of BSTS Treaty compliance stems not only from the system's capabilities, but also from the changing nature of early warning systems. When the ABM Treaty was drafted, early warning satellites were not considered to be ABM components, or part of an ABM system, because the satellites had limited capabilities and BMD weapon systems had not yet been conceived which could use the boost-phase data these satellites produced. [18] BSTS, like its predecessors, is an early warning system; however, unlike its predecessors, BSTS might eventually contribute to the effectiveness of a layered ABM system. Assuming the existence of BMD weapons which could use BSTS data to provide acquisition and tracking information, BSTS would have to be given closer scrutiny than it would if it could only serve as an advanced early warning system.

Space Surveillance and Tracking System (SSTS).–Originally designed as an upgrade to the ground-based *Spacetrack* satellite tracking network, SSTS will demonstrate the space-based technology necessary to track and identify objects already in space. [19] SSTS technology, if perfected, could be used to support the U.S. ASAT weapon or to provide information for midcourse ABM interceptors. DOD maintains that the SSTS program is ABM Treaty compliant because the "capabilities of any demonstration satellites will be significantly less than those necessary to achieve ABM performance levels or substitute for an ABM component." [20]

If developed as originally conceived—i.e., as a component of our satellite tracking network—SSTS would probably not have raised serious ABM compliance issues even though such a system could have supplied information useful to BMD research. However, now that SSTS is part of the SDI program, DOD's assessment that it is not an ABM component will probably need to be periodically reexamined as more specific information on testing procedures and system capabilities becomes available.

Airborne Optical Adjunct (AOA).–The AOA experiment will demonstrate the technical feasibility of using optical sensors on an airborne platform for BMD applications. As part of its feasibility demonstration, AOA will observe ballistic missile

[17] *Report to Congress on the Strategic Defense Initiative. 1985*, op cit., p. B-6.

[18] Early warning *radars*, on the other hand, being *similar* in capability to ABM battle management radars, are specifically limited by the Treaty.

[19] SSTS tracks and identifies objects in space; BSTS identifies launches and objects entering space.

[20] *Report to Congress* on the Strategic Defense *Initiative, 1985*, op. cit., p. B-7.

tests at agreed ABM Test Ranges. DOD maintains that because of limitations on sensor and platform performance, the AOA could not substitute for an ABM component and therefore does not violate the ban in Article V(1) against developing air-borne ABM components.

Clearly, if AOA were designated as a "component" rather than as an "adjunct," the planned tests "in an ABM mode" would violate Article V(1) of the ABM Treaty. Here, as in other SDI programs, the distinction between an adjunct or subcomponent and an ABM component depends less on objective determinations of capability than on how one defines those terms.

Directed-Energy Programs:

ALPHA/LODE/LAMP. –ALPHA is a ground-based laser designed to explore the potential of chemical lasers in space-based BMD applications. LODE (Large Optics Demonstration Experiment) and LAMP (LODE Advanced Mirror Program) are experiments to demonstrate critical beam control and optics. In the late 1980s, the LODE/LAMP mirror is to be integrated with a high-power chemical laser using LODE beam control technology. DOD reports that "All of these tests are underroof experiments using devices incapable of achieving ABM performance levels." [21]

The ALPHA/LODE/LAMP series of tests, if conducted in the laboratory, would seem to be consistent with the generally accepted view that the ABM Treaty's prohibitions on development only apply "to that stage of development which follows laboratory development and testing. "

Acquisition, Tracking and Pointing (ATP).–For the near term, ATP[22] experiments will concentrate on ground-based, laboratory-level experiments on the technology required for space- and ground-based weapon sensors. In the future, "the measurement of booster plumes from space is a distinct possibility, "2[3] as are "experiments with passive sensors in the Shuttle bay. "[24] The Shuttle may also be used in follow-on experiments "to explore pointing and tracking technology. "2[6] It is DOD's position that "If conducted these experiments will use technologies which are only part of the set of technologies ultimately required for an ABM component. These devices will also not be capable of achieving ABM performance levels. "

As long as the ATP tests remain in the laboratory there would be no violation of the ABM Treaty. The proposed space-based tests would violate Article V(1)'s prohibition against testing space-based ABM components if they were considered as "components" or as being able to substitute for ABM components. Administration officials have argued that these are generic experiments investigating pointing and tracking technologies which would have many applications and could not substitute for ABM components.

Integration of High-Powered Laser and Optical Devices.–The Defense Department eventually plans to integrate ALPHA/LODE/LAMP, ATP, and perhaps other laser and optical subsystems into one "experimental device. " This "experimental device" will be used for "ground-based testing against ground-based static targets. " DOD claims that these "important subsystems . . . (separate or in whole) are not ABM components or prototypes. " This position rests on three arguments: 1) this "experimental device" is not capable of being based in space; 2) the power, optics, and laser wavelength are not compatible with atmospheric propagation at ranges useful for ABM applications; and 3) tests are not planned against missiles or their elements in flight.

This argument rests on the assumption that the "experimental device" in question here, although more than a subsystem or adjunct, is still less than a component or prototype. The ultimate credibility of this assumption probably cannot be assessed until more precise information becomes available on the nature of the "experimental device" and its tests.

Ground-Based Laser Uplink. -These experiments will use a ground-based laser to examine the effects of the atmosphere on beam propagation. DOD maintains that the tests are treaty compliant because "the testing mode and capabilities are below the power level and beam quality required for a ground-based laser ABM weapon, and testing will not include strategic ballistic missiles or their elements in flight. "[26]

The testing of ground-based lasers at agreed ranges would not violate the terms of the ABM Treaty. The testing of mirrors in space to redirect the beam of a ground-based laser would raise compliance questions.

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[21] Ibid.

[22] The ATP program is a replacement for the now-canceled *TALON GOLD* tracking telescope. Originally. *TALON GOLD* was to have flown on the Shuttle to test the technology necessary to ensure that a laser was properly aimed at its target.

[23] *Report* t. *Congress on* the *Strategic Defense Initiative, 1985*, op. cit., p. B-6.

[24] Ibid., p. B-i'.

[25] Ibid.

[26] Ibid.

Kinetic-Energy Programs:

Space-Based Kinetic-Kill Vehicles.–This program will be designed to prove the feasibility of rocket-propelled projectile launch and guidance. If successful, this technology might be used as an anti-satellite weapon or to defend against such weapons. In a more advanced form, space-based kinetic-kill vehicles might have applications as ABM interceptors. To attempt to ensure that this program does not violate the ABM Treaty, DOD intends to limit the performance of the demonstration hardware to satellite defense missions. Testing may include "intercepts of certain orbital targets simulating anti-satellite weapons. "

The ABM Treaty does not ban anti-satellite weapons or weapons used for satellite defense, unless those weapons are tested "in an ABM mode, " or could substitute for ABM systems or components. However, it should be noted that the trajectory of a ballistic missile in flight-although not orbital-resembles in many ways that of a satellite. Anti-satellite weapons and other "gray area" systems will be discussed in a later section.

Land-Based Electromagnetic Railgun. -This program will demonstrate the capability to launch unguided and guided projectiles from an electromagnetic accelerator know as a "railgun." DOD claims that test devices will not be ABM components, will not be tested "in an ABM mode, " and will not have ABM capabilities.

Testing a railgun in the laboratory or in a fixed, ground-based mode at an ABM test range would not violate the terms of the ABM Treaty.

Space-Based Electromagnetic Railgun. -This program would investigate the feasibility of space-based railgun operation. DOD claims that the program would "demonstrate a capability to defend against anti-satellite interceptors and will also permit a decision to be made on the applicability of more advanced technology for ABM purposes. " However, "specific performance parameters . . . will be established to satisfy Treaty compliant guidelines. "

As with space-based kinetic-kill vehicles, space-based railguns might be tested as ASAT weapons or satellite defense weapons without violating the ABM Treaty. However, as discussed below, the distinctions between ASAT and BMD technologies and applications become less clear as the systems become more capable,

ABM Systems or Components:

Fixed, Ground-Based ABM Launchers.–SDI also plans to conduct tests of "ABM components" at designated ABM test ranges. Two such tests, the *High Endoatmospheric Defense Interceptor (HEDI)* and the *Exoatmospheric Reentry-Vehicle Interceptor Subsystem (ERIS),* will demonstrate the capability to intercept strategic ballistic missile warheads within and above the atmosphere. Since such tests will be at agreed test ranges, using fixed, ground-based launchers which cannot be rapidly reloaded, and since each interceptor missile is not intended to deliver more than one independently targetable warhead, these two programs are permitted by the ABM Treaty.

Terminal Imaging Radar (TIR). –TIR is a radar that will be tested "in an ABM mode. " This radar will be used to discriminate between reentry vehicles and transfer this information to interceptor missiles. DOD has announced that since the TIR tests will be conducted at a designated ABM test range from a fixed, land-based platform, they are treaty compliant.

If TIR were mobile, testing it "in an ABM mode" would violate Article V(1) of the Treaty. As this and similar technologies are developed, it will be necessary to distinguish between those systems which are incapable of operation except when fixed and land-based and those which are designed to be fixed and land-based but could operate in a mobile mode with little or no redesign.

Long Wavelength Infrared (LWIR) Probe. –The LWIR probe appears to be designed to provide a data base with which to evaluate optical system sensors, It is conceivable that this technology might also eventually substitute for current ABM radars. Even if operated as a "pop-up radar, " systems based on the LWIR probe would not seem to violate Article V(1)'s prohibition against sea-, air-, space-, and mobile land-based ABM systems and components. In any case, since DOD plans to conduct the LWIR tests from fixed, land-based launchers at agreed test ranges, this program does not seem to raise treaty compliance issues.[27]

Integrated Demonstration. -DOD will eventually wish to test the HEDI and ERIS interceptors with the Terminal Imaging Radar and associated command, control, and communication systems to perform terminal defense engagements. If conducted at agreed test ranges with fixed, ground-based launchers and radars, and assuming no rapidly reloadable launchers or multiple independently guided warheads, then such tests would be allowed under the treaty,

[27] *"Report to Congress on the Strategic Defense Initiative, 1985,* op. cit., p. B-9.

Other "Gray Area" Programs

In addition to the questions raised by current and proposed BMD programs, research into anti-satellite weapons, anti-tactical ballistic missiles, and large phased-array radars also pose ABM Treaty questions. In certain cases, parts of these technologies could also function as components or adjuncts to BMD systems; in other cases, research essential for non-ABM systems will supply information critical to BMD research.

Anti-Satellite Weapons.–There is great overlap between BMD and ASAT technologies. In general, even a poor anti-ballistic missile could be an excellent ASAT. The trajectory of a missile reentry vehicle while outside the atmosphere—peak altitude on the order of 1,000 km and velocity slightly suborbital-is similar to that of a satellite. The Soviet GALOSH ABM system was not designed as an ASAT but may have ASAT capability for satellites in orbits similar to ICBM trajectories. The U.S. miniature homing vehicle ASAT weapon evolved from a design originally intended for mid-course BMD.

Conversely, since technologies investigated for ASAT may also be useful in a BMD role, aggressive ASAT development could aid in the development of advanced BMD systems. Technology development ostensibly for advanced ASAT systems might provide a loophole for undertaking BMD research which might otherwise be considered a violation of the ABM treaty.

Developing an ASAT system which had BMD capability, or upgrading one to give it BMD capability, would be a violation of either Article V or VI of the ABM Treaty. Nonetheless, since information valuable to ABM research could be obtained from tests "in an ASAT mode" even before an ABM capability was achieved, ASAT weapon development could help to erode the ABM Treaty.

Large Phased-Array Radars. -Another relevant connection between ASAT systems and the ABM Treaty involves the large phased-array radars required for ASAT space surveillance and battle management. Space-track radars may be hard for an adversary to distinguish from the early-warning radars and ABM battle management radars which are currently limited by the ABM treaty. In addition to their space surveillance and tracking role, such radars can also provide early warning of missile and bomber attack and would be essential components of any ABM system. Such systems may also be used to observe missile tests in order to assist verifying compliance with treaty obligations.

Agreed Statement F in the ABM Treaty exempts space-track radars, and radars used for national technical means of verification, from the siting restrictions on ABM and early-warning radars. ASAT development will certainly stimulate development and deployment of space monitoring radars and sensors. To the extent that the distinction between an early warning radar and a space track radar is ambiguous, confusion can result which raises additional ABM Treaty compliance questions.

Anti-Tactical Ballistic Missiles.–Since the ABM Treaty prohibits defenses only against *strategic* missiles, anti-tactical ballistic missiles (ATBM) systems are not prohibited. Anti-tactical ballistic missiles were not included in the ABM Treaty because the United States wished to protect SAM-D, a surface-to-air missile then under development.[28] Since the treaty was signed, the Soviets have developed and deployed a weapon similar to the original SAM-D.

Aggressive ATBM development and deployment might affect the continuing viability of the ABM Treaty. Missiles deployed under the rubric of anti-tactical ballistic missiles could have an impact on the penetrativity of both sides' SLBMs. Eventually, ATBM systems could become so capable as to completely undercut the provisions of the ABM Treaty which prevent the development and deployment of systems to defend against ICBMs.

SDI and the Allies

Under Article IX of the ABM Treaty, the United States and the Soviet Union each agree not to "transfer to other States, and not to deploy outside its national territory, ABM systems or their components limited by [the ABM] Treaty. " Agreed Statement G of the Treaty declares the intention of the signatories that Article IX's provisions should extend to "technical descriptions or blue prints specially worked out for the construction of ABM systems and their components . . . "

The Reagan Administration has stated its intention to "proceed with cooperative research with the Allies in areas of technology that could contribute to the SDI research program. "[29] However, the Administration has assured Congress that

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"SAM-D was intended to have some capability against short-range tactical ballistic missiles as well as against aircraft. However, as SAM-D developed (changing its name to 'Patriot'), its anti-tactical missile capabilities were not pursued.

"*Report to Congress on the Strategic Defense Initiative, 1985,* op. cit., p. A-4.

such research will be "consistent with existing international obligations including the ABM Treaty, "3° and that "the United States will not seek to arrange for the Allies to do for the United States what it cannot do under the Treaty. ''[31]

Attempts to define the precise nature of Article IX's prohibitions encounter many of the difficulties already discussed (e. g., how to define an ABM system or component or how to characterize advanced ATBMs). The ABM Treaty does not constrain cooperative laboratory research efforts. The Treaty would, however, prevent joint development, testing, production, or deployment of ABM systems or components, including those—e.g., fixed, land-based launchers and interceptors–which the United States, acting alone, could legally develop, test, produce, and deploy.

[30] Ibid.
[31] Ibid.