Arms Control in Space

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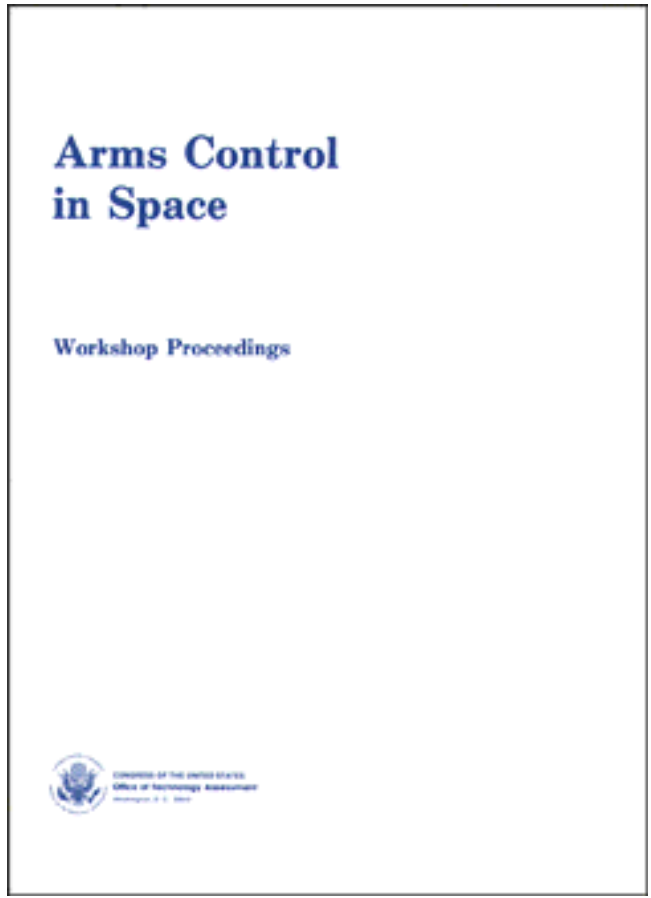

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Workshop on Arms Control in Space
January 30-31, 1984

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NOTE: Several participants were originally invited as alternates for others who could not attend the entire workshop.

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Contents

Contents—Continued

Summary

In late 1982 and early 1983, the Subcommittee on Arms Control, Oceans, International Operations, and Environment of the Senate Committee on Foreign Relations held hearings on space weapons and arms control. To explore these issues further in a discussion format not easily achieved in hearings, Sen. Larry Pressler, Chairman of the Subcommittee, asked OTA to conduct a workshop focusing on anti-satellite (ASAT) weapons as one aspect of space arms control. The workshop, held in Washington, D. C., on January *30* and 31, 1984, provided an opportunity for technical, diplomatic, military, and policy-analysis experts to interact, think out loud, and build upon each other's ideas.

The workshop was organized into six sessions, although issues involving anti-satellite weapons and arms control are not easily compartmentalized into distinct subject areas. Each session was introduced by a 10- or 15-minute informal oral presentation which set the stage for further discussion. This workshop proceedings volume is organized along the same divisions as the sessions, with some rearrangement.

The first session, an overview, reviewed technical aspects of anti-satellite systems and presented a candidate set of topics for discussion in later sessions. The second session covered pros and cons of ASAT arms control. Soviet attitudes and efforts regarding ASATs were the focus of the third session; U.S. attitudes and developments in ASATs and ASAT arms control were reviewed in the fourth. The effect of ASATs on the continued viability of the 1972 Anti-Ballistic Missile (ABM) Treaty, and vice versa, were covered in the fifth session. The last session centered on verification issues.

At Senator Pressler's request, OTA is publishing the workshop proceedings. OTA's agreement with the panelists was that the workshop report would discuss the viewpoints, ideas, and findings arrived at during the conference, but that particular statements or opinions would not be attributed to specific individuals. Therefore, the transcript has been paraphrased and rearranged to form this report. The proceedings have been circulated among the panelists, who were given the opportunity to suggest corrections and clarifications. They have not been reviewed by the Technology Assessment Board.

The workshop panelists were asked to raise and clarify issues, not to resolve them. No attempt was made to reach conclusions or develop consenses during the workshop sessions. However, OTA has noted and listed below several points where the panelists appeared to be in general agreement. These points are followed by a brief discussion of some of the fundamental bases for disagreement among the panelists. Following that is a list of some issues, raised during the course of the workshop, which were felt to merit further research and analysis.

POINTS OF GENERAL AGREEMENT

No arms control agreement can eliminate all anti-satellite capability. However, panelists differed in interpreting the significance of this residual ASAT capability which would be infeasible or impractical to ban. Some systems not designed to be ASATs (ICBMs, manned spacecraft, etc.) nevertheless have some ASAT potential, making some de facto residual ASAT capability inevitable. ASAT arms control supporters stressed that it would be minor compared to the capability of extensive ASAT or "space mine" efforts which could be undertaken in the absence of an arms control agreement, while some of the ASAT arms con-

trol opponents believed that the residual capability might nevertheless pose a significant threat to U.S. satellites.

ASAT arms control cannot eliminate the need to protector supplement vital satellites with a variety of survivability measures. However, it can serve to lessen the measures required to protect space systems. Under any arms control accord, programs to ensure survivability of critical satellites or programs which supplement or replace their function will remain vital. The temptation to assume that survivability measures could be relaxed following an agreement must be resisted. "We could be that stupid, " said one panelist, "but we don't really have to be."

The "verifiability" of an ASAT accord can only be assessed for a specified set of restrictions and measures, and any discussion of the verifiability of a particular provision ought to include consideration of the significance of potential violations of that provision. The panelists did not evaluate in detail, partly because of security classification restrictions, the verifiability of compliance with the various kinds of arms control agreements that were discussed. It was clear that the standards of verification required for effective ASAT arms control are highly controversial. Panelists agreed, however, that bans on testing would require less extensive verification measures than bans on possession, and that compliance with some ASAT arms control provisions could be verified with high confidence.

Future U.S. and U.S.S.R. activities in space hold great potential for generating uncertainty and misunderstanding regarding the countries' respective intentions. Workshop participants agreed that the Soviet Union will continue its vigorous exploitation of space, and that some Soviet activities will be perceived in the United States as provocative. Similarly, some American actions will appear provocative to the Soviets. Both countries will observe activities which they will not completely understand and which will cause considerable concern. Misunderstandings concerning the intent of various space actions could be particularly dangerous during crises or low-level conflicts.

Ambiguities might be lessened or resolved with some type of "rules of the road" or "behavior in space" agreement. Some panelists thought that an agreement concerning behavior in space, or towards space objects, might serve to reduce tensions and uncertainties. Such an agreement need not be associated with other measures limiting anti-satellite weapons systems; indeed, there might be value even if (thought some panelists) or especially if (thought others) there were no accompanying ASAT restrictions. Such an agreement might be modeled after the "rules of the road" on the high seas, which are embodied in several international agreements that recognize freedom to operate, lessen the risk of accidental collision, and minimize unnecessary provocation at sea. Possibly the most valuable feature of a "rules of the road in space" agreement would be the establishment of a forum like the U.S.-U.S.S.R. Standing Consultative Commission, which would help maintain an ongoing dialog between the United States and the Soviet Union and would permit discussion of activities whose significance was not clear. A "rules of the road" agreement should not be allowed to impede more serious provisions concerning space weapons if such provisions are found to be desirable. The precise form of a "space behavior" agreement was not explored in depth at the workshop, and the political and diplomatic procedures and tradeoffs required to negotiate and implement such an agreement were not addressed.

If ASAT threats are reduced by an agreement, there may be fewer reservations about placing important systems in space, creating in turn greater incentive for developing ASAT weapons. If an accord has the effect of relaxing survivability measures at the same time that reliance on space systems is increasing, then the growth of targets both valuable and vulnerable might provide strong motivation to attempt covert ASAT development. This possible paradox reinforced panelists' observations that an ASAT accord is no substitute for effective measures to reduce space system vulnerability.

Preservation of the functions now performed in space does not require the survival of all space

assets. Military support activities carried out in space are very important, but they can be duplicated or distributed among many space systems. Furthermore, many alternatives to space-based systems exist or can be developed.

The idea that the United States needs an ASAT weapon in order to deter enemy ASAT attack was not strongly supported. Many participants felt that the ability to retaliate against terrestrial assets served to deter ASAT attack at least as well as the ability to respond in kind against enemy satellites. Furthermore, one of the rationales other than deterrence which has been given for the U.S. ASAT program-to carry out attacks on particularly hostile Soviet satellites-conflicts with the ASAT's deterrent role. Nobody at the workshop felt that A SAT attack scenarios were well enough understood to predict the outcome of "tit-for-tat" ASAT retaliatory attacks in general. The likelihood and nature of subsequent escalation would be highly dependent on which satellites were attacked and under what circumstances.

The U.S. air-launched ASAT weapon now undergoing testing is clearly technically superior to the present generation of Soviet ground-launched ASATs. The ability to home in from a wide range of directions, and the flexibility of being launched from highly mobile aircraft, will make the U.S. ASAT a considerably more capable weapon if deployed. The United States will be able to launch consecutive ASATs much more rapidly than the Soviets, who are restricted in how rapidly their ASAT can be fired by their limited number of launch sites and by the time required to recycle them. There are also significant asymmetries in the target sets which are at risk to the two systems. Many important space functions are carried out by the United States using satellites in geosynchronous orbit, well out of range of the Soviet ASAT. Many Soviet satellites with similar functions use highly elliptical "Molniya" orbits, which could be vulnerable to U.S. attack at their lower altitudes. However, the United States would face severe logistical and operational difficulties in attempting to exploit this vulnerability. In addition, since Soviet satellites are shorter lived than U.S. satellites and are consequently replaced more frequently, the Soviets may be better prepared to reconstitute space systems than the United States would be.

In spite of asymmetries in capability, neither the existing Soviet ASAT nor the U.S. ASAT undergoing tests poses a severe military threat to the other side. The present level of ASAT technology is significantly limited. Both U.S. and U.S.S.R. weapons are restricted to targets in low Earth orbit and cannot reach geosynchronous orbit. Both systems may have to wait several hours for a target satellite to come within range of the appropriate F-15 base (for the U.S. system) or ground launch site (for the Soviets), although the mobility of the F-15 makes this restriction considerably less severe for the U.S. ASAT. If either the U.S. or the U.S.S.R. system were mated to boosters able to reach geosynchronous orbit, the ascent would take many hours. In light of these limitations, many treaty proponents would tolerate (although not necessarily prefer) a treaty which would "grandfather" existing systems. Perceptions differed as to the relative political implications of the existing U.S.S.R. system versus the U.S. ASAT which is undergoing testing, but nobody felt that the overall military balance was affected significantly by either—especially when compared with potential future ASAT developments.

A ban on testing ASAT weapons would greatly increase the difficulty of developing a high-confidence, high-quality, dedicated ASAT system. Panelists thought it would be very difficult to develop and field a highly capable new system with no detectable tests. Some tests might go undetected—for example, there are many perfectly legitimate activities involving rendezvous in space which could be made to be partial tests of ASAT interception capability—but many tests would be required to instill confidence in an ASAT system, and some of these would probably be detected. Banning the tests would force the violator either to forgo tests or to test covertly; covert testing, assuming that it could in fact be carried out undetected, would certainly be more difficult

34-310 0 - 84 - 2

and less extensive than the overt testing that would be possible in the absence of a ban. In the absence of tests, all agreed that no one could be highly confident that a new system would be effective in difficult scenarios (against many targets in a short time interval and/or effective at geosynchronous altitude). If a system were to be developed without testing, the inability to make refinements based on tests and the lack of confidence developed through tests would degrade the system's military significance.

ASAT and ballistic missile defense (BMD) systems and technologies are closely related. As effective ASAT weapons are developed and introduced, boost-phase ballistic missile defense systems will become increasingly problematical since all such systems utilize space-based early warning systems and possibly other subsystems which would be vulnerable to ASAT attack. Many, although not all, prospective midcourse BMD systems would also have vulnerable space-based assets, and even terminal BMD systems would likely utilize space-based early-warning sensors. At the same time, even a poor quality or prototype midcourse or boost-phase BMD system may have very significant ASAT capability since satellites are much easier to destroy than missile warheads. Therefore, development of boost-phase and mid-course BMD systems will severely constrain ASAT arms control possibilities. Conversely, since ASAT and BMD technologies are related, treaties limiting ASAT development or testing will limit development and deployment of boost-phase and midcourse BMD systems. Of course, the 1972 ABM Treaty and 1974 protocol thereto already severely constrain testing, development, and deployment of BMD systems.

POINTS OF DISAGREEMENT

Disagreement over the desirability of an ASAT treaty hinges on basic philosophical differences over the role of arms control. Although acknowledged at the workshop, these differences were not discussed or debated significantly during the sessions. They are outlined below in an attempt to summarize some of the considerations most relevant to different sides of the ASAT arms control debate.

One attitude, supporting ASAT arms control, is that we value the safety of our own satellites more than we value the ability to destroy Soviet satellites. We want to protect those of our own military support functions which we presently carry out via satellites, and protecting them is much easier if our satellites are not threatened by a highly developed, highly capable Soviet ASAT. Preventing the Soviets from deploying an effective ASAT would be much more helpful than developing our own.

While a ban on all Soviet ASATs would be ideal, the principal U.S. interest is to prevent the Soviets from developing a highly capable system: one which works reliably, threatens satellites in geosynchronous orbit, operates with no warning, and/or attacks many targets at once. Several approaches, including banning ASAT testing, banning the development of new ASAT systems, orbarming all dedicated ASAT systems, could inhibit such a Soviet development. Banning only tests or new developments would be more easily verified than barming all dedicated ASATS; however, a total ban might nevertheless be a more effective appreach to preventing development of a highly capable Soviet system. Although no agreement can eliminate all ASAT capability, supporters of ASAT arms control felt that an agreement could be devised which would make Soviet development of such a highly capable ASAT system very difficult, and that such an agreement could be adequately verified. The criterion for supporting an agreement would be improvement in the security of our space systems as compared to not having an agreement.

A contrasting approach considers military competition between the United States and U.S.S.R. to be inevitable, with arms control in many cases not being an effective or appropriate alternative to that competition. Accordingly, the relevant measure of national security would be relative advantage or disadvantage of the United States with respect to the U.S.S.R. Those holding this view consider it essential to deny the enemy the use of space during a conflict when such use provides a military advantage. In the case of ASAT arms control, even if U.S. satellites were to be safer with an ASAT limitation or test ban than without one (which would almost certainly be the case), a treaty might not be appropriate if it would benefit the Soviet Union more than it would the United States. Such asymmetrical advantage might arise under an ASAT accord for two reasons: First, a treaty would divert the military competition away from an arena (ASAT competition) where the United States would otherwise have been able to exploit its superior ability to develop highly sophisticated technologies. Second, the Soviets might cheat. Because of the asymmetric nature of Soviet and American societies, it is argued, the Soviet Union is much more likely than the United States to cheat on an agreement. For the same reason, Soviet attempts to cheat are more likely to be successful. Whether or not the kinds of violations which might go undetected would in themselves pose major threats to U.S. security, any covert violation would work to our military disadvantage and would have undesirable political and psychological consequences as well.

There is disagreement regarding how much significance can be attributed to residual or covert ASAT capability. The panelists agreed that a considerable testing program is required in order to have high confidence in an ASAT system. However, there are differences of opinion regarding how significant an incompletely or covertly tested system might be. A covert system might not engender high confidence, it might not be as reliable as a dedicated, overtly tested system, and it might be discovered, but it might nevertheless still be developed. There is disagreement not only about how remote this possibility is, but also about how this possibility affects the relative advantages of a treaty versus the risks.

ASAT arms control is also complicated by more general considerations regarding the military use of space. On the one hand, emplacing weapons in space or using weapons against targets in space can be seen as breaking a de facto political taboo which would be difficult to restore. Furthermore, introducing weapons into space might make the world a more dangerous place; this is now almost universally believed to be the case concerning introduction of multiple independently targetable reentry vehicles (MIRVs). On the other hand, any space arms control might be viewed as a political and psychological barrier inhibiting the much wider exploration and exploitation of space as a theater of military operation. A primary example of the wider possibilities of space is ballistic missile defense—while many would not be willing to limit ASAT weapons at the price of impeding investigations into the possibilities of BMD, others see those restrictions on BMD which would be included in an ASAT accord as reinforcing the ABM treaty in support of its original and continuing goals.

TOPICS FOR FURTHER RESEARCH

Among the more general subject areas suggested to the workshop for further research were possibilities for “rules of the road” agreements in space. As noted above, many participants believed that some measures to reduce uncertainty and ambiguity in space might be desirable. Although possible models were proposed, potential agreements were not discussed in detail. What sort of mechanisms (be they unilateral actions, treaties, or informal working ar-

rangements) could be established to permit mutual U.S. and U.S.S.R. use of space with a minimum of suspicion?

Are there ways of characterizing ASATs such that we can define and ban the most threatening or destabilizing types? Certain activities in space are clearly more threatening than others, just as certain activities are more visible than others. Is there a way that a "rules of the road" agreement could focus on the more dangerous rather than the more visible? What are the implications for verification and for stability?

No treaty of any kind can be perfectly verified. Several questions arise in handling ASAT treaty provisions which must therefore be verifiable only partially, or with less than 100 percent confidence. One problem involves how general or specific treaty provisions must be made. Treaty language intended to prevent some particularly threatening activity (e.g., testing ASAT interceptors at geosynchronous orbit) might be phrased in general terms (e.g., forbidding all ASAT tests) which would include less threatening activities that might be less verifiable (e.g., testing ASATs in low earth orbit where they might be masked as non-ASAT-related operations). What are the implications of having varying levels of confidence in verifying compliance with treaty provisions? Are activities which are not explicitly proscribed under a treaty necessarily condoned?

Another verification issue requiring further work involves cooperative verification procedures. Although existing rules regarding freedom of navigation and innocent passage on the high seas permit forces of one country to approach those of another, approaching a foreign satellite closely enough to examine it in space might nevertheless not be taken kindly in the absence of prior approval. If nuclear weapons are to be kept out of space with high confidence, then cooperative inspection procedures (either in space or on the ground) will likely be required. Can such procedures be arranged?

Opening Statement by Senator Larry Pressler

In the quarter-century since the launch of the first man-made satellites, the world has witnessed a quantum leap in the development of space-based and space-related technology. These developments have largely served peaceful purposes. We have learned to use satellite data in crop forecasting; space systems are today's key link for communications between nations; and by operating in space we may be able to solve our energy crisis and learn more about the universe in which we live. The military has also played a major role in space. To date, military space programs have enhanced global security and provided a principal method for arms control verification. No one can dispute that the military should sustain these efforts.

But as technology has improved our ability to operate in space, attention has turned towards using space as a new medium of warfare. We are no longer simply speaking of using space systems for reconnaissance, military communications, early warning and crisis management, but we are on the threshold of transforming space into the new field of battle.

Some would argue that this threshold has already been crossed. Indeed, for over 15 years the Soviet Union has operated an anti-satellite weapon. That weapon continues to be tested and its use against American satellites would seriously harm U.S. security.

In response to this deployment, the United States has developed and started to test a counter-ASAT. This American system will be come operational in the latter half of this decade.

The ASAT problem is, however, only the forward edge of a potentially ominous trend in the military uses of space. The United States, and no doubt the Soviet Union, is starting a process that may lead to the deployment of beam-powered weapons capable of attacking a large number and a wide variety of targets in or flying through space, including ballistic missiles.

While I support the goals of removing the threat posed by nuclear weapons, it is far from clear that the move into space-based ballistic missile defenses will remove this threat. We must proceed with caution and engage in careful deliberation before beginning such an initiative. These futuristic weapons are certain to cost hundreds of billions of dollars. They may be ineffective and could complicate the task of providing for an effective national defense posture, while underminingg strategic stability.

Given the potential costs and risks, I believe that the Congress must carefully consider both the strategic options and their arms control implications. For this reason, the Senate Foreign Relations Arms Control Subcommittee has held a series of hearings on the issue of arms control in space. Let me note that we began our deliberations long before ASAT and so-called "Star Wars" weapons received the serious attention given to them today. In consequence of these hearings, the Foreign Relations Committee favorably reported out S.J. Res. 129 which calls for a return to the negotiating table on ASATs, a moratorium of limited duration on ASAT space flight tests, and the inclusion of future space weapons technologies in these talks.

The hearings in the Arms Control Subcommittee provided Senators with a great deal of information in analyzing the implications of a space arms race and the arms control alternatives. But we continue to face many uncertainties and many questions remain unanswered. These issues must be quickly addressed if arms control is to be relevant to the problem. In addition, the Congress will soon have to decide whether to fund a multibillion dollar research program on directed energy weapons. This workshop should allow us to continue the learning process begun in the Foreign Relations Committee.

I am, therefore, pleased that the Office of Technology Assessment has agreed to conduct

this workshop. Special thanks go to OTA Director Jack Gibbons and to workshop director Peter Sharfman for organizing this meeting. In addition, I want to thank this highly distinguished group of participants for coming to Washington to share their wisdom with us, particularly our workshop Chairman, McGeorge Bundy.

As I said, the Congress has a great deal to learn about space weapons and arms control. I am certain that this workshop will have an important role in our examination of these issues.

Overview

This workshop focused on anti-satellite weapons as an arena for arms control. Early in the first session, however, a panelist pointed out that such a focus in many ways creates an artificial distinction. Space holds a special "emotional allure." Much of the public debate concerning the militarization of space may result as much from that allure as from an informed judgement of the contribution of space activities to the military balance of power.

"Nuclear weapons and nuclear war remain the most important focus for arms control," a panelist pointed out. "ASAT arms control could reinforce nuclear arms control, but it could also divert attention from that central, overriding threat." At the same time, however, he and the remainder of the panel recognized that the appeal of space for military support operations is indeed high, and that the "allure of space" cannot be neglected in any discussion of ASAT arms control.

ORGANIZING DISCUSSION

Three ways of organizing discussion about ASATs were presented in the opening session. The first is to enumerate the various mechanisms of destroying satellites. There are essentially three distinct types: 1) direct interceptors, such as the current U.S. and Soviet ASAT weapons which home in on and then destroy target satellites; 2) "space mines," satellites which are stationed in orbit and later detonated to destroy nearby satellites; and 3) directed-energy weapons, which destroy satellites by delivering particle or radiation beams from a distance.

Other techniques such as concealment, spoofing, jamming, capturing control, and attacking ground stations, can disrupt the operation of a satellite. The difference between interfering with a satellite and permanently disabling it is significant, especially with respect to what is possible or desirable to regulate in a treaty. This distinction was made several times during the workshop.

A second method of organizing ASAT issues is to focus on the functions of potential target satellites and on the implications of subjecting these satellites to attack. So far, there are five primary roles for military support satellites-communications, surveillance and warning, navigation, meteorology, and geodetic survey. Different measures may be required to preserve each of these different functions in the presence of an ASAT threat.

A third organizational scheme is to enumerate anti-satellite attack scenarios and consider their effects on military capabilities and their prospects for escalation. Journal articles and press reports have discussed "just about every possible circumstance" involving anti-satellite activity, from tampering in peacetime to global nuclear war. Studying various possible scenarios has the advantage that, while ASAT technology can and will change, the scenarios for A SAT conflict may be more constant.

DISCUSSION FOCUSES

According to one panelist, the intersections or confluences of these three approaches—ASAT technologies, tempting or particularly threatening targets, and plausible circumstances-show the relevance of ASAT weapons and tactics to arms control. He singled out in the first workshop session several points about which further discussion could be fo-

cused. These issues, along with some items identified later in the workshop, are briefly described below and include:

RESIDUAL ASAT CAPABILITY

Many systems can destroy satellites besides those built or designed for that purpose. For example, ICBMs can be reprogramed to attack satellites rather than terrestrial targets, giving both the U.S. and U.S.S.R. a de facto nuclear ASAT capability. The nuclear-armed Galosh anti-ballistic missile (ABM) interceptors, deployed by the Soviet Union around Moscow under the terms of the 1972 ABM Treaty, can easily destroy satellites passing overhead at altitudes lower than about 1,000 km. However, several panelists pointed out that the use of nuclear warheads against satellites is not plausible in situations short of nuclear war.

There is also nonnuclear residual capability. Rendezvous and docking procedures used in manned spaceflight could be applied to ASAT interception. With sufficient radar support, it is conceivable that Galosh interceptors having conventional warheads might be effective against satellites.

Since the above systems would remain even if all dedicated ASAT systems were banned, panelists agreed that residual ASAT capability will exist under any arms control regime. The more that space utilization and space technology develop, the greater the residual ASAT threat will become. Therefore, panelists strongly emphasized that no arms control agreement can replace the need to make the functions that we carry out in space survivable (see app. A). Functional survivability includes protection against non-ASAT threats, such as attacks on ground stations, and it does not require survival of all space assets. Space systems can be duplicated, and non-space-based alternatives for many support functions now done in space can be developed. Panelists noted that survivability would be easier to ensure if dedicated ASAT systems, especially highly threatening future ones, were controlled.

Determining the level and effectiveness of residual ASAT capability is important to weighing the desirability of any treaty. An ineffective ASAT which had no more capability than the residual capability of non-ASAT systems would not significantly increase the threat these non-ASAT systems potentially pose to satellites. There is, then, some minimum level of capability that an ASAT weapon would have to exceed before its existence would be significant. It would make little sense for an ASAT treaty to require a level of verification holding ASAT capability far below this minimum. However, exactly where this minimum level is located is a highly debatable point. Panelists who felt that the residual capability of non-ASAT systems was quite significant questioned the value of negotiating any limit to dedicated ASATs at all. The level of residual ASAT capability was discussed further in the verification session of the workshop.

COMPARISON OF U.S. AND U.S.S.R. ASAT WEAPONS

Although this topic is unavoidable in any discussion of ASATs, several panelists warned against overemphasizing the two countries' respective capabilities in isolation, without simultaneously considering their respective target sets and possible scenarios.

Both U.S. and U.S.S.R. weapons are designed to intercept target satellites using a three-step procedure. First, ground-based sensors identify the target satellite and determine its orbit. Next, the interceptor is launched and guided towards the intercept point, and finally, the interceptor's homing sensors are activated and it closes in on the target satellite. However, while the U.S. air-launched ASAT climbs directly towards its target satellite in ten or twenty minutes, the Soviet ground-launched ASAT must roughly match orbits with its target, a process which has taken up to several hours in tests.

The range of the booster and the homing process determine which target orbits an ASAT weapon can threaten. The U.S. Miniature Homing Vehicle (MHV) ASAT weapon now undergoing testing destroys its target by direct impact and can home in on its target from a wide range of directions. It needs only to get to the same place at the same time as its target, and does not need to match orbits with that target. The present generation of Soviet ASATs, on the other hand, is co-orbital-it needs to be in the same place at the same time traveling roughly in the same direction at the same speed as its target. So far, all Soviet ASAT tests have been conducted against targets in orbits with inclination angles near 65 degrees.

Workshop panelists felt it "beyond doubt" that the U.S. air-launched approach is "clearly superior" to the Soviet ground-launched technique. Besides the limitation of having to share its target's orbit, the Soviet ASAT is restricted by the small number of launch sites that can handle its modified SS-9 booster. As many as twelve hours might be required, while the Earth turns under the target orbit, to bring the target within range of a launch site. The Soviets are further limited by the recycle time of each launch pad, and they cannot launch many ASATs in rapid succession. U.S. air-launched ASAT interceptors can be launched much more rapidly, and from a much wider geographic area, than the Soviet ground-launched ASAT. The advantages of the U.S. ASAT's airplane-launched approach, and its direct homing interception, more than compensate for its altitude limit, which has not been released by the Air Force but was estimated by a panelist to be considerably lower than that of the Soviet ASAT. Although present U.S. plans call for ASAT-equipped F-15 squadrons having the associated logistical support to be based only at two sites within the continental United States, the planes and the associated support structure could be based in other areas to give even wider geographic coverage and more immediate response.

Another important asymmetry between near-term U.S. and U.S.S.R. ASAT capabilities is the target sets which each weapon will face. Many critical functions which the United States performs in space are carried out by satellites in geosynchronous orbit, far out of range of the Soviet ASAT. Similar functions for the U.S.S.R. are in many cases carried out by satellites in highly elliptical "Molniya" orbits, which could be vulnerable to U.S. attack at their lower altitudes. Present plans for deploying ASAT-equipped squadrons within the continental United States would not permit such attacks, but suitably equipped planes might be able to attack these Soviet satellites if they, and the appropriate logistical support, were based in the Southern Hemisphere. Even assuming appropriate bases could be obtained, in-flight refueling would be required.

Countering the potential advantages of the United States system is that it is still undergo ing preliminary testing, whereas the Soviet ASAT has been tested, in a restricted manner, about twenty times over the last 16 years. The U.S. Department of Defense considers the Soviet ASAT to be operational. A panelist warned against comparing something that is "technologically possible that one side doesn't have" against an opposing system which "perhaps looks a little bit like a turkey" but in fact does have some capability. At any rate, no one doubted that the U.S. system could be made operational within a few years at most.

MILITARY ROLE IN SPACE

Much of the concern about ASATs and ASAT arms control deals with the role of satellites in military activities and the corresponding threat to military capability posed by ASAT weapons. Space systems are used extensively for military support, but satellites do not now fill a crucial, indispensable, and irreplaceable role. Many functions now carried out in space can be performed by other means. A paradox arises in that, to the extent that ASAT arms control masks the intrinsic vulnerability of satellites, alternatives to space systems may not seem necessary and satellites will be increasingly relied upon. If space utilization grows, so will the incentive to build

ASAT weapons. The solution is for arms control, if pursued, to supplement satellite survivability and redundancy programs and not to replace them. This point was repeated throughout the workshop: ASAT arms control cannot be a substitute for protecting and duplicating satellite functions.

ASAT ATTACK SCENARIOS AND POTENTIAL FOR ESCALATION

Does ASAT attack have a unique potential for triggering wider conflict? Does it imply that future conflict might be restricted to space? These points stimulated considerable discussion, but the panel doubted both.

Since military satellites are used principally for support activities, they don't functionally differ from terrestrial support systems. "Is the sinking of a U.S. intelligence ship not as likely and as inflammatory in a crisis as interception of a U.S. spy satellite?" questioned one panelist. Another panelist pointed out that "war in space cannot at all be separated from war on Earth. " In any conflict, each side has certain objectives, and they are on the ground. "You don't shoot satellites just for the fun of it. "

Other participants pointed out, though, that an ASAT attack might be less provocative than a terrestrial attack since people would not be directly threatened. "Maybe you destroy the 'allure of space', " said a panelist, "but you don't kill anybody." One panel member stressed that one cannot dismiss isolated ASAT scenarios to consider ASAT attack only in the context of a wider conflict. "I am skeptical about that because the United States has worked as hard as it possibly can to make itself extraordinarily vulnerable" to a low-level ASAT attack. "We have nothing in the pipeline to replace anything that's in space."

One panelist stated that the most worrisome ASAT scenarios involve low-level conflicts. In desperate cases, even a party not having a dedicated ASAT weapon might be tempted to attack an opposing satellite with whatever means could be arranged on the spur of the moment. In a low-level crisis which had not yet escalated to such a stage, however, existence or lack of a dedicated ASAT able to intercept with high confidence a threatening satellite might make the difference between attacking and not attacking. Carrying out such an attack "would be a tremendous temptation if it were easy to do so and could be done quickly and precisely and with very low collateral damage," even with the attendant risk of escalation.

Another panelist disagreed, maintaining that having fewer or poorer weapons does not necessarily lower the probability of their use. If a power feels that conditions warrant an attack on a satellite, it will be as likely to carry out that attack if it has one weapon as if it has 100. A decision of that magnitude will be a response to many internal and external pressures. "It isn't going to happen by itself, " and if it is deemed to be necessary it may as likely happen with an improvised system as with a dedicated one.

An ASAT attack scenario which has been widely discussed involves attacks on the satellite-borne sensors that provide the U.S. early warning of a Soviet first strike. One participant minimized the importance or plausibility of such an attack scenario. A Soviet attack on warning sensors to prevent a preemptive or "launch-under-attack" U.S. strike might instead trigger that strike. So, if it were not to reveal an imminent Soviet nuclear attack, any Soviet ASAT attack would have to be nearly simultaneous with the launch of the ICBMs that it was intended to mask. Since any direct-intercept ASAT would take several hours to climb to the U.S. early warning sensors at geosynchronous altitude (no existing ASAT is presently capable of getting that far), only yet-to-be-developed directed-energy weapons or pre-emplaced space mines would present a significant threat in this scenario.

At any rate, the United States does not rely solely on early-warning satellites for notification of impending attack. Ground-based radars provide a backup, and for submarine-

launched missiles they give negligibly less warning time than space-based sensors. Ground-based radars can also be supplemented by ship-borne, air-borne, and rocket-borne sensors.

CONNECTIONS BETWEEN ASAT AND BALLISTIC MISSILE DEFENSE

There are quite significant strategic and technological links between anti-satellite weapons and ballistic missile defense (BMD) systems. ASAT issues are central to BMD, and while consideration of BMD is less crucial to analysis of ASAT per se, the two subjects have significant overlap.

One connection is that any effective BMD (except for local, low-altitude site-defense systems) is an even more effective anti-satellite weapon. Even a poor BMD can have significant ASAT capability since satellites are much easier to destroy than missile reentry vehicles (RVs). A system used for ASAT would face at most a few dozen targets, and therefore could take much more time to attack a satellite than a system used for BMD could allocate to each of the up to 1,000 ICBMs or thousands of warheads in a massive attack. Satellites are intrinsically more vulnerable to damage than are RVs, and in a great many ASAT scenarios, attacks on satellites would take place in a much less hostile environment than the nuclear war in which a BMD would have to operate. Furthermore, an orbiting satellite's trajectory is completely predictable, except for limited maneuvers, making a satellite in effect a fixed target.

A second link between ASAT and BMD is that BMD systems (again with the possible exception of local site-defense systems) have space-based elements which would be vulnerable to ASAT attack. Even if a BMD system did not use weapons based in space, it would likely have space-based sensors and communications links; any BMD system intended to attack ICBMs during their boost phase necessarily would require space-based sensors to detect missile launch. If BMD weapons systems were put in orbit, they would be ideal targets for each other. They would be large, expensive, and hard to miss. All indications at present are that space-based weapons would be much cheaper to destroy than to replace "probably by a factor of 10. Right now it looks like a factor of 1,000. " On the other hand, they might be capable of self-defense once they became operational.

As ASAT technology is perfected, it will become increasingly unrealistic to deploy "anything that's space-based and expensive." Conversely, if BMD technology is significantly developed, it will severely constrain the possibilities for ASAT arms control, but it might also elevate strongly the incentive for ASAT arms control.

PROSPECTS FOR VERIFICATION

The issue of verifying compliance with an ASAT accord occupied much of the later workshop sessions. Panelists agreed that a total ban on anything having any ASAT capability would be both infeasible and unrealistic considering that residual ASAT capability (ICBMs, manned spacecraft, etc.) will invariably remain even if all dedicated ASAT systems are banned. There was also considerable agreement, though, that the extensive testing program necessary to develop and acquire confidence in an advanced ASAT weapon would almost certainly be detectable, and that a ban on such testing would require less extensive verification measures than a ban on possession. These issues are discussed further elsewhere in this report (p. 39 ff.).

"RULES OF THE ROAD"

Another important point developed in later sessions was the concept of "Rules of the Road" or "Utilization of Space" agreements. Whether or not some agreement limiting ASAT weapons or testing is desired or implemented, panelists saw a use for an agreement between the United States and U.S.S.R. which would allow each party to continue its use of

space without unnecessarily threatening the other. The United States and U.S.S.R. are each likely to conduct space activities which will appear provocative to the other, and some arrangements for reducing uncertainty might be helpful. The form of such an agreement was not discussed in detail; some additional discussion is reviewed in later sections of this report.

PRESENT TECHNOLOGY

The panel agreed that present ASAT technology (both Soviet and U. S.) is limited in significant ways, and that developing systems free of these limitations would require testing programs which would almost certainly be observable. Both existing systems (the Soviet system and the U.S. system undergoing tests) are only capable of reaching low earth orbit (on the order of 1,000 km)–neither can reach important satellites located at geosynchronous orbit (36,000 km). Both systems have inherent time delays, in waiting for targets to come within range of the launch site and in reaching their targets once launched. (The U.S. system, however, is significantly less constrained in these respects.) Both systems leave intact the adversary's ability to launch ASATs. There was general agreement that present ASAT weapons are much less threatening, and much less destabilizing, than what could be deployed in a new generation of ASATs, including ones which could attack many targets promptly and which could reach geosynchronous orbit.

As an example, one panelist posed the case of both the United States and U.S.S.R. having constellations of space-based beam weapons. As mentioned previously, such systems would likely be targeted at each other. Whichever side attacked first would not only retain its own ASAT (or BMD) capability but would eliminate its opponents. This extreme incentive to attack first would be highly destabilizing.

Another participant took issue with this scenario, stating that the systems would likely operate so that such an attack by one side would result inmost of both constellations being destroyed. For instance, one party detecting an attack could detonate space mines trailing its opponent's systems. All panelists agreed, however, that the present systems are not as threatening as future ones could be.

Descriptions, Pros, and Cons of Possible Agreements

FOCUSES AND PHILOSOPHIES

Before the United States undertakes to negotiate a treaty, it must determine that a treaty would be desirable. Could there be a treaty which would be in our interest, recognizing that Soviet interests do not coincide with our own? We then need to ask whether such a treaty might also be in the Soviet interest. If not, it is pointless to continue. It is not sufficient to find a single set of actors on each side that would be in favor of a treaty. In order to be acceptable, a treaty must be desirable to a large number of players on each side.

Early in the workshop, a panelist questioned whether anti-satellite weapons were indeed an appropriate focus for arms control. He pointed out that the technology and concepts are still being developed. Furthermore, given that some residual ASAT capability will always exist, one can't deny a country the ability to destroy satellites. Although an ASAT arms control accord might include some desirable features, the panelist felt that those goals might better be pursued in association with other arms control ventures.

Another panelist stated that an ASAT agreement would greatly increase the security of our satellites by limiting the development of new ASATs that could be considerably more sophisticated than the present systems. Such an agreement would make the task of protecting our satellites much easier. We must compare the residual ASAT capability under a treaty with the threat to our satellites in an all-out ASAT competition, he pointed out.

One panelist felt that we should be seeking a stable stopping point to the ASAT competition, or at least some intermediate points that would slow down the race, reduce tensions, and lend themselves to further negotiation. In particular, some concern was expressed about the U.S. ASAT being deployed without sufficient consideration of its long-term or possibly irreversible implications. An interim accord would provide some time.

Many participants supported the idea of finding ways to prevent "provocative and inflammatory" activities in space. Panelists realized that both the United States and the Soviet Union will continue to utilize space in ways which might have great potential for creating uncertainty and misunderstandings. This possibility could be mitigated by an arms control agreement. "Survivability is not the only goal" of a space arms control agreement, suggested a panelist, "and in my mind not even the main goal." He explained that the case for arms control really rests on the Soviets' desire to come to some working agreement with us so we both can develop space capabilities "without coming to clashes or crises or problems." This panelist supported a "rules of the road" agreement which would "provide some limit on activities which are going to pose major puzzles" to both the United States and the U.S.S.R. This form of agreement might or might not include an ASAT ban.

We and the Soviets tend to legislate the norms of international conduct by our actions and our agreements, noted a participant. In this manner, we have, for example, in effect declared that "offensive nuclear weapons are okay to have," but that "they're not okay to use directly in a threatening manner in crises." Regarding anti-satellite activity, we have so far "pretty much legislated that it's okay to live and let live in space."

"An ASAT treaty," he continued, "ought to reinforce that healthy kind of approach to space."

PHILOSOPHICAL DIFFERENCES

A point which was readily recognized at the workshop, but was not discussed or debated in depth, was that disagreement about the value of an ASAT accord stems from deeper philosophical differences about arms control in general.

Putting it a little simplistically, treaty proponents feel that our national security will be better with an ASAT treaty than without one, and that such a treaty can be verified well enough to ensure our security. Treaty opponents, on the other hand, focus on possible asymmetries in the relative costs and benefits of a treaty to the United States and to the Soviet Union. The Soviet Union, they feel, would benefit more from United States compliance than the United States would benefit from Soviet adherence with possible cheating. They feel that arms control is appropriate only if it would be advantageous to the U.S. in spite of this inherent asymmetry.

Is the criterion for negotiation that we end up better with a treaty than without one? Or, is it rather that our position with respect to the Soviets be better with a treaty than without one? Similarly, there are differences in overall attitudes concerning space and space arms control. Some view deployment of space-based or space-directed weapons as the breaking of a de facto political taboo, which would not only make the world more dangerous but would also be difficult to reverse. Alternatively, any space arms control treaty could be seen as a political and psychological barrier to the wider exploration and exploitation of space as a theater of military operation.

ASAT LIMITATION TREATIES

In discussing possible forms of ASAT arms control, the panel categorized five types of ASAT arms control agreements:

1. Bans on all testing, use, and possession of all ASAT capability.
2. Bans on all testing, use, and possession of dedicated ASATs.
3. Bans on use and testing, but not possession, of dedicated ASATs.
4. Bans on development or use of new types of ASATs; no restrictions on existing ASAT systems.
5. Bans on use of ASATs; no restrictions on possession or testing.

Panelists readily agreed that the first type of agreement is unattainable. Some non-ASAT systems have some capability to serve as ASATs, so residual capability would remain even if dedicated ASAT systems were banned. Recognizing this fact, the second type of agreement would deal only with dedicated, and presumably more threatening, ASAT systems.

Most of the workshop discussion about ASAT limitations involved a testing ban which might or might not include existing systems and which might or might not prohibit ASAT possession. Testing of a dedicated ASAT weapon would be more visible, and less ambiguous, than its possession. To avoid some of the difficulties of a more extensive ban, a treaty could permit possession of ASATs but ban use and testing. Without testing, the significance of possible ASAT possession might decrease with time. In the view of some, new systems could not be relied upon, and confidence in existing systems would slowly degrade.

The fourth type of agreement, conceding the existence and operation of existing systems, would still restrict the deployment of new and more threatening ASATs. It would also suppress the question of residual ASAT capability, since if both sides had a dedicated system it is unlikely that either would use “baling-Wire” systems. Considering the disparity between the U.S. and the Soviet ASATs, though,

several panelists felt that the Soviets might not be willing to concede to the United States the right to test and deploy the air-launched MHV ASAT without reserving the right to develop a system at least as effective.

The fifth type of agreement in the above list would prohibit the use of ASAT weapons and might also delineate acceptable behavior by codifying some set of "rules of the road." Such measures attracted much interest among the panelists as supplements to, as well as alternatives to, ASAT limitations. Proposed agreements of this sort are not as well defined as prohibitions of ASAT testing or possession, for which draft treaties have been prepared by various parties.

ASAT ARMS CONTROL: PRO ARGUMENTS

ASAT treaty proponents see an ASAT arms race as not serving our best interests. "The burden is always on arms control to explain how the world is going to be better with the treaty than without," remarked a panelist, "and the burden is never on the person who just wants to keep blundering ahead to explain how the world is going to be safer that way. Treaty proponents see continued ASAT competition as unwise, and believe that a treaty would be worthwhile even if it served only to constrain future developments. Observing that the ASAT problem will not disappear completely, with or without a treaty, one panelist noted that "in the absence of restrictions, the problem is going to get a great deal worse.

Offense Dominance.—An ASAT race is not desirable because, for the foreseeable future, the offense will always win. Satellites are expensive, and they are inherently vulnerable because of their known trajectories, their limited numbers, and their fragility. Significant cost and performance tradeoffs are required to protect satellites against attack. Therefore, U.S. satellites are likely to be much cheaper to destroy than to replace. This balance will not be changed by deployment of a U.S. ASAT weapon, even if it is superior to the Soviet ASAT. Assuming that we need our own satellites much more than we need to attack Soviet satellites, treaty proponents believe that we should attempt to negotiate a mutual limitation on ASATs.

Defense and Possible Future Developments.–Arms control proponents particularly saw great value in ending the ASAT competition as soon as possible. Current technologies are relatively primitive compared to future possibilities, which could be very threatening. It is easier to protect satellites against the current threat than against subsequent generations of ASATs. The later that action is taken, the more systems will be deployed, the more complicated the technology will become, and the more difficult compliance with any treaty will be to verify. Adequately verifiable testing bans are possible, proponents feel, and they would severely limit the development of truly threatening anti-satellite weapons. The ASAT competition has not progressed so far that stopping now would be irrelevant.

We are now at a stage in which only our low-altitude satellites might be vulnerable, and we face the quite possible future alternative of having our entire in-orbit force structure subject to prompt destruction. Directed-energy ASAT weapons, for example, will very likely be deployed if there is no ASAT accord. Such weapons, having long ranges and near-instantaneous reaction times, would be destabilizing—especially if based in space. If such systems were developed by either or both sides, they would be tempting targets, and each side would have great incentive to attack first in order to disarm its opponent. In the absence of an ASAT accord, we are also likely to see the advent of space mines, which could be comparatively inexpensive. If space mines were widely deployed, most or all of our important satellites would be subject to almost instantaneous destruction.

Existing Unreliability. -Future ASATs will likely be much more reliable than the present systems, which has significant implications for stability. Neither the existing Soviet ASAT nor the U.S. ASAT under development can presently be considered highly reliable. The

U.S. weapon has never been tested against a target in space. According to published reports, the Soviet weapon has not functioned properly in a significant percentage of its tests. Some panelists did note, however, that without knowing the nature of and responses to these failures, we can not necessarily infer a reduced confidence or lower reliability of the Soviet ASAT.

Highly reliable ASATs, if they existed, might increase the risk that low-level crises would escalate. As discussed in the overview, confidence in the ability to attack a threatening satellite easily, quickly, and precisely may increase the likelihood of doing so. In a tense situation, posited one panelist, the United States or the U.S.S.R. might initiate ASAT conflict by reasoning "we're not going to kill anybody; we're not going to threaten anybody's strategic warning system, but nobody's going to take pictures of us for a few weeks now. " Both the temptation and the danger of an ASAT attack against a reconnaissance satellite in a crisis would be "extraordinarily high."

Economic Pressure.—A panelist noted that ASAT limitations could forestall utilization of ASAT competition by the Soviets as a relatively low-cost means of applying pressure to the United States. Perceiving a full-scale military buildup by the United States, but constrained by the performance of their own economy, the Soviet political leadership may seek ways to pressure the United States without having to engage in an across-the-board response. Inmost cases, the development, or improvement, of an ASAT system is much cheaper than protecting against ASATs by duplicating or supplementing space assets.

Mutual Benefit to Treaty.–ASAT arms control advocates noted that ASAT arms control negotiations are not a "zero-sum" game. Both the United States and the Soviets would benefit from an ASAT accord. Soviet interest in negotiations does not mean that we must a priori oppose them. "Certainly you can't expect the Soviet Union to sign any agreement which works to their net disadvantage, " explained a panelist, "but most people regard the elimination of nuclear war, or even the significant delay, decade by decade, of all-out nuclear war, as being to the advantage of the Soviet Union as well as the United States. "

Private Sector Concerns.—One argument which has been made in favor of ASAT arms control found no support at the workshop. In the past, it had been argued that without an ASAT accord, private industry would be reluctant to invest in space systems which are inherently vulnerable to ASAT attack. Panelists pointed out that the Soviet's current capability to destroy anything in the United States or at sea has not affected the private sector. They noted, as an example, that the Soviet ability to shoot down airliners "which has been demonstrated" has not affected airline investment decisions.

A concern of private industry which was backed up at the workshop is the problem of space debris from ASAT weapons test. Studies mentioned at the workshop indicate that a significant source of debris in low-altitude orbit is Soviet ASAT testing and ASAT-related activity. ASAT tests at or near geosynchronous orbit would be of considerable concern to communications satellite companies.

ASAT ARMS CONTROL: CON ARGUMENTS

Much opposition to ASAT treaty efforts stems not from the desire to have ASAT weapons but rather from the viewpoint that arms control is not an effective or appropriate means of addressing the ASAT question.

Residual ASAT.–ASAT treaty opponents raised the problem of residual ASAT capability—means for destroying satellites which would be infeasible or unrealistic to eliminate by any form of agreement. They also noted that methods for interfering with the operation of systems using satellites, short of destroying them (jamming, spoofing, or attacking ground stations or support facilities), might be difficult to address in an ASAT arms control accord.

Asymmetric Societies.—The asymmetrical nature of the Soviet and the U.S. societies, according to arms control opponents, implies that there will be asymmetric advantage from any symmetric treaty. The Soviets are much more likely than the United States to cheat on an agreement, and if they do cheat they are much more likely to get away with it. Furthermore, there seem to be differences between the United States and the Soviet Union in interpretation of "borderline" activities-"I think we have learned over the last twenty years that the way the Soviet Union keeps a treaty is not exactly the way two-thirds of the Senate had in mind, " summed up one participant.

Verification.— Treaty opponents are very concerned about the verifiability of compliance with an ASAT accord. No treaty, of course, is perfectly verifiable, but different people assess differently the likelihood (or significance) of activities which may escape detection. Inventories of ASAT interceptors on the ground or the contents of satellites in space may be difficult to monitor. Compliance with bans on ASAT interceptor testing maybe difficult to verify since there are many legitimate activities requiring rendezvous in space which could be made to be partial tests of ASAT interception capability. Furthermore, even a small amount of Soviet cheating in an ASAT arms control agreement could be significant since U.S. satellites are long-lived, valuable, and limited in number. We would be more sensitive to loss of a few satellites than the Soviets, whose satellites have shorter lifetimes and are consequently replaced more frequently.

Limits on U.S. Strengths.–More general objections to ASAT arms control result from the constraints it would put on the ability of the United States to exploit its technological expertise. By permitting the Soviets to "make up lost time" in developing advanced ASAT technology, said a panelist, ASAT arms control would "allow the Soviets a major competitive advantage. "

Both the United States and the Soviet Union have too great an interest in the military use of space to agree to an ASAT treaty that would deny the ability to engage in conflict there, he explained. "If there is conflict, there is going to be conflict in and from space. It inevitable because of what we've been doing for about the last twenty years" by putting very valuable systems in space and using them to the extent that we do.

Ballistic Missile Defense. Another very significant source of opposition to ASAT arms control is the desire to investigate advanced ballistic missile defense technologies. Some of the concepts most attractive to BMD supporters involve "boost-phase" defenses which attack missiles as they climb out of the atmosphere. However, since effective boost-phase weapons would likely also be effective against satellites, they would almost certainly have to be restricted under an ASAT accord which limited the most threatening ASAT technologies. Systems capable of doing boost-phase BMD would be inconsistent with the existing 1972 ABM treaty, but supporters of BMD research may not wish to contend with a restrictive ASAT accord as well. An opinion expressed at the workshop was that "the ABM treaty is bad enough to have as a complicating factor in any type of transition towards strategic defense without adding a layer of porous ASAT agreement. "

Difficulty.-A more pragmatic reason for opposing ASAT arms control is that the process of negotiating such a treaty with the involved executive agencies, with the Soviets, and with the Congress is "incredibly painful" and not worth undertaking in the absence of an overwhelming conviction that it would be in the national interest.

ASAT WEAPON: PRO ARGUMENTS

Those opposing an ASAT treaty believe that ASAT arms control is not in the national interest. They may also believe that having an ASAT weapon is in the national interest. Anti-ASAT treaty arguments and pro-ASAT weapon arguments, although related, are distinct.

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Three justifications for developing anti-satellite weapons were reviewed at the workshop. Of the three, one was mentioned but not discussed in detail, and another was not supported by ASAT proponents on the panel.

Attack Hostile Satellites.-The primary reason for developing an American ASAT weapon is to deny the use of space to an adversary during conflict. The particular example cited by administration officials and by workshop participants is the threat posed by Soviet ocean reconnaissance satellites which are said to be able to locate U.S. Navy ships on the high seas. Those holding this view do not wish to allow the Soviets freedom to conduct reconnaissance activities from space which threaten American forces. They also expect that the Soviets will utilize other space assets for improving the effectiveness of their military forces (" force-multiplication") and want to be able to deny the Soviets these capabilities as well.

An American ASAT weapon could be stabilizing, it was argued, if used against Soviet reconnaissance satellites which would otherwise be available for retargeting Soviet missiles. In a "shoot-look-shoot" scenario, Soviet reconnaissance satellites would be used to locate U.S. military targets that had survived a first strike. This data would be used to retarget a Soviet reserve force to destroy those remaining targets. The Soviets likely know that they would probably need "more than one echelon of strategic attack" to carry out an effective strike against the United States homeland, argued a panelist. Denying them this "shoot-look-shoot" capability would make it harder to conduct an effective first strike, lessening its probability and therefore increasing stability.

Support Negotiations.—A second reason mentioned at the workshop for developing a U.S. ASAT weapon would be use as a "bargaining chip" to induce the Soviets to negotiate an ASAT treaty. Whether or not this viewpoint may motivate development of some weapons systems, it does not properly belong in a tabulation of "pro-weapon" arguments. If one seeks to negotiate a ban on ASAT weapons, for example, then one presumably has already determined that having an ASAT weapon is not necessary.

Deterrence.—The third reason given for having an ASAT weapon is to deter ASAT attack. This rationale was not supported at the workshop. Arms control supporters and opponents both felt that the ability to retaliate against terrestrial targets served to deter ASAT attack at least as well as the ability to retaliate against satellites. Satellites can be protected against ASAT attack in a number of ways, and having the capability to respond in kind was not thought to be singularly effective in protecting satellites.

A panelist also pointed out that the deterrent role of an ASAT is in opposition with, not in support of, the role of eliminating hostile satellites. If an ASAT capability is required in order to support objectives (such as preventing detection of naval surface units by Soviet satellites) which are unrelated to retaliation, then the deterrent value of an ASAT must be balanced against its potential use in initiating space conflict to attack hostile satellites.

"RULES OF THE ROAD"

Many panelists, including supporters of ASAT limitations as well as those questioning the effectiveness or utility of ASAT bans, agreed that some sort of international agreement concerning "rules of the road in space" could be beneficial. These rules could also include rules on space-related ground activities. While the nature of such an agreement was left vague, and the negotiation process which might conclude in such an agreement was not analyzed, several motivations and possible examples for such an agreement were raised.

Rules of the road would try to alleviate situations which either side would consider particularly dangerous. For example, they might inhibit effective placement of space mines by establishing a minimum separation between satellites. As both sides continue their operations in space, such rules may become increasingly valuable.

One of the functions of a regime of rules in space would be to reduce instances where seemingly dangerous activities are observed without the means of finding out exactly what is going on. Certain activities which might be provocative could be prohibited, or they might be required to be accompanied by an explanation, perhaps in advance, which had some basis for being believable. The most important function of such an agreement, suggested one panelist, might be the establishment of a forum where questionable activities could be discussed. That the forum would help maintain an ongoing dialogue between the United States and the U.S.S.R. would be healthy in and of itself. Alternatively, said another panelist, it would be nice to know that if the Soviets do something that we find very threatening, they did it on purpose. "We might still find ourselves getting dangerously close to a war, but at least we would know better where we stood." A panelist also pointed out that besides defining acceptable conduct, "rules of the road" might also give some basis for responding to certain violations.

A precedent for "rules of the road" is the ban in the 1972 ABM Treaty prohibiting interference with the national technical means used by each side to verify compliance with that treaty. This measure is a "function ban": it does not refer to satellites or space in particular, but rather prohibits interfering with the function of verification. Such a function ban might be extended by building upon the example of the 1971 "Agreement on Measures to Reduce the Risk of Outbreak of Nuclear War, " which requires the United States and the U.S.S.R. to notify each other "in the event of signs of interference with [early warning systems] or with related communications facilities, if such occurrences could create a risk of outbreak of nuclear war. " This clause could be strengthened to prohibit interference with the function of early warning in general without reference to satellites or ASATs. A very important motivation for rules of the road would be the recognition, such as that implicit in the 1971 Measures Agreement, that accidents will happen.

An additional model could be the international regime existing on the high seas, in which certain particularly hostile and dangerous activities have been banned. Similar bans could be applied to space activities. However, since the "rules of the road" on the high seas as they currently exist do not keep ships out of lethal range of each other, similar rules would not be sufficient to ban space mines. New measures would be required if it were desired to eliminate the threat of space mines by keeping satellites apart by more than a lethal distance.

"Rules of the road will not prevent ASAT attacks, " pointed out one panelist. "Perhaps they can't even be verified very well. . . . Nevertheless, an agreement along those lines might be worth having precisely because it would reduce ambiguous acts" and minimize the chances of escalation or misunderstanding in a crisis. Panelists agreed that "rules of the road" would not require an ASAT ban; some of those supporting an ASAT accord felt that it would be strengthened by rules of the road; those opposed to an ASAT agreement saw merit in rules of the road as an alternative.

All panelists agreed that the Soviets are increasing their utilization of space, including their development of ASAT capability. That fact, taken with their willingness to negotiate space arms control with the United States, can be seen as indicating that they would like to jointly draw up some general rules of behavior. "If that's the signal, that's a very interesting signal, " interpreted a panelist. "It makes it that much more useful to look for ASAT treaties that simply have the merit of putting some kind of terms of agreement on record, if nothing more. "

GENERAL DISCUSSION

There was no agreement on how much the ASAT threat would be reduced by a treaty, or on the significance and likelihood of residual or covert ASAT activity. An important point is the extent to which residual, possibly covert, ASAT systems would place our spacecraft at risk under a treaty regime. "Is it going to be closer to one-eighth of the original threat or is it going to be closer to seven-eighths?" asked one participant.

GRANDFATHERING EXISTING SYSTEMS

The discussion of possible ASAT limitations, their advantages, and their disadvantages touched on a number of issues. One of these was the question of "grandfathering" existing ASAT systems: Should the Soviets be permitted to keep their system? Should the United States be permitted to continue developing its own? One panelist felt strongly that the objective of a treaty is to prevent the development of technologies and capabilities which are much more threatening than those existing now. Such a treaty would block the "sustained, organizational effort" required to implement such advances in ASAT technology. Existing systems, which are not nearly as threatening as future ones could be, might be grandfathered in such a treaty. Alternatively, further testing and development of existing systems could be banned, especially at higher orbits.

One panelist felt that the Soviets would not accept an agreement which would permit existing systems because of the asymmetries in capability between the U.S. and U.S.S.R. ASATs. The U.S. F-15 system, a far more capable weapon, will be able to destroy Soviet satellites much more rapidly than they could be replaced and would be sufficient to deny the Soviets access to low earth orbit for a considerable period of time. Given the Soviets' present technique for attaining higher orbits by using lower altitude parking orbits, the U.S. ASAT could effectively deny the Soviets the ability to reconstitute higher orbit systems as well.

Another panelist was skeptical about negotiating away the Soviet ASAT because of the measures that would be required to give the United States assurance that it had been dismantled. The Soviets have "only in a sort of Aesopian way" admitted that the present SS-9 based ASAT exists at all, he said, "which is not a hopeful way to start out on the negotiation" concerning the "extraordinary measures" required to ensure that the system had been dismantled. However, if the Soviet ASAT is neither eliminated nor balanced with a symmetrical U.S. capability, then the political viability of any ASAT accord in this country would be "very, very low. "

U.S. ASAT REQUIREMENT

Another issue stimulating considerable discussion was the need for a U.S. ASAT weapon. There was widespread disagreement about the requirement for an American ASAT to deny the Soviets the ability to target the U.S. fleet with their ocean reconnaissance satellites. There were no panelists with Navy backgrounds ("we've been sinking the Navy without its representation, " noted a participant), but at any rate there was little support for the position that the Radar Ocean Reconnaissance Satellite (RORSAT) is an extremely threatening system. The capability to destroy Soviet reconnaissance satellites is neither necessary nor sufficient to protect the U.S. fleet, it was pointed out. The United States has many ways to deny the Soviets intelligence from these satellites-RORSATs are vulnerable to a variety of electronic countermeasures. Studies made more than 10 years ago laid out a "long laundry list of things that could be done other than blowing it up," such as decoying and jamming.

Furthermore, there are many ways the Soviets can locate American ships without the use of RORSATs. "For instance, they can ask

their own ships, which accompany our aircraft carriers, pointed out a panelist. "If they didn't have radar ocean reconnaissance satellites, they would have other things."

Also disputed was the argument that a U.S. ASAT would be stabilizing since it would deny the Soviets the ability to execute a "shoot-look-shoot" attack. That rationale is an example of the "impractical war conduct scenarios" which one can set up and then show to be impossible if only some particular weapon is built, a panelist said. "That is not a valid reason to oppose ASAT treaties."

Finally, the argument that a U.S. ASAT weapon is needed to induce the Soviets to negotiate was also challenged. "It is not supported by historical experience," said a panelist. "In 1978 and '79, the negotiations [with the Soviets on anti-satellite weapons] were very active and were moving along nicely, and we didn't even have a paper program-much less a system." He pointed out that the Soviets "accepted it on faith" that the United States was quite capable, technologically and industrially, of putting together a system if it wanted to. "If both parties feel they can't negotiate except from a position of strength, the conclusion is there will be no negotiations."

LIMITATIONS OF ASAT ACCORDS ON BMD DEVELOPMENT

According to some panelists, the effects of an ASAT accord on the future development of ballistic missile defense are some of the most important anti-treaty arguments. "They involve important issues of judgement." While it was in effect, an ASAT accord would prevent development and deployment of space-based ballistic missile defense, said an accord supporter. However, any such treaty could have provision for periodic review. Treaties can be mutually eliminated or unilaterally abrogated; they contain "all kinds of possibilities for not constraining ourselves for the indefinite future." However, another panelist countered that treaties "tend to become sacrosanct." Any attempt to withdraw from an ASAT accord would become a "major political football" which might obscure strategic considerations.

URGENCY

One of the most important points raised by treaty supporters was that, if an agreement is to be reached at all, there is great value in reaching it sooner rather than later. A treaty may be much harder to negotiate, and be much less effective, if it is delayed. In particular, many treaty proponents thought it would be "extremely damaging" to complete tests of the U.S. air-launched ASAT because the Soviets will react to that development. If, following future American tests, the Soviets believe the U.S. system to operate reliably, they may not be willing to concede the United States' right to keep that system without demanding that they themselves be permitted to match or exceed that system's capabilities. "Quit while you're behind," urged a panelist, "or while you're nominally behind." In another panelist's words, "negotiating from strength is a sinusoidal function and you have to pick your timing right. . . . We should be negotiating now because we are behind by just the right amount."

In arguing for an agreement as soon as possible, one panelist noted that the negotiations need not take a long time. "You do not have to negotiate the ultimate ASAT agreement, and the best agreement to negotiate first is the broadest one." Another panelist countered that while an agreement need not take a long time, it probably will take a long time for reasons which are more political than technical. "If you don't want an agreement and you don't go to the table, it is likely to take a very long time" to negotiate and conclude a treaty.

Soviet Attitudes and Efforts

MILITARY EFFORTS

PAST DEVELOPMENT AND PRESENT STATUS

The Soviets have attached a great deal of significance to space activities. Their programs, controlled by the military, area source of great national pride and have tremendous momentum. They have pursued all of the military support activities in space that the United States has undertaken, often for reasons not clear to American observers. The U.S.S.R. has also exploited options that the United States has forgone.

Development of the current Soviet co-orbital ASAT began in the 1960's for reasons which "really kind of remain something of a mystery" and quite possibly were not thought through in depth. It is not presently a very capable weapon. "I don't think that the orbital intercept system is of great military significance, " said a panelist, echoing views which were widely shared at the workshop. "Indeed, it hard to imagine exactly what threat it does pose." However, the Soviets have been taking the system very seriously. They have maintained it, tested it, and improved it over the years. They have not made major advances or introduced significant variants of the co-orbital ASAT, but instead have been systematically making incremental modifications. A panelist warned against drawing too many conclusions about the lack of major upgrades in the Soviet ASAT. The United States had maintained nuclear-armed ASAT interceptors on islands in the Pacific Ocean for 12 years without upgrades. We chose to develop an entirely new system—the air-launched direct homing interceptor-because that type of system had clear advantages. "There is no reason to suppose that the Russians might not have made a similar decision. "

One must be careful in comparing the Soviet and the American space efforts. Many qualifications are required in order to determine true Soviet capabilities or level of effort. When comparing launch rates, for example, one must recognize that Soviet satellites are much shorter lived than American ones. Although the Soviets had 98 launches (military plus civilian) in 1983 compared to 22 for the United States, during that time the United States had about twice as many active satellites in orbit as the Soviets.

To some extent, the Soviet approach of having more but shorter-lived satellites reflects the Soviets' poorer technology; nevertheless, it does give them some significant strengths. They have replacement satellites and launchers and will be able to reconstitute space systems quickly in case of ASAT attack.

"The Soviets would fare better than we would in an environment in which satellites had an 'enemy-induced lifetime' of two weeks, " said a panelist. "They would hardly notice it whereas it would hurt us a lot. " However, he noted that if the United States deploys its ASAT, it will be able to destroy Soviet satellites within a few hours of launch. The Soviet ability to replace satellites every few weeks would not be very useful.

At present, the United States is seen by many observers as being more dependent on space systems than the Soviet Union. However, as the Soviets increase their use of space support systems, any asymmetry between Soviet and American reliance on space will lessen. Indeed, one panelist felt that the Soviets are now "fully as hooked on the use of those systems as we are, " and that they are clearly using space systems in connection with their Afghan and other military ventures.

SPECULATION ON FUTURE DEVELOPMENTS

Future Soviet space activities are certain to increase and will appear provocative to many observers in the United States no matter what the "real" explanations may be. The Soviets will be undertaking "all sorts of operations at a level substantially higher than we're going

to be involved in." The Soviets are reportedly doing research and development into directed energy weapons, and at least one participant gave "considerable credence" to the notion that the Soviets might launch a space laser later in this decade. Such a device, rather than an incremental refinement of their co-orbital interceptor, would be required to deal with the American target set which has many satellites in very high orbits.

Another panelist cautioned that there has been, at times, considerable misrepresentation of the Soviet space program. "They may be working on lasers, " he said, and "they certainly work on space. " However, there has been "no significant, no credible report" of Soviet space-based lasers. "They could put a laser into space, just as we could, " he continued, but it would be "militarily insignificant. "

One participant questioned the relevance of speculating about Soviet motivations and developments, and of comparing the Soviet and American systems. "Useful as [that process] might be if better answers were available, " he felt, it turns out "not to be a particularly illuminating way to go" in the present circumstances. "Maybe it's a diversion that really isn't very helpful at all. "

DIPLOMATIC AND POLITICAL

SOVIET PERCEPTIONS

The Soviets currently say they see the U.S. strategic buildup as representing a desire to achieve and maintain a first-strike capability. Looking for means of countering this across-the-board buildup, the Soviets could see development of their ASAT weapons system as being an effective way to put very significant pressure on the United States with very little investment.

A panelist, attempting to view the American strategic rearmament program from the Soviets' "rather paranoid perspective," noted that the MX, the Trident D-5, and the Pershing II missiles are seen as being the "workhorses" of this presumed preemptive attack. Enduring command and control systems and ASAT weapons would fulfill vital support roles. If the United States were to pursue ballistic missile defense, it would be perceived, from this viewpoint, as enhancing a first strike posture by threatening to blunt Soviet retaliation.

American arms control overtures are also seen by the Soviets as supporting a U.S. first-strike capability, explained the panelist. Our proposals, which would have the effect of reducing Soviet force levels while not constraining the types of weapons programs we are undertaking, would just make it easier for us to undertake a first-strike attack.

POSSIBLE POLICY

The Soviets have stated their interest in resuming ASAT negotiations with the United States. They have been getting diplomatic credit for taking the initiative in promoting space arms control. The Soviets in 1981 and again in 1983 brought draft ASAT treaties before the United Nations. A major factor which seemed to have been a damper on U. S.-U.S.S.R. progress in the 1978 and 1979 ASAT negotiations had been the People's Republic of China's nonaccession to the Outer Space Treaty of 1967. After the OTA workshop had concluded, one of the participants informed OTA that the PRC had indeed acceded to the Outer Space Treaty as of December 1983–an event "of great importance. "

Panelists noted that the Soviets have several incentives to negotiate an ASAT treaty with the United States. One is the argument "so frequently employed in American arms control negotiations: 'sure, we can make that proposal because, even though it might not be a good thing if it were accepted, we can count upon the Americans to not accept it simply because we propose it.' " Alternatively, and

contrary to their seeking to engage in an ASAT race to pressure the United States, the Soviets have an interest in limiting ASAT technology because that is an area where the United States might be able to excel. The Soviets are concerned that "we're going to push them into a technological race in areas where we have some advantage."

The Soviets have changed their public position since 1981. At that time, they would have permitted existing ASAT systems to remain under a treaty. Now, they claim that the U.S. weapon is too much more capable than their own to permit such an arrangement, and they will likely seek to ban it or else demand the right to respond with at least as capable a system of their own. A panelist noted that, should the Soviets seek to mirror the U.S. ASAT by deploying an air-launched equivalent, their BACKFIRE bomber would be a "splendid machine" for that purpose. It is large, fast, maneuverable, and can climb to high altitudes; BACKFIRES and their crews and logistical support exist in quantity.

The 1983 Soviet draft ASAT treaty modified or removed many of the features of the 1981 draft which had been considered objectionable from the American point of view. In particular, it did not include explicit objection to the U.S. space shuttle. The Soviets do not find the space shuttle to be an object of "fear and loathing," said a panelist. He dismissed the idea that, using the space shuttle, the United States might "swallow one of their satellites and bring it back to Los Angeles or somewhere and dissect it." "I would strongly suggest that we not try that," he continued. "The first time we try it, we will have three shuttles instead of four."

However, Soviet attitudes concerning the shuttle might very well be modified by use of the shuttle for anti-satellite experiments or tests. *Aviation Week and Space Technology* articles cited at the workshop report that anti-satellite related activity is scheduled for future shuttle missions. Although the Soviets have indicated an understanding of the importance placed by the United States on protecting shuttle activities, including those involving military support, it was felt at the workshop that their tolerance would not extend to active ASAT experiments. One panelist felt that, in reaction to U.S. ASAT activity (shuttle-related or otherwise), the Soviets may go so far as to challenge such long-established precepts as right of overflight of Soviet territory by military-support space systems.

Other panelists made the observation that it would be "very surprising" if the Soviets, in concluding an ASAT treaty, would be prepared to give up the capability to attack elements of a strategic weapons system based in space. This would apply in particular to space-based elements of a strategic defensive system.

A panelist noted that by vigorously pursuing space activities and at the same time seeking space arms control negotiations with the United States, the Soviets could be indicating that they would like to draw up some rules of behavior which would permit them to expand their space activities in a way that is "reasonably safe and reasonably in concordance with what we want to do." Lack of significant progress on their co-orbital ASAT should not be taken as indicative of a desire for arms control. "I don't think that it's useful or that it's likely to succeed to rest the case for arms control on evidences of Soviet restraint. . . . They will restrain themselves when they see a political purpose to it, and the arms control agreement or other agreements provide the political purpose for it." Without disagreeing, another panelist cautioned against attributing to the Soviets the same policy or operational doctrine concerning ASATs as the United States holds. "We have a notion of what we think ASAT development or ASAT arms control would do within the context of American security policy . . . [but] it is not obvious to me that they are going to make those judgments in the same way we do."

U.S. Attitudes and Efforts

BACKGROUND

DEPENDENCE ON SPACE SYSTEMS

The United States has placed high importance on the utilization of space for military support operations. It has developed advanced space technology which is deployed in valuable, sophisticated, and long-lived satellites. Space systems are particularly attractive to the United States in view of its policy of being able to project power worldwide. The high capability and high cost of American satellites, however, tend to make them attractive targets for ASAT attack. We have not expended much effort in the past making these assets redundant or survivable, increasing the motivation for the Soviets to develop an ASAT.

At the same time, the U.S. has recognized the vulnerability of space assets and has not relied on them as extensively as it otherwise might have. For example, the space-based Global Positioning System, when fully operational, will permit increased accuracy of U.S. strategic missiles, but guidance of U.S. ICBMs and SLBMs will not rely solely upon that system. Space systems play a very important role in military support which should not be underestimated, but critical, indispensable systems are designed with minimum dependence on satellites. If space links are involved, they are part of a redundant set of alternatives. As a result, there has not been a strong incentive to develop ASAT weapons.

Possibly more significant than our partial dependence on satellites, thought some panelists, is our moving towards total dependence on the space shuttle as a launch vehicle. "If the Soviets have an interest in impeding or disabling all or some parts of our space program, the way to go to the jugular is to go to the shuttle, " remarked a panelist. "The Air Force's claims that there is need for retention of conventional launch capability are absolutely correct. "

ANTI-SATELLITE SYSTEMS AND NEGOTIATIONS

In the 1960's, the United States maintained an operational system of nuclear-armed ASAT interceptors at Johnston Island and Kwajalein atoll in the Pacific Ocean. These were decommissioned by 1975 for several reasons, including: 1) the threat of orbiting nuclear weapons, which the ASATs were intended to counter, never materialized; 2) nuclear ASAT detonations in space would damage friendly satellites and terrestrial systems by electromagnetic pulse (EMP) generation; and 3) the existence of the nuclear-armed ASAT system formed a disincentive to spending additional money on a more sophisticated and more usable ASAT weapon. In 1978 and 1979, the United States held three rounds of bilateral negotiations with the U.S.S.R. concerning A SAT weapons. The talks were never resumed following the Soviet invasion of Afghanistan.

PRESENT POLICY

Although administration representatives were invited to participate in the workshop, none did so. As a result, the panelists attempted to represent administration positions from the perspective of outside, interested, and knowledgeable observers, and at times cited administration testimony before the Senate Foreign Relations Committee.

ASAT ARMS CONTROL

Present Reagan Administration policy is to complete development and deployment of the F-l5-launched, direct-ascent ASAT interceptor and to defer ASAT negotiations which have been sought by the Soviet Union. Three reasons have been given to Congress for building a U.S. ASAT weapon: 1) The existence of the Soviet ASAT requires that the United States develop an equivalent capability in order to deter Soviet ASAT attack, 2) the United States requires an ASAT in order to compel the Soviet Union to enter ASAT weapon negotiations in good faith, and 3) the United States requires the capability to deny the Soviets use of space assets which support attacks against U.S. forces.

Inadequate verification has been the primary stated reason for the United States not responding positively to Soviet requests to resume ASAT negotiations. Difficulty in verifying the destruction or ensuring the absence of dedicated ASAT systems, and the inevitable existence of potential residual ASAT capability (Galosh ABM interceptors, Soyuz rendezvous procedures, etc.) have been cited as being impediments to treaty verification. Potential residual or covert Soviet ASAT capability has been felt to preclude an effective ASAT treaty. Pursuit of the Strategic Defense Initiative, which would likely be impeded by effective ASAT arms control, may have been a factor in the opposition to ASAT negotiations but had not been brought up in testimony before the Senate Committee on Foreign Relations as of early 1984 (the most recent testimony offered before that Committee had been in May 1983).

ASAT arms control was not seen by the panelists as being high on the incoming Reagan administration's list of priorities. Its most important military objective was to build up strategic forces, and ensuring the survivability of military support satellites was made a very high priority. Strategic Arms Reduction Talks and Intermediate Nuclear Forces negotiations may have been a priority, but ASAT negotiations certainly were not. The possibility of future ASAT talks had not been foreclosed, but it was felt that they could be considered at some future time if they were seen to be in the national interest. For the time being, the Air Force was to continue development of the air-launched ASAT weapon.

A workshop participant noted that it seemed as if there had been no net assessment, at least in the first three years of this administration, of the overall advantages and disadvantages of an ASAT treaty. ASAT was not a priority issue, so there was no motivation for overcoming bureaucratic impediments against "getting the focused attention either of persons who don't wish to agree or of the person who can tell them to. " The lack of such a comprehensive policy, if it indeed is missing, is likely due to the lack of ongoing ASAT negotiations. During the 1978-79 ASAT negotiations, there was incentive to formulate an administration-wide policy. "Negotiating with the Soviets was really driving the whole process" at that time, observed a panelist.

ARMS CONTROL IN GENERAL

The Reagan administration reevaluated previous administrations' attitudes towards arms control. It was felt by members of the incoming administration that many previous arms control agreements had not been in the best interests of the United States. Negotiations which had led to treaties had had the effect of codifying and preserving the status quo. Since the new administration felt that the United States was in an unsatisfactory military balance with respect to the Soviet Union, taking into account rates of buildup as well as levels of deployed forces, this imbalance would have to be redressed before there was much hope of successful arms control. "The burden of proof," explained a panelist attempting to interpret administration attitudes, "would be on those who argued that an arms control negotiation about anything was more likely to succeed if begun in 1981 than if begun in 1982 or 1983 or 1984 or 1986 or 1987. "

Panelists also perceived an assumption within the administration that it would be a mistake to modify military programs to meet arms control objectives — either to make arms control successful or to rely upon successful conclusion of an agreement. "If a program makes sense in the absence of arms control, " voiced a panelist attempting to represent this attitude, "then that program makes sense, and one should not think about the alternatives of either 'go ahead with this program' or 'go ahead with an arms control treaty '."

Administration policies seemed to some panelists to be consistent with an attitude, held implicitly by administration policymakers, that the U.S./U.S.S.R. relationship will be one of military competition for the indefinite future. "It is beyond the ability of policy makers to opt out of that competition, " as restated by a panelist. However, "the policymakers may have some choices about where that competition takes place. " It would therefore make sense for the United States to steer the military competition into an arena where the United States might excel—developing and deploying sophisticated technology, such as space technology-and away from competitions which just involve spending money, such as putting tanks into Central Europe. Along these lines, there are those who argue that space is where the United States can "outflank" the Soviets and sustain some kind of superiority, and that consequently an ASAT treaty might be one of the less attractive arms control possibilities.

ASAT, BMD, and the 1972 ABM Treaty

ASAT systems and anti-ballistic missile systems are closely related, as are ASAT and ABM arms control. The development of ASATs can affect the continued viability of the existing ABM arms control regime; conversely, development of strategic defensive systems can affect possibilities for ASAT arms control. This section reviews the 1972 ABM treaty ("I have a rule. . . never to be flabbergasted at the same thing more than three times, " explained a panelist, "but I am always somewhat surprised at how people forget what it is that the treaty says and what it does not say"). This section also discusses some of the relationships between ASAT and ABM, regarding both weapons systems and arms control measures.

REVIEW OF 1972 ABM TREATY

PURPOSE

The Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Limitation of Anti-Ballistic Missile Systems, which entered into force on October 3, 1972, states its overall purpose in Article I:

> 1) Each party undertakes to limit anti-ballistic missile (ABM) systems and to adopt other measures in accordance with the provisions of this Treaty.
>
> 2) Each party undertakes not to deploy ABM systems for a defense of the territory of its country and not to provide a base for such a defense, and not to deploy ABM systems for defense of an individual region except as provided for in Article 111 of this Treaty.

This explicit declaration of purpose is an important aspect of the treaty. As time, technology, and circumstances change, it is possible to refer again to the declared purpose in order to develop specific new understandings which are required to modernize the treaty.

DEFINITIONS

An anti-ballistic missile system is defined, for the purposes of the treaty, as "a system to counter strategic ballistic missiles or their elements in flight trajectory. " This phrase is followed by the words "currently consisting of" and then a list of three items: ABM interceptor missiles, ABM launchers, and ABM radars. The treaty is not restricted to those systems. It says what the current systems are, but it is intended to cover all ABM systems.

Note that the definition refers to strategic weapons. Systems to counter tactical missiles are not covered at all-" a loophole that we designed carefully, and which they are pushing through, " according to a panelist (see app. B). Note also that the treaty defines an ABM as a system to counter strategic weapons. It does not say "system 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 (SAM S), 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. The analogy of upgrading ASAT weapons to give them ABM capability is similarly relevant and similarly covered by the treaty.

This definition is essentially a capability test. All systems which are ABM-capable, whether or not they were designed for that purpose, are either considered ABM systems under the treaty or else are in violation of Article VI(a), which prohibits giving ABM capability to non-ABM systems. This article was "really aimed at SAM systems, " explained a panelist, "but the same thing applies to ASAT systems. " If an ASAT weapon is given the ability to counter strategic ballistic missiles,

then "it's a violation or else it's got to count as an ABM system, one way or the other."

MAJOR PROVISIONS

The ABM treaty prohibits all ABM deployments which are not explicitly permitted. Article III bans all deployments other than two sites (amended by a 1974 protocol to one) on each side, each having restricted numbers of interceptors, launchers, and radars. These prohibitions, interpreted a panelist, are clear: "Can you deploy lasers? No. Can you deploy particle beams? No. Can you deploy squizzle dumps or freebie dobbles? No."

Article IV permits testing, at designated test sites, of certain systems not deployable under Article III. However, systems permitted at test sites or 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-based, or mobile land-based." Only fixed, land-based systems can be tested, and only specified fixed, land-based systems can be deployed. "Development," as referred to in this provision, was defined in a statement to Congress by the chief U.S. negotiator of the ABM treaty: "It is understood by both sides that the prohibition on development applies to activities involved after a component moves from the laboratory development testing stage to the field testing stage, wherever performed." Interpreted by a workshop panelist, "if I see one outside the laboratory—a prototype, a bread-board model—if I see one, it's a violation. I don't have to see it tested." The second part of Article V prohibits a launcher from being able to fire more than one interceptor or be reloaded rapidly.

Upgrades are prohibited in Article VI(a), as discussed above. No non-ABM systems shall be given ABM capability or be tested in an ABM mode. The second 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 outwards. Agreed Statement F, approved by U.S. and U.S.S.R. delegation heads at the same time that the treaty was signed, 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 XIII establishes the Standing Consultative Commission to handle questions relating to treaty compliance, to consider possible amendments, and to consider proposals for further limiting strategic arms.

Agreed Statement D of the ABM treaty discusses components based on "other physical principles" and capable of substituting for interceptors, launchers, or radars. Capability, again, is crucial. If a new device can substitute for a launcher, interceptor, or radar, its deployment is prohibited. If it is instead only an adjunct or supplement, it would be permitted. This article specifies that "specific limitations" on such new systems and their components would be "subject to discussion" in the Standing Consultative Commission, and that such discussion might lead to amendment of the treaty. Only if the treaty were amended to permit these new components would their deployment be allowed; otherwise, they are prohibited.

CONNECTIONS BETWEEN ASAT, BMD, AND THE ABM TREATY

As mentioned above, developing an ASAT system which had BMD capability, or upgrading one to give it BMD capability, would be a violation of the ABM treaty. The test of violation is capability-can the ASAT destroy missiles? There is an absolute prohibition on anything not fixed on land at an ABM site or a designated test site which is able to destroy "strategic ballistic missiles or their elements in flight trajectory. "

National technical means of verification are protected from interference in Article XII. Reconnaissance satellites are not explicitly mentioned in the treaty text, but they are listed as an example of national technical means in the transmittal letter from the Secretary of State to the President which accompanied the treaty and were also mentioned in the transmittal letter to Congress. ASAT attacks against reconnaissance satellites used to monitor compliance with the ABM treaty are, therefore, banned by that treaty.

Another relevant connection between ASAT systems and the ABM treaty involves the radars required for ASAT battle management (in the absence of an ASAT treaty) or ASAT treaty verification (if such a treaty is concluded). These space-track radars will physically be very hard to distinguish from early-warning radars and ABM battle management radars which are covered by the ABM treaty, and any ASAT treaty may need specifically to address space-track radars to ensure that the prohibitions against ABM battle management radars are not circumvented. However, according to a panelist, the signal emitted by a radar "would be quite different if it were fundamentally a space track system than if it were an ABM, " making somewhat easier the task of distinguishing between the two (see app. B).

TECHNOLOGIES

There is great overlap between BMD and ASAT technologies. In general, even a poor or prototype anti-ballistic missile could be an excellent ASAT. Looking at BMD systems designed to attack a ballistic missile at different stages in its flight trajectory, we have three categories of BMD systems:

1. Boost-phase BMD.–BMD systems designed to attack missiles as they are climbing out of the atmosphere under powered flight have great ASAT potential. Therefore, any treaty effectively limiting systems having ASAT capability would almost certainly have to restrict boost-phase BMD. Of course, the ABM treaty already in effect prohibits boost-phase BMD: in order to respond quickly enough to attack missiles in their boost phase, a boost-phase BMD system will either require space-basing of weapons components or else it will need to launch "pop-up" components immediate ly upon detection of missile launch by space-based sensors. It may well also require directed-energy weapons which produce beams propagating at or near the speed of light. "Both of those are prohibited by the ABM treaty, " reminded a panelist. "It's not as if there's some little, subtle question as to whether a space-based BMD system would be permitted or not. It's not. You can't develop it, you can't test it, you can't deploy it, and it's caught in about eight different places in the treaty. It is not close. "
2. Midcourse BMD.–The trajectory of a missile reentry vehicle while outside the atmosphere is similar to a satellite orbit: the peak altitude is on the order of 1,000 km and the velocity is slightly suborbi-

tal. There is therefore great overlap between midcourse BMD systems and ASAT systems. The Soviet Galosh ABM system was not designed as an ASAT but does 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 midcourse BMD. Since the ABM Treaty strictly limits locations of permitted ABM systems, there are significant constraints, in terms of number and location, on ABM systems which could be used as ASATs. Including the interceptors at test ranges, each side would have only about 115 interceptors and they would be located between 45 and 60 degrees latitude. ABM systems permitted under the treaty are therefore "important for some kinds of satellites in certain kinds of orbits, in certain places," but they are "probably not a very significant threat" to satellites in general. In addition to the constraints in the ABM treaty, midcourse BMD (like boost-phase BMD) would probably be inhibited by an effective ASAT treaty.

3. Terminal BMD.–BMD systems which attack missile warheads after the warheads have re-entered the Earth's atmosphere have the least overlap with ASAT technology. They are also not very useful systems for defending large areas, as opposed to selected hardened targets. While research into terminal BMD systems is proposed as part of the Reagan administration's Strategic Defense Initiative, they are not the systems primarily responsible for the renewed interest in ballistic missile defense pursuant to the President's March 23, 1983 "Star Wars" speech.

ROLES

Since ASAT and BMD technologies are so closely related, the outcome of any ASAT limitation or testing ban will almost certainly impede midcourse and boost-phase BMD development. Conversely, technology development ostensibly for an advanced ASAT system might provide a loophole for undertaking BMD research which would be in violation of the ABM treaty.

At the same time, the development of high-quality ASATs which will probably occur in the absence of an ASAT agreement would put the space-based elements of any BMD system (sensors if not weapons) at risk. Unconstrained ASATs would threaten sensors even for ABM systems which are within the scope of the present ABM treaty.

PERCEPTIONS

As noted above, aggressive ASAT development will aid development of advanced BMD systems since technologies investigated for ASAT maybe useful in either role. ASAT development may therefore be perceived as supporting a BMD program. To the extent that development of BMD is seen as being threatening, ASAT development may likewise be perceived to be a threatening act.

In a political context, a participant suggested that some of the hostile implications of pursuing BMD research might be ameliorated by simultaneously pursuing some sort of space behavior or "rules of the road" agreement.

DRAFT ASAT TREATIES

The 1983 Soviet draft ASAT treaty includes a subtlety of language which may or may not have been intended. The phrase "space object" is a negotiator's "term-of-art" originating with the Outer Space Treaty negotiations. It stands for anything in space except for ballistic missile reentry vehicles, which were purposely and carefully exempted from the jurisdiction of that treaty. Although the Soviet draft mentions space objects in the introduction, an operative article prohibits testing and deploying "space-based weapons for the destruction of objects on the Earth, in the atmosphere, or in outer space" (emphasis added). It does not say "space objects," implying that attacks on reentry vehicles would not be excluded from

the ban. One participant, noting that the "Soviets are not dummies when it comes to treaty language," thought that quite possibly they intended to use language that was "opaque as to their views" which would "invite us to reveal our views of some of these substantive matters through the route of fiddling around with these language details."

The draft ASAT treaty proposed by the Union of Concerned Scientists, on the other hand, prohibits attacks on "space objects" and therefore does not address the problem of attacks on reentry vehicles. That exemption was made because the ABM problem had been explicitly addressed in the 1972 ABM treaty. "There is a tendency in drafting treaties to make the treaty stand by itself," commented a panelist. "That should be resisted. Every treaty exists in the milieu of other agreements.

At least one participant disputed the value of preparing drafts outside of an ongoing process of negotiation: "I do not like the idea of people putting out draft treaties on ASAT matters." They are invariably "incomplete" since the text alone does not include any of the history that accompanies a true negotiation process and since the authors are not necessarily official representatives of their governments. The "prejudicial effects" of extant drafts "could probably be dismissed in a couple of weeks," but that time could be put to better use should negotiations be resumed.

TREATY WORDING

The language of the ABM treaty was left "fuzzy" in places, and definitions were not made overly precise, in order to leave a "no-man's-land" surrounding prohibited areas. The hope was that debate would ensue as to whether the "no-man's-land" had been entered before there were any questions of treaty violation. This "noble experiment," however, did not provide the desired results. "It turns out the Soviets are creatively legalistic," interpreted one panelist. "They don't worry about the fuzzy areas. In their view, action in a fuzzy area is permitted because it not prohibited.

However, the suggestion that the Soviets do not uphold the spirit of a treaty was debated by another panelist. "I don't like to talk about the 'spirit of agreement' because there ain't no such thing." However, this panelist noted that there is significant value in having an operative article in a treaty which states the treaty's general purposes. When circumstances change, forcing development of new understandings in order to maintain the treaty, one can look back on that declaration of intent to make an easy transition. "Here is the agreed purpose that's built into the treaty. Here are the new circumstances that bear on that purpose, and here are the new specific understandings that are needed to modernize" the treaty.

Verification Issues

CAVEATS

Verification issues are inherently difficult to discuss in an open meeting. However, a panelist pointed out that verification is much more than a detailed catalog of technical intelligence capabilities. Another panelist agreed, noting that the intelligence agencies say that their job is not verification, but monitoring. They make that distinction very clearly, he explained: "verification" is a political, legal, diplomatic, and military process, of which "monitoring" is only a part.

Workshop panelists started the session devoted to verification by making two observations. First, verification is concerned with determining whether or not specified treaty provisions are being complied with and is therefore inherently dependent on the wording of those provisions. Second, any discussion of verification ought to include consideration of the overall military or security purposes which the treaty is to serve. The level and confidence with which compliance with a provision need be verified must depend on the significance and implications of violating that provision.

GOALS

Therefore, any discussion of verification technology and procedure must implicitly or explicitly be preceded by discussion of philosophy—what is it that the treaty is to accomplish? Five not necessarily mutually exclusive goals of a space arms control or space behavior agreement were identified at the workshop:

1. to reduce the vulnerability of existing space assets to dedicated or residual ASAT threats by constraining those threats;
2. to prevent future development of a high-confidence, high-quality ASAT by the opposing party;
3. to relax tensions between the superpowers by establishing a regime of acceptable behavior in space;
4. to obtain political or diplomatic goodwill; and
5. to avert or constrain an arms race in space.

Some aspects of a treaty maybe much more relevant for achieving the principal purposes of the agreement than others, and therefore it may be more important to verify some portions of an agreement than others.

LEVELS OF VERIFIABILITY

Some provisions in a treaty may serve to ban activities which are not very threatening in themselves but are prohibited in order to ensure that other, more threatening activities are not undertaken. In these cases, the activities which are of less concern might not need to be detected with as high a level of confidence as long as there were higher confidence that the more threatening activities were not taking place. As an example, consider a ban against testing ASAT interceptors at geosynchronous orbit, which would be a more threatening act than testing them in low Earth orbit. It might be easier to ban these high altitude tests if tests in low earth orbit were also prohibited. Even if some low-altitude tests were conducted covertly by masking them as legitimate rendezvous operations, the

low-altitude ban might prevent overt, explicit low-altitude ASAT tests which might be more easily adapted to higher orbits than a covert capability would be.

Limitations which might not be highly verifiable, taken alone, might nevertheless be useful in an agreement as long as one understands the limited contributions such bans might make to security. Subversion of even a leaky ban would require a totally covert program, which would certainly be more difficult than an overt one and which mayor may not be possible. Furthermore, technical encroachment of a treaty proscription by a single component is not the same as development of a militarily significant system. "Soyuz can ram satellites, " admitted a participant, "but you have to have one hell of a lot of Soyuzes floating around to make a terribly militarily effective ASAT system. "

The problem of levels of verification has arisen in previous arms control issues. "In the late 1970's, there was some agreement among a large fraction of the community," said a panelist, "that although cruise missile verification could not be absolute, verification could be good enough considering that they did not pose a first strike threat. " Another panelist noted that we do not necessarily have to respond to weaknesses in our verification capabilities by either contorting arms provisions to avoid the weaknesses or by avoiding arms control altogether. There are defensive means other than arms control, such as hardening and survivability measures or changes in operational procedures, which can offset the military advantage that might accrue to a party attempting to cheat on an agreement.

FACTORS IN VERIFICATION OF ASAT ARMS CONTROL

COMPLICATIONS

Discussion of ASAT arms control brought forth several factors which tend to complicate the verification of compliance with such an agreement, and several other factors which ease that task. One of the complications is the enormous volume of space where illicit activities might be conducted. Verification of compliance with a SALT or START arms control agreement involves inspection of number of areas within the Soviet Union or its immediate airspace. This area, although vast, is relatively well determined and is amenable to close inspection by space-based photographic reconnaissance satellites. The region where space activities might be conducted starts at altitudes of about 100 km and can range well past geosynchronous orbit at 36,000 km. Also increasing the difficulty of verifying compliance with an ASAT treaty *is* the large number and growing variety of Soviet space launches. Soviet launches have increased at a rate of about 2 percent per year, averaged over the last 15 years. Although this launch rate may very well decrease in the future as the Soviets develop longer lived satellites, each additional type of satellite requires a body of experience in order to classify its function and permit discrimination between unusual activity and routine behavior.

Third, the functional characteristics distinguishing ASAT weapons or space mines from other satellites may not be readily observable. All national technical means have imperfect discrimination, and the physical differences between permitted and prohibited satellites may be small. As panelists had previously pointed out, much Soviet space activity is not likely to be completely understood by the United States no matter what the "true" Soviet intent might be.

A fourth complication is the inevitable presence of some residual ASAT capability in systems which may be undesirable or infeasible to ban. ICBMs, SLBMs, ABM interceptors, maneuvering spacecraft, and possibly air-

based or ground-based lasers may fall into this category. These systems may pose problems in determining whether they are being operated in an ASAT mode; normal operation (of rendezvous between spacecraft, for example) may be difficult to distinguish from certain types of ASAT activities. This question of residual ASAT capability is one of the most crucial factors in the debate concerning the desirability of an ASAT accord, and just how much ASAT activity could go undetected is a critical question. As the number of systems possibly having some ASAT capability proliferates, the monitoring task of determining how these systems are being used will become even more difficult.

A fifth, somewhat ironic, point made during this discussion was that at present, the principal motivation for the United States to develop the sort of space monitoring capability which would be useful in verifying an ASAT accord is to provide targeting information for the U.S. ASAT weapon. Panelists did note, however, that it is likely that any monitoring capability needed to verify a treaty would be desirable in any case. Intelligence collection requirements would persist even in, or especially in, the absence of a treaty. However, the lack of an ASAT weapon system might reduce the bureaucratic enthusiasm or political backing for an extensive space monitoring system.

SIMPLIFICATIONS

Mitigating these complications are several offsetting factors which assist our capability or monitoring space arms control. First, although space is large, it is transparent and accessible to monitoring, and weaknesses in round-based monitoring systems can be mitigated by putting those systems into space. Soviet satellites will be observable by U.S. national technical means. Confusion as to the true nature of a Soviet spacecraft maybe mitigated by an agreement which will serve to reduce ambiguity of space operations. Furthermore, all ASAT-related activities start on the ground. Relevant ground sites, including launch facilities, can be observed by an extensive array of U.S. monitoring facilities; all launches of significant size from Soviet territory can now be detected. After all, although the Soviets have never publicly announced their existing ASAT tests, these tests have been detected and analyzed by the United States.

Second, if the Soviet Union attempts to conduct covert ASAT testing or development, it will need to monitor its own activity if it intends to obtain any data concerning how well its system performs. The Soviet requirement to recover data from or observe its activity in some way may also provide the United States with an opportunity to detect or intercept the transmission. The Soviet need to hide covert testing from the United States may narrow down the regions where the United States need concentrate its own verification effort.

Finally, the claim has been made that unattainably stringent levels of verification are needed for an ASAT treaty because U.S. targets are few and valuable and therefore vulnerable to even a small amount of cheating. This reasoning was thought by many participants to be not so much an argument against an ASAT treaty as it was a compelling reason for the United States to increase the survivability of its space systems. Rather than precluding arms control, the situation of having few but valuable satellites calls for having alternatives to them. “If the United States is truly and genuinely that dependent upon a few satellites, I’d just like to know what the hell DOD plans on doing about it, because in the absence of any ASAT arms control, the problems are only worse. ”

VERIFICATION PARTICULARS

The verification discussion was explicitly not intended to be an exhaustive analysis. Security considerations, in particular, prevented many highly relevant points from being studied in detail. However, like the other workshop sessions, the session on verification did serve to foster discussion on a range of topics.

One participant pointed out that ASAT treaties would ban, first of all, the act of destroying satellites, and that this aspect of any ASAT treaty is readily verifiable. Less clear was how detectable the capability to destroy a satellite or its ability to function would be.

Satellite failure can easily be detected. Although there was concern that the Soviets might be able to develop a system which could cause one or two U.S. satellites to fail in a manner mimicking an equipment malfunction, panelists noted that satellites presently have a lot of on-board "state-of-health" monitoring. These sensors can be augmented to determine whether a failure is due to an internal flaw or whether it has been externally induced. Satellites can have sensors to measure incident laser light, rises in temperature, or sudden accelerations, for example. A satellite's location or behavior might also indicate a cause for its failure, either hostile or benign. Therefore, the Soviets would not have high confidence that covert interference would remain undetected.

Central to the ASAT arms control debate is the level of residual or covert ASAT capability which could remain, or be developed covertly, after a treaty had been ratified. A panelist noted that capabilities associated with known ASAT launch sites and research and development facilities would be detectable. The detectability of other possible residual or covert activity was more controversial. One possible "worst-case" evaluation of ASAT capability which might be covertly developed or maintained under a test ban was attempted at the workshop. Again, no detailed assessment of the likelihood of these developments, or of the particular means the United States could employ to search for them, was undertaken. There was, however, a general feeling that nothing arose in that evaluation which would clearly permit covert development of a high-confidence, high-quality ASAT weapon under such a test ban, although some panelists did express strong reservations about the detectability of nuclear space mines and ground or air-based lasers. ASAT capability is categorized below by technology.

DIRECT INTERCEPTION

1) Fully capable, dedicated, tested systems.—Neither the United States nor the U.S.S.R. now has such a system. Developing one would require an extensive testing program. If such a proposed system were to be similar to the existing Soviet ASAT, its launches would be visible; orbiting vehicles would be noticed, especially maneuvering ones. If such a direct intercept system were to be similar to the U.S. miniature homing vehicle, its ascent could be seen, its telemetry could be detected, and its target could be seen. Suspicious rendezvous operations in space could be inquired about Tests against points in space would eliminate any observation of the target, but there would be concomitant loss of confidence in the results of the test.

2) Existing Soviet ASAT.–Tests of the ex isting Soviet ASAT can be monitored. We possibly would not be assured that all ASAT interceptors had been destroyed pursuant to a ban, but we could with high reliability know if one had been tested. There will certainly not be high confidence that an ASAT intercept would work reliably mated to a booster it has never been tested with. Even with no major design change, the confidence in and signifi cance of any untested system is bound to degrade with time.

3) Residual "baling-wire" direct intercep ASAT.—One can never rule out the existence of some covert, improvised ASAT capability of this sort, but one can deny high confidence in such a system by preventing tests.

4) Nuclear-armed ICBM or ABM missiles used as ASATs.—Testing nuclear warheads in space is risky, in terms of collateral damage to friendly systems; prohibited, under the limited test ban treaty; and easily detectable. (Testing warheads underground could be done with high confidence.) Nuclear ASAT capability cannot reasonably be prohibited since ICBMs and possibly ABMs will exist with or without an ASAT treaty. Workshop panelists felt that such systems did not present a significant ASAT threat except during nuclear war, in which case damage to satellites would be likely whether or not it had been intended. "The Soviets are bad, but they're not lunatics, " said one panelist, "and I can just see no credibility whatsoever in the notion that they'd fling a nuclear weapon up into the heavens and crack it off. It would cost them a lot. "

5) Non-nuclear ICBM or ABM used as ASATs.–With appropriate radar support, it is possible that the Soviet Galosh ABM could perform ASAT attacks with a non-nuclear charge. Galosh deployment and testing are permitted under the ABM treaty, but the location of the launchers and the consequent range of orbits at risk are limited by the ABM treaty and protocol. Testing of an ICBM or ABM in an ASAT profile would be prohibited under an ASAT test ban, would be differentiable from ABM tests, and would likely be detected.

"SPACE MINES"

In general, any satellite very close to another country's satellite is a priori suspicious. Any mine or weapon which would be effective from further away is a complex system which requires maneuvering or pointing and would therefore require testing. These tests would be detectable. Concerning close approach, however, panelists noted that under the regime presently existing on the high seas, opposing forces do have the right to make close approaches. Banning close approaches in space would require codification of principles not incorporated in present law. Such an agreement would be highly verifiable, and could be made even more so by putting potential target satellites in orbits "out in the middle of nowhere" where there would be no innocent reason for other satellites to be anywhere nearby at all.

1) Non-nuclear space mines.—These would have to get very close (on the order of 1 km) to their targets. There would be no innocent reason to have a satellite that close to another country's satellite, and such approaches could be easily detected.

2) Nuclear space mines.—The Outer Space Treaty of 1967 prohibits orbiting of "nuclear weapons, or any other kinds of weapons of mass destruction. " Nuclear space mines are therefore presently prohibited. There are also significant inhibitions (collateral damage, breaking the nuclear threshold) against their use for ASAT (see "Nuclear-armed ICBM or ABM missiles" section above). At present, nuclear space mines can easily be built, tested underground, and deployed. However, actual emplacement of mines within a nuclear kill radius (100 to 200 km) of their targets, or of mines able to be maneuvered within that range, would likely be identified from tracking data. Inspector satellites that could detect nuclear weapons in space satellites were briefly discussed. However, they may not be technically feasible, and negotiating an agreement regulating their use might pose problems (see "Cooperative Verification Measures" section below).

3) Projectile-emitting. -Satellites carrying interceptors which could travel 100 kilometers or so to their targets could similarly be identified from tracking data; furthermore, projectile-emitting satellites would likely require extensive testing of their target acquisition and homing systems, and these tests would likely be detected.

DIRECTED ENERGY WEAPONS

1) Space-based directed energy.–Space-based directed energy weapons might best be considered space mines with kill radii of hundreds to thousands of kilometers since they are ef-

fectively instantaneously acting. Space-based, non-nuclear-pumped lasers would be quite large and may emit hydrogen fluoride or other gases. Their operation and testing would be observable. Nuclear-pumped directed energy weapons, like non-directed nuclear weapons, could not be tested covertly in space, and placing them into orbit is contrary to existing treaties. On-board nuclear weapons might be searched for (see discussion of inspection in "Cooperative Verification Measures" below).

2) Air-based, ground-based, or pop-up directed energy.—All such systems would require testing. Possible targets could in principle be monitored to see if they are being illuminated by strong lasers, are giving off gases, are being unexpectedly accelerated, or are emitting unusual signals. Air and ground-based systems may be detectable by national technical means; furthermore, they are increasingly less effective as the target altitude increases, since intensity drops off as the square of the distance between the weapon and the target. It is far easier to blind an optical sensor than to damage a satellite, requiring probably one millionth of the energy. Lasers capable of blinding sensors are easily available, so the capability of blinding sensors cannot be banned. However, the act of blinding a satellite would be readily detected: after all, "imaging satelites are only so particularly vulnerable when they are looking at you. "

SPOOFING, JAMMING, OR OTHERWISE INTERFERING WITH THE OPERATION OF SYSTEMS USING SATELLITES

These categories would likely not be covered under an ASAT testing ban, since ensuring the absence of such capability would not be verifiable. Furthermore, the United States is not likely to negotiate away the capability to interfere with hostile satellites in these ways: "We would like to do that, we're very good at doing that, and we intend to do that in case of conflict. "

COOPERATIVE VERIFICATION MEASURES

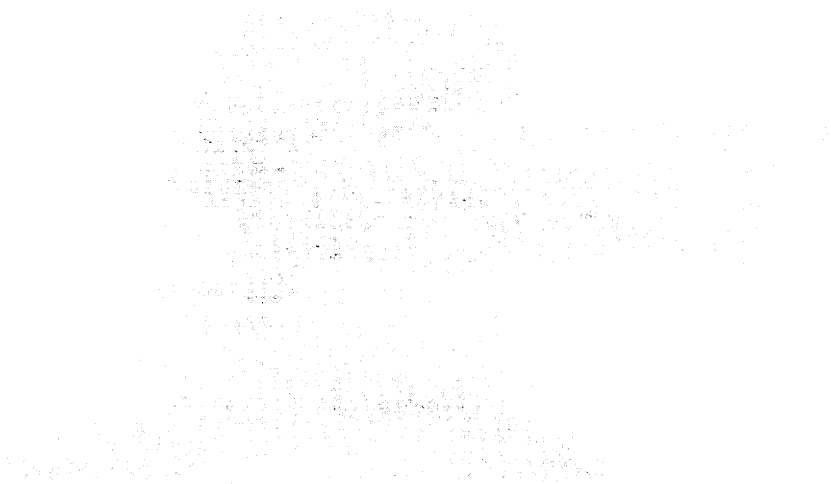
Some of the verification techniques discussed at the workshop would require, or would at least greatly benefit from, cooperative verification procedures between the United States and the U.S.S.R. Just one example would be verifying the absence of orbiting nuclear weapons, although such measures might be useful in many other cases as well.

If the capability for detecting nuclear weapons in orbit were felt to be required (note that the 1967 Outer Space Treaty forbidding them was ratified, and remains in force, in the absence of such explicit procedures), some sort of co-operative program would need to be established. One method mentioned at the workshop might involve a form of "on-orbit" inspection. In that example, all satellites would be required to withstand some level of neutron irradiation. On demand, suspect satellites would be subject to such irradiation from an orbiting inspector satellite. Emission of delayed neutrons from the target would reveal the presence of fissionable material. Alternatively, non-intrusive examination for fissionable material might be done on the launch pad.

There are several difficulties with inspection in orbit. In the case mentioned above, for example, it might be possible to conceal a nuclear warhead by shielding it appropriately. A more general problem with any "on-orbit" inspection is that the inspector satellite, requiring the capability to acquire, track, and rendezvous with a target satellite, would have and would regularly test all the attributes of an ASAT interceptor except for detonation of a warhead. Another problem with actively probing inspections in particular, noted a panelist, is that "if it's carrying an accelerator, one

might want to think about it" —such an inspector might indeed have A SAT potential in its own right. Perhaps limits on the size, approach velocity, or capability of inspector satellites could be established.

Appendixes



Appendix A

Survivability of Space Capability

All panelists agreed that survivable space capability is important to the United States with or without an ASAT treaty. An irreducible residual ASAT threat will remain under any treaty, making survivability measures essential. Without a treaty, of course, satellites will face dedicated ASAT systems in addition to residual capability, making survivability requirements that much more difficult.

"Survivable space capability" includes measures both to protect and to supplement satellites. U.S. satellites have been hardened against nuclear effects and are spaced so that not more than one at a time should be vulnerable to any one nuclear explosion. Protection includes hardening against radiation, hardening against system-generated electromagnetic pulse (high voltages induced within components by radiation from nuclear explosions), and hardening against other nuclear effects. There are additional protective measures which can and should be applied to satellites to guard against non-nuclear threats. Satellites can be made to evade direct-intercept ASATs or space mines by maneuvering or by interfering with (jamming or confusing) the ASAT's homing sensors. In the absence of an ASAT ban, satellites could conceivably also be given active defenses.

Another way to protect satellites is to proliferate them. Various functions can be distributed on a wide variety of satellites, and duplicate satellites can be orbited. These spares can be left silent until needed and they can be decoyed, making their detection and destruction more difficult. One of the most important motivations for distributing capability is to buy time-it will take much 1onger to destroy many satellites with shared functions than it will take to destroy any single satellite. Proliferated systems should be simpler and more basic than the full-fledged, highly sophisticated equipment now used in military satellites. Non-space assets such as ground stations would have to be proliferated as well, with the proviso again that the proliferated stations not be as complex as the main ground station.

Satellites can also be replaced by other systems. Today, satellites are used in support of strategic forces but they are not essential. Ground-based radars can be used for early warning. Nuclear detonation detection, besides being proliferated onto many small satellites, can be done for our own warheads by placing transmitters on them, if needed. Tactical theater support now done with satellites can be replaced with a variety of systems —remotely piloted aircraft, sounding rockets, balloons, and low-cost replacement satellites launched on cheap boosters or ICBMs or SLBMs. There are many alternatives to space for functions which are now carried out in space.

Compliance With the 1972 ABM Treaty

The Reagan Administration's recent public allegations of Soviet non-compliance with arms control agreements have drawn much attention. One of these allegations concerned construction of a radar in Siberia which was said to be almost certainly in violation of the 1972 ABM treaty. This radar was discussed at one point in the workshop, and portions of that discussion are described in this appendix.

THE SOVIET RADAR NEAR KRASNOYARSK

According to Articles III and IV of the ABM treaty, ABM radars may be located only at agreed ABM sites or test ranges. Article VI notes that early warning radars may not be constructed except on the periphery of the country and looking outward. Agreed Statement F states that phased-array (electronically steered) radars greater than a specified size may not be deployed except as permitted by Articles III, IV, and VI. It goes on to exempt radars used "for the purposes of tracking objects in outer space or for use as national technical means. "

The Soviets are constructing a phased-array radar of greater than the specified size near Krasnoyarsk in central Siberia. The location is not near the periphery of the country and it is not oriented outwards. If it is indeed an early warning or ABM battle management radar, the Soviets are in violation of the ABM treaty. The Soviets claim that the radar is allowable under the exemption in Statement F. Since it is geographically poorly sited to be effective for intelligence (national technical means) purposes, it would have to be a space track radar to be permitted under the treaty.

The administration has charged that this radar "almost certainly" violates the ABM treaty. Others find the issue somewhat less clear. The radar "sort of looks like a duck, and it walks a little bit like a duck, but it doesn't look quite like all the other ducks, " in the words of one panelist. "The Soviets say, 'Oh, don't worry. It's not a duck. Notice there are some differences between it and other ducks, and when you hear it later, you'll find out it barks. It doesn't quack. ' "

According to a panelist, the signal from a space track radar (a "dog") would be quite different from that of a radar used for ABM battle management (a "duck"). Therefore, the question will presumably be resolved when the radar becomes operational. However, some panelists were not willing to wait that long to find out, and they thought that the administration's announcement was proper. "You can't expect me to look at something that looks like a duck and walks like a duck and tell me it's a dog and I'm supposed to take it on faith. . . . You've got to provide more help than that. " They felt that the Soviets were obligated to be more forthcoming about the radar than they had been within diplomatic channels, and that the public announcement served notice that the United States feels the issue has not adequately been resolved. Other panelists felt that existing channels were the appropriate forum and that the public announcement did not serve any constructive purpose.

Some panelists were generally skeptical as to whether the radar is in fact in violation of the ABM treaty. The utility of having such a flagrantly illegal early-warning radar, if it is one, was not felt to be sufficient incentive for the Soviets to unilaterally abrogate the ABM treaty. Others, including some who had access to intelligence data, had little doubt that the radar is indeed optimized for the ABM role. The alternative to being an illegal ABM radar is for the radar to be for tracking satellites, indicating a buildup of the Soviet space monitoring capability and being at least suggestive of an extension of their ASAT program.

BREAKOUT FROM AND LOOPHOLES IN THE ABM TREATY

The ABM treaty is under a great deal of pressure. In the United States, no ongoing research, development, or deployment contradicts treaty provisions. However, deployment of ballistic missile defense beyond the permitted single site would violate the ABM treaty, as would development, testing, or deployment of any ABM systems or components other than fixed, land-based ones. A panelist estimated that at the time of President Reagan's March 23, 1983 "Star Wars" speech, U.S. research into ground-based BMD components was about three years away from the point at which continuation could have run up against the ABM treaty. In light of the March 23 speech and

ensuing developments, this estimate may be lengthened to about a decade because more futuristic BMD technologies, which are highly immature, presumably will be emphasized at the expense of the older, more developed systems which were closer to deployment.

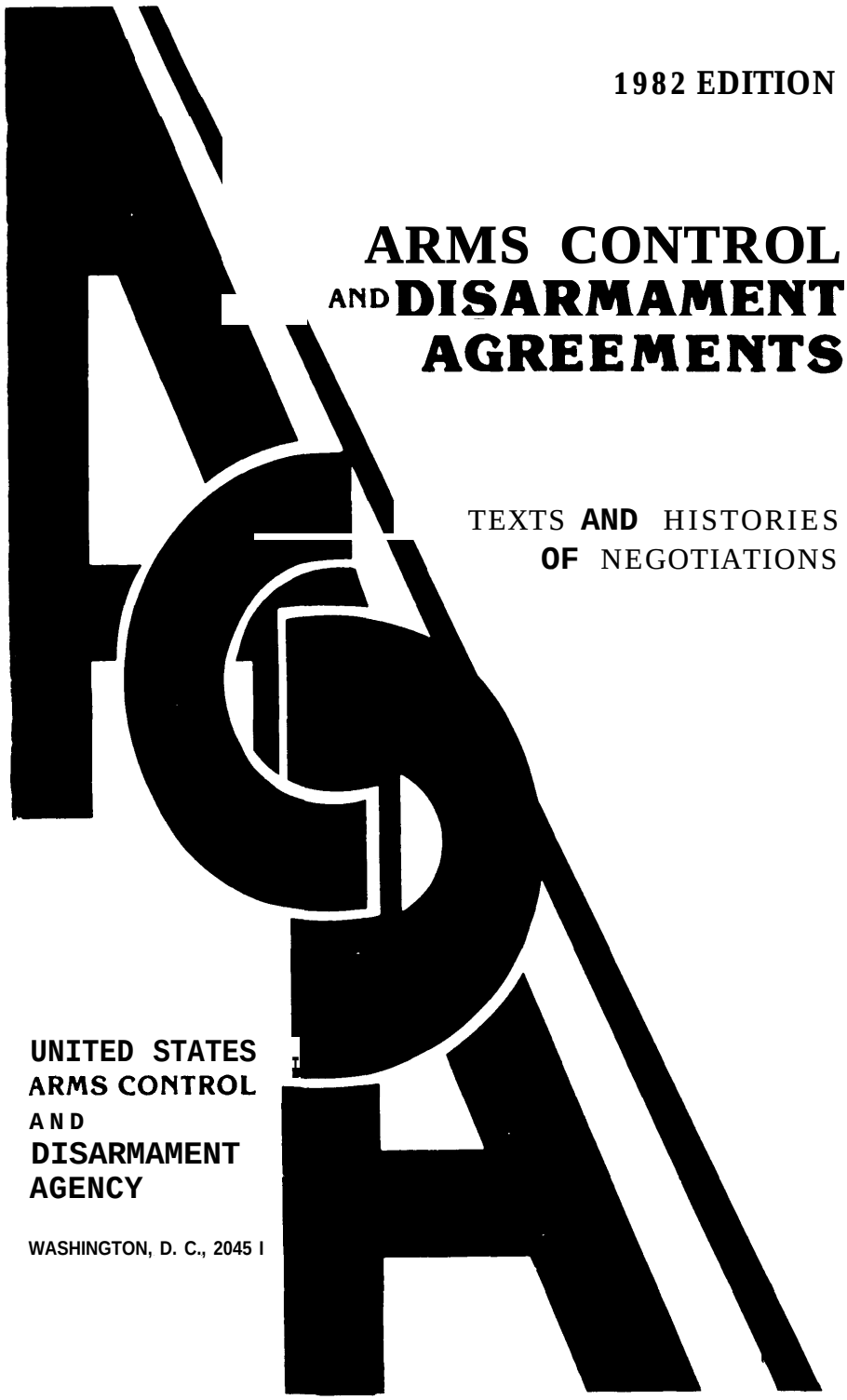
The Soviets, according to articles in *Aviation Week and Space Technology* referred to by workshop participants, are building defenses against tactical ballistic missiles. Since the ABM treaty prohibits defenses only against **strategic missiles**, anti-tactical ballistic missile (ATBM) systems are not covered and are therefore permitted. Anti-tactical ballistic missiles were not included in the ABM treaty at United States insistence in order to protect SAM-D, a surface-to-air missile then under development which was intended to have some capability against short-range tactical ballistic missiles as well as against aircraft. However, according to a panelist, as SAM-D developed (changing its name to 'Patriot'), "it lost not only its capability against missiles, but it lost much of its anti-aircraft capability" as well. At the same time, "the Soviets have essentially designed and deployed the 'SAM-D-ski', which looks a lot like what we were trying to protect."

ATBM systems, and their impact on the continuing viability of the ABM treaty, were a source of considerable concern to many panelists. A panelist felt that "if things are deployed under the rubric of anti-tactical ballistic missiles, they can or will have an impact on the penetrability of our SLBMs and the French deterrent system and the British deterrent system, and the whole ball of wax can unravel." The U.S. deployment of Pershing II missiles in Europe could stimulate a particularly troubling Soviet ATBM deployment. 'The United States has no excuse for deploying anti-tactical ballistic missiles in its homeland," pointed out a participant, "but the Soviet Union does-and we're giving them a better one. We are now deploying an offensive system that says, 'Hey, you know those ATBMs? Come on, bring them out, there's a legitimate use for them now.' "

Panelists did note that, even if the Soviets should deploy extensive ATBM systems, it need not change the strategic balance. "We know how to deal with them," said one. "It requires penetration aids. We know how to do that." These aids are not presently deployed in the strategic inventory, which "we ought to do something about," but the United States is not in imminent danger of being effectively disarmed.

Another cause for concern is the continued miniaturization of components. Those who worry about possible scenarios in which the Soviet Union builds and stockpiles components in preparation for rapid breakout from the ABM treaty are worrying more now because small radars can have enough capability to fulfill some ABM roles. Even so, small radars cannot do so in the absence of large phased-array battle management radars. Since ABM battle management radars and space track radars share at least some characteristics, panelists felt that a radar clause might be required in an ASAT agreement to prevent circumvention of the ABM treaty restrictions on radars.

ABM Treaty and Related Documents



Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Limitation of Anti-Ballistic Missile Systems

Signed at Moscow May 26, 1972
Ratification advised by U.S. Senate August 3, 1972
Ratified by U.S. President September 30, 1972
Proclaimed by U.S. President October 3, 1972
Instruments of ratification exchanged October 3, 1972
Entered into force October 3, 1972

The United States of America and the Union of Soviet Socialist Republics, hereinafter referred to as the Parties,

Proceeding from the premise that nuclear war would have devastating consequences for all mankind,

Considering that effective measures to limit anti-ballistic missile systems would be a substantial factor in curbing the race in strategic offensive arms and would lead to a decrease in the risk of outbreak of war involving nuclear weapons,

Proceeding from the premise that the limitation of anti-ballistic missile systems, as well as certain agreed measures with respect to the limitation of strategic offensive arms, would contribute to the creation of more favorable conditions for further negotiations on limiting strategic arms,

Mindful of their obligations under Article VI of the Treaty on the Non-Proliferation of Nuclear Weapons,

Declaring their intention to achieve at the earliest possible date the cessation of the nuclear arms race and to take effective measures toward reductions in strategic arms, nuclear disarmament, and general and complete disarmament,

Desiring to contribute to the relaxation of international tension and the strengthening of trust between States,

Have agreed as follows:

Article I

1. Each party undertakes to limit anti-ballistic missile (ABM) systems and to adopt other measures in accordance with the provisions of this Treaty.

2. Each Party undertakes not to deploy ABM systems for a defense of the territory of its country and not to provide a base for such a defense, and not to deploy ABM systems for defense of an individual region except as provided for in Article III of this Treaty.

Article II

1. For the purpose of this Treaty an ABM system is a system to counter strategic ballistic missiles or their elements in flight trajectory, currently consisting of:

(a) ABM interceptor missiles, which are interceptor missiles constructed and deployed for an ABM role, or of a type tested in an ABM mode;

(b) ABM launchers, which are launchers constructed and deployed for launching ABM interceptor missiles; and

(c) ABM radars, which are radars constructed and deployed for an ABM role, or of a type tested in an ABM mode.

2. The ABM system components listed in paragraph 1 of this Article include those which are:

(a) operational;
(b) under construction;
(c) undergoing testing;
(d) undergoing overhaul, repair or conversion; or
(e) mothballed.

Article III

Each Party undertakes not to deploy ABM systems or their components except that:

(a) within one ABM system deployment area having a radius of one hundred and fifty kilometers and centered on the Party's national capital, a Party may deploy: (1) no more than one hundred ABM launchers and no more than one hundred ABM interceptor missiles at launch sites, and (2) ABM radars within no more than six ABM radar complexes, the area of each complex being circular and having a diameter of no more than three kilometers; and

(b) within one ABM system deployment area having a radius of one hundred and fifty kilometers and containing ICBM silo launchers, a Party may deploy: (1) no more than one hundred ABM launchers and no more than one hundred ABM interceptor missiles at launch sites, (2) two large phased-array ABM radars comparable in potential to corresponding ABM radars operational or under construction on the date of signature of the Treaty in an ABM system deployment area containing ICBM silo launchers, and (3) no more than eighteen ABM radars each having a potential less than the potential of the smaller of the above-mentioned two large phased-array ABM radars.

Article IV

The limitations provided for in Article III shall not apply to ABM systems or their components used for development or testing, and located within current or additionally agreed test ranges. Each Party may have no more than a total of fifteen ABM launchers at test ranges.

Article V

1. Each Party undertakes not to develop, test, or deploy ABM systems or components which are sea-based, air-based, space-based, or mobile land-based.

2. Each Party undertakes not to develop, test, or deploy ABM launchers for launching more than one ABM interceptor missile at a time from each launcher, not to modify deployed launchers to provide them with such a capability, not to develop, test, or deploy automatic or semi-automatic or other similar systems for rapid reload of ABM launchers.

Article VI

To enhance assurance of the effectiveness of the limitations on ABM systems and their components provided by the Treaty, each Party undertakes:

(a) not to give missiles, launchers, or radars, other than ABM interceptor missiles, ABM launchers, or ABM radars, capabilities to counter strategic ballistic missiles or their elements in flight trajectory, and not to test them in an ABM mode; and

(b) not to deploy in the future radars for early warning of strategic ballistic missile attack except at locations along the periphery of its national territory and oriented outward.

Article VII

Subject to the provisions of this Treaty, modernization and replacement of ABM systems or their components may be carried out.

Article VIII

ABM systems or their components in excess of the numbers or outside the areas specified in this Treaty, as well as ABM systems or their components prohibited by this Treaty, shall be destroyed or dismantled under agreed procedures within the shortest possible agreed period of time.

Article IX

To assure the viability and effectiveness of this Treaty, each Party undertakes not to transfer to other States, and not to deploy outside its national territory, ABM systems or their components limited by this Treaty.

Article X

Each Party undertakes not to assume any international obligations which would conflict with this Treaty.

Article XI

The Parties undertake to continue active negotiations for limitations on strategic offensive arms.

Article XII

1. For the purpose of providing assurance of compliance with the provisions of this Treaty, each Party shall use national technical means of verification at its disposal in a manner consistent with generally recognized principles of international law.

2. Each Party undertakes not to interfere with the national technical means of verification of the other Party operating in accordance with paragraph 1 of this is Article.

3. Each Party undertakes not to use deliberate concealment measures which impede verification by national technical means of compliance with the provisions of this Treaty. This obligation shall not require changes in current construction, assembly, conversion, or overhaul practices.

Article XIII

1. To promote the objectives and implementation of the provisions of this Treaty, the Parties shall establish promptly a Standing Consultative Commission, within the framework of which they will:

(a) consider questions concerning compliance with the obligations assumed and related situations which may be considered ambiguous;

(b) provide on a voluntary basis such information as either Party considers necessary to assure confidence in compliance with the obligations assumed;

(c) consider questions involving unintended interference with national technical means of verification;

(d) consider possible changes in the strategic situation which have a bearing on the provisions of this Treaty;

(e) agree upon procedures and dates for destruction or dismantling of ABM systems or their components in cases provided for by the provisions of this Treaty;

(f) consider, as appropriate, possible proposals for further increasing the viability of this Treaty; including proposals for amendments in accordance with the provisions of this Treaty;

(g) consider, as appropriate, proposals for further measures aimed at limiting strategic arms.

2. The Parties through consultation shall establish, and may amend as appropriate, Regulations for the Standing Consultative Commission governing procedures, composition and other relevant matters.

Article XIV

1. Each Party may propose amendments to this Treaty. Agreed amendments shall enter into force in accordance with the procedures governing the entry into force of this Treaty.

2. Five years after entry into force of this Treaty, and at five-year intervals thereafter, the Parties shall together conduct a review of this Treaty.

Article XV

1. This Treaty shall be of unlimited duration.

2. Each Party shall, in exercising its national sovereignty, have the right to withdraw from this Treaty if it decides that extraordinary events related to the subject matter of this Treaty have jeopardized its supreme interests. It shall give notice of its decision to the other Party six months prior to withdrawal from the Treaty. Such notice shall Include a statement of the extraordinary events the notifying Party regards as having jeopardized its supreme interests.

Article XVI

1. This Treaty shall be subject to ratification in accordance with the constitutional procedures of each Party. The Treaty shall enter Into force on the day of the exchange of Instruments of ratification.

2. This Treaty shall be registered pursuant to Article 102 of the Charter of the United Nations.

DONE at Moscow on May 26, 1972, in two copies, each in the English and Russian languages, both texts being equally authentic.

FOR THE UNITED STATES OF AMERICA	**FOR THE UNION OF SOVIET SOCIALIST REPUBLICS**
RICHARD NIXON	L. 1. BREZHNEV
President of the United States of America	*Genera/ Secretary of the Central Committee of the CPSU*

Agreed Statements, Common Understandings, and Unilateral Statements Regarding the Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Limitation of Anti-Ballistic Missiles

1. Agreedi Statement

The document set forth below was agreed upon and initialed by the Heads of the Delegations on May 26, 1972 (letter designations added);

AGREED STATEMENTS REGARDING THE TREATY BETWEEN THE UNITED STATES OF AMERICA AND THE UNION OF SOVIET SOCIALIST REPUBLICS ON THE LIMITATION OF ANTI-BALLISTIC MISSILE SYSTEMS

[A]

The Parties understand that, in addition to the ABM radars which maybe deployed in accordance with subparagraph (a) of Article Ill of the Treaty, those non-phased- array ABM radars operational on the date of signature of the Treaty within the ABM system deployment area for defense of the national capital may be retained.

[B]

The Parties understand that the potential (the product of mean emitted power in watts and antenna area in square meters) of the smaller of the two large phased-array ABM radars referred to in subparagraph (b) of Article Ill of the Treaty is considered for purposes of the Treaty to be three million.

[C]

The Parties understand that the center of the ABM system deployment area centered on the national capital and the center of the ABM system deployment area containing ICBM silo launchers for each Party shall be separated by no less than thirteen hundred kilometers.

[D]

In order to insure fulfillment of the obligation not to deploy ABM systems and their components except as provided in Article III of the Treaty, the Parties agree that in the event ABM systems based on other physical principles and Including components capable of substituting for ABM interceptor missiles, ABM launchers, or ABM radars are created in the future, specific limitations on such systems and their components would be subject to discussion in accordance with Article XIII and agreement in accordance with Article XIV of the Treaty.

[E]

The Parties understand that Article V of the Treaty includes obligations not to develop, test or deploy ABM interceptor missiles for the delivery by each ABM interceptor missile of more than one independently guided warhead.

[F]

The Parties agree not to deploy phased-array radars having a potential (the product of mean emitted power in watts and antenna area in square meters) exceeding three million, except as provided for in Articles III, IV and VI of the Treaty, or except for the purposes of tracking objects in outer space or for use as national technical means of verification.

[G]

The Parties understand that Article IX of the Treaty includes the obligation of the US and the USSR not to provide to other States technical descriptions or blue prints specially worked out for the construction of ABM systems and their components limited by the Treaty.

2. Common Understandings

Common understanding of the Parties on the following matters was reached during the negotiations:

A. Location of ICBM Defenses

The U.S. Delegation made the following statement on May 26, 1972:

Article III of the ABM Treaty provides for each side one ABM system deployment area centered on its national capital and one ABM system deployment area containing ICBM silo launchers. The two sides have registered agreement on the following statement: "The Parties understand that the center of the ABM system deployment area centered on the national capital and the center of the ABM system deployment area containing ICBM silo launchers for each Party shall be separated by no less than thirteen hundred kilometers." In this connection, the U.S. side notes that its ABM system deployment area for defense of ICBM silo launchers, located west of the Mississippi River, will be centered in the Grand Forks ICBM silo launcher deployment area. (See Agreed Statement [C].)

B. ABM Test Ranges

The U.S. Delegation made the following statement on April 26, 1972:

Article IV of the ABM Treaty provides that "the limitations provided for in Article III shall not apply to ABM systems or their components used for development or testing, and located within current or additionally agreed test ranges." We believe it would be useful to assure that there is no misunderstanding as to current ABM test ranges. It is our understanding that ABM test ranges encompass the area within which ABM components are located for test purposes. The current U.S. ABM test ranges are at White Sands, New Mexico, and at Kwajalein Atoll, and the current Soviet ABM test range is near Sary Shagan in Kazakhstan. We consider that non-phased array radars of types used for range safety or instrumentation purposes maybe located outside of ABM test ranges. We interpret the reference in Article IV to "additionally agreed test

ranges" to mean that ABM components will not be located at any other test ranges without prior agreement between our Governments that there will be such additional ABM test ranges,

On May 5, 1972, the Soviet Delegation stated that there was a common understanding on what ABM test ranges were, that the use of the types of non-ABM radars for range safety or instrumentation was not limited under the Treaty, that the reference in Article IV to "additionally agreed" test ranges was sufficiently clear, and that national means permitted identifying current test ranges.

C. Mobile ABM Systems

On January 29, 1972, the U.S. Delegation made the following statement:

Article V(1) of the Joint Draft Text of the ABM Treaty includes an undertaking not to develop, test, or deploy mobile land-based ABM systems and their components. On May 5, 1971, the U.S. side indicated that, in its view, a prohibition on deployment of mobile ABM systems and components would rule out the deployment of ABM launchers and radars which were not permanent fixed types. At that time, we asked for the Soviet view of this interpretation. Does the Soviet side agree with the U.S. side's interpretation put forward on May 5, 1971?

On April 13, 1972, the Soviet Delegation said there is a general common understanding on this matter,

D. Standing Consultative Commission

Ambassador Smith made the following statement on May 22, 1972:

The United States proposes that the sides agree that, with regard to initial implementation of the ABM Treaty's Article XIII on the Standing Consultative Commission (SCC) and of the consultation Articles to the Interim Agreement on offensive arms and the Accidents Agreement, agreement establishing the SCC will be worked out early in the follow-on SALT negotiations; until that is completed, the following arrangements will prevail: when SALT is in session, any consultation desired by either side under these Articles can be carried out by the two SALT Delegations; when SALT is not in session, *ad hoc* arrangements for any desired consultations under these Articles may be made through diplomatic channels.

Minister Semenov replied that, on an *ad referendum* basis, he could agree that the U.S. statement corresponded to the Soviet understanding.

E. Standstill

On May 6, 1972, Minister Semenov made the following statement:

In an effort to accommodate the wishes of the U.S. side, the Soviet Delegation is prepared to proceed on the basis that the two sides will in fact observe the obligations of both the Interim Agreement and the ABM Treaty beginning from the date of signature of these two documents.

In reply, the U.S. Delegation made the following statement on May 20, 1972:

'See Article 7 of Agreement to Reduce the Risk of Outbreak of Nuclear War Between the United States of America and the Union of Soviet Socialist Republics, signed Sept. 30, 1971,

The U.S. agrees in principle with the Soviet statement made on May 6 concerning observance of obligations beginning from date of signature but we would like to make clear our understanding that this means that, pending ratification and acceptance, neither side would take any action prohibited by the agreements after they had entered into force. This understanding would continue to apply in the absence of notification by either signatory of its intention not to proceed with ratification or approval.

The Soviet Delegation indicated agreement with the U.S. statement.

3. Unilateral Statements

The following noteworthy unilateral statements were made during the negotiations by the United States Delegation:

A. Withdrawal from the ABM Treaty

On May 9, 1972, Ambassador Smith made the following statement:

The U.S. Delegation has stressed the importance the U.S. Government attaches to achieving agreement on more complete limitations on strategic offensive arms, following agreement on an ABM Treaty and on an Interim Agreement on certain measures with respect to the limitation of strategic offensive arms. The U.S. Delegation believes that an objective of the follow-on negotiations should be to constrain and reduce on a long-term basis threats to the survivability of our respective strategic retaliatory forces. The USSR Delegation has also indicated that the objectives of SALT would remain unfulfilled without the achievement of an agreement providing for more complete limitations on strategic offensive arms, Both sides recognize that the initial agreements would be steps toward the achievement of more complete limitations on strategic arms. If an agreement providing for more complete strategic offensive arms limitations were not achieved within five years, U.S. supreme interests could be jeopardized. Should that occur, it would constitute a basis for withdrawal from the ABM Treaty. The U.S. does not wish to see such a situation occur, nor do we believe that the USSR does. It is because we wish to prevent such a situation that we emphasize the importance the U.S. Government attaches to achievement of more complete limitations on strategic offensive arms. The U.S. Executive will inform the Congress, in connection with Congressional consideration of the ABM Treaty and the Interim Agreement, of this statement of the U.S. position.

B. Tested in ABM Mode

On April 7, 1972, the U.S. Delegation made the following statement:

Article II of the Joint Text Draft uses the term "tested in an ABM mode," in defining ABM components, and Article VI includes certain obligations concerning such testing. We believe that the sides should have a common understanding of this phrase. First, we would note that the testing provisions of the ABM Treaty are intended to apply to testing which occurs after the date of signature of the Treaty, and not to any testing which may have occurred in the past. Next, we would amplify the remarks we have made on this subject during the previous Helsinki phase by setting forth the objectives which govern the U.S. view on the subject, namely, while prohibiting testing of non-ABM components for ABM purposes: not to prevent testing of ABM components, and not to prevent testing of non-ABM components for

non-ABM purposes. To clarify our interpretation of "tested in an ABM mode, " we note that we would consider a launcher, missile or radar to be "tested in 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 ABM 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 cooperative 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 ABM radar at the same test range. Radars used for purposes such as range safety or instrumentation would be exempt from application of these criteria.

C. No-Transfer Article of ABM Treaty

On April 18, 1972, the U.S. Delegation made the following statement:

In regard to this Article [IX], I have a brief and I believe self-explanatory statement to make. The U.S. side wishes to make clear that the provisions of this Article do not set a precedent for whatever provision may be considered for a Treaty on Limiting Strategic Offensive Arms. The question of transfer of strategic offensive arms is a far more complex issue, which may require a different solution.

D. No Increase in Defense of Early Warning Radars

On July 28, 1970, the U.S. Delegation made the following statement:

Since Hen House radars [Soviet ballistic missile early warning radars] can detect and track ballistic missile warheads at great distances, they have a significant ABM potential. Accordingly, the U.S. would regard any increase in the defenses of such radars by surface-to-air missiles as inconsistent with an agreement.

Protocol to the Treaty Between the, United States of America and the Union of Soviet Socialist Republics on the Limitation of Anti-Ballistic Missile Systems

Signed at Moscow July 3, 1974
Ratification advised by U.S. Senate November 10, 1975
Ratified by U.S. President March 19, 1976
Instruments of ratification exchanged May 24, 1976
Proclaimed by U.S. President July 6, 1976
Entered into force May 24, 1976

The United States of America and the Union of Soviet Socialist Republics, hereinafter referred to as the Parties,

Proceeding from the Basic Principles of Relations between the United States of America and the Union of Soviet Socialist Republics signed on May 29, 1972,

Desiring to further the objectives of the Treaty between the United States of America and the Union of Soviet Socialist Republics on the Limitation of Anti-Ballistic Missile Systems signed on May 26, 1972, hereinafter referred to as the Treaty,

Reaffirming their conviction that the adoption of further measures for the limitation of strategic arms would contribute to strengthening International peace and security,

Proceeding from the premise that further limitation of anti-ballistic missile systems will create more favorable conditions for the completion of work on a permanent agreement on more complete measures for the limitation of strategic offensive arms,

Have agreed as follows:

Article I

1. Each Party shall be limited at any one time to a single area out of the two provided in Article I I I of the Treaty for deployment of anti-ballistic missile (ABM) systems or their components and accordingly shall not exercise its right to deploy an ABM system or its components in the second of the two ABM system deployment areas permitted by Article Ill of the Treaty, except as an exchange of one permitted area for the other in accordance with Article II of this Protocol.

2. Accordingly, except as permitted by Article II of this Protocol: the United States of America shall not deploy an ABM system or its components in the area centered on its capital, as permitted by Article III(a) of the Treaty, and the Soviet Union shall not deploy an ABM system or its components in the deployment area of Intercontinental ballistic missile (ICBM) silo launchers as permitted by Article ill(b) of the Treaty.

Article II

1. Each Party shall have the right to dismantle or destroy its ABM system and the components thereof in the area where they are presently deployed and to deploy an ABM system or its components in the alternative area permitted by Article Ill of the Treaty, provided that prior to Initiation of construction, notification is given in accord

with the procedure agreed to in the Standing Consultative Commission, during the year beginning October 3, 1977 and ending October 2, 1978, or during any year which commences at five year intervals thereafter, those being the years for periodic review of the Treaty, as provided in Article XIV of the Treaty. This right may be exercised only once.

2. Accordingly, in the event of such notice, the United States would have the right to dismantle or destroy the ABM system and its components in the deployment area of ICBM silo launchers and to deploy an ABM system or its components in an area centered on its capital, as permitted by Article Ill(a) of the Treaty, and the Soviet Union would have the right to dismantle or destroy the ABM system and its components in the area centered on its capital and to deploy an ABM system or its components in an area containing ICBM silo launchers, as permitted by Article Ill(b) of the Treaty.

3. Dismantling or destruction and deployment of ABM systems or their components and the notification thereof shall be carried out in accordance with Article VIII of the ABM Treaty and procedures agreed to in the Standing Consultative Commission.

Article Ill

The rights and obligations established by the Treaty remain in force and shall be complied with by the Parties except to the extent modified by this Protocol. In particular, the deployment of an ABM system or its components within the area selected shall remain limited by the levels and other requirements established by the Treaty.

Article IV

This Protocol shall be subject to ratification in accordance with the constitutional procedures of each Party. It shall enter into force on the day of the exchange of instruments of ratification and shall thereafter be considered an integral part of the Treaty.

DONE at Moscow on July 3,1974, in duplicate, in the English and Russian languages, both texts being equally authentic.

For the United States of America:

RICHARD NIXON

President of the United States of America

For the Union of Soviet Socialist Republics:

L. L BREZHNEV

Genera/ Secretary of the Central Committee of the CPSU

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