Chapter 6

ASAT Arms Control: Options

Contents

Table

Chapter 6

ASAT Arms Control: Options

INTRODUCTION

This chapter explores how various ASAT arms control provisions might affect the long-term national security interests of the United States. The interaction between these arms control provisions and the unilateral satellite survivability measures that the United States might pursue is discussed in greater detail in chapter 7. Four types of arms control are presented below: restrictions on ASAT testing, possession, use, and "rules of the road' for space. Each of these provisions is described and an assessment is given of its ability to protect U.S. space assets and contribute to other long-term U.S. goals. Potential conflicts between ASAT arms control and the development of military capabilities (e.g., the U.S. MV ASAT program and the Strategic Defense Initiative) are also examined.

The development of anti-satellite weapons poses a significant threat to the military satellites of both the United States and the Soviet Union. These military satellites, in turn, provide information and services which can be threatening to either side. Here lies the inherent difficulty in arriving at acceptable A SAT arms control agreements-given the choice, the United States would like to protect its own satellites while eliminating any military threat posed by Soviet satellites. [1] Since such a one-sided advantage is not possible, it is reasonable to examine whether there are mutual restraints that would contribute to national security and protect U.S. satellites, yet allow an adequate response to the threat posed by Soviet satellites.

The debate over ASAT arms control contains many familiar themes: To what extent can the the United States monitor Soviet compliance? Do the Soviets intend to cheat, and if so, can they? What recourse would the United States have if faced with either clear or ambiguous Soviet violations? Is the United States better off pursuing arms control, technological superiority, or some combination of both? What will be the response of our allies to new development programs or arms control proposals? These issues are discussed below, both in the context of specific arms control provisions and in a more general discussion of monitoring treaty compliance.

Most of the provisions discussed in this chapter would require the United States and the Soviet Union to enter into a bilateral agreement to limit A SAT weapons development. As a result of the technologies involved, their theater of operation, and the closed nature of Soviet society, it is unlikely that the United States could monitor Soviet compliance with complete certainty. The United States can know only part of what the Soviet Union does and little or nothing about what it intends; therefore, any arms control agreement involves some degree of risk. For the purposes of this discussion, the value or danger of a particular arms control provision is measured by its likely impact on U.S. national security after allowance is made for possible covert Soviet violations. In other words, given the risks of entering into an agreement with the Soviets, are we better off with or without a particular provision?[2]

This chapter focuses primarily on bilateral treaties of unlimited duration. Other arrangements for ASAT constraints, such as multi-

[1] Not all Soviet military satellites threaten the United States, Presumably, the United States would like the Soviet Union to retain some reconnaissance and early warning satellites since these satellites contribute to stability by allowing verification of arms control agreements and by assuring the Soviets that they are not under nuclear attack,

[2] 1 t is important to note that "risk, as it is used here, does not imply merely the probability that the Soviets can or would violate a particular provision of an A SAT agreement. Rather, risk signifies both the probability that the Soviets would violate the agreement and the threat to U.S. national security that would likely result from such a Soviet violation.

lateral agreements, joint declarations, executive agreements or even unilateral declarations, might also be in the national interest. However, this report is limited exclusively to bilateral agreements for the sake of simplicity and primarily to formal treaties of unlimited duration because they are the hardest to obtain and have the most lasting effect on national policy and programs.

PROVISIONS RESTRICTING ASAT TESTING

An agreement that established limits on testing could be a useful means by which to prevent the development of reliable, dedicated ASAT systems. The effectiveness of test restrictions is assumed to derive from the naturally conservative nature of military planners. Many informed observers believe that, except when forced by necessity, Soviet military planners would be reluctant to rely on systems that have not been tested near their full capabilities, particularly in situations where the stakes are high, second chances may not come, and the penalties for failure could be severe.

A test ban would prevent the testing which would increase confidence in new ASAT weapons or, at minimum, would force testing to be done covertly, under less than optimal conditions. In either case, the result would be to erode the confidence that an ASAT system would work as planned, when needed.

There are several ways to frame a test ban. The most comprehensive would be a ban on all "testing in an ASAT mode." For the purposes of this discussion, "testing in the ASAT mode" would include tests of ground-, sea-, air-, or space-based systems against targets in space or against points in space. Testing of ASAT systems or components on the ground would not be prohibited. Such an approach would avoid both the necessity of defining an ASAT weapon and of restricting systems that, although not designed as ASATS, might have some inherent ASAT capability. For example, it is possible that the Soviet GALOSH ABM system might have some ASAT capability. An agreement that banned all "testing in an ASAT mode" would not require the United States and the Soviet Union to agree whether GALOSH *was an* ASAT or if it *could function as an* ASAT, but would simply ban the testing of this system *as an* ASAT.

More limited "no-test" agreements could also be used to inhibit the development of specific types of ASATS or to place restrictions on certain types of testing. Such a treaty might be used to ban the testing of only ASAT weapons that would be based in space. Alternatively, it might be used to ban the testing of specific space-based ASAT weapons (e.g., directed-energy weapons or space mines) thought to be particularly destabilizing. Such a ban might also limit ASAT testing to low altitudes to protect critical early warning and communication satellites that are in higher orbits.

All of these examples of limited test bans could be further modified by agreed limitations on allowable numbers of tests. For example, the United States and the Soviet Union might agree to limit themselves to only 10 tests over the next 5 years, or to a set number (either constant or declining) of tests per year for the duration of the agreement.

Monitoring Compliance With a Test Ban

In past bilateral agreements between the United States and the Soviet Union, the Soviet Union has tended to take advantage of treaty ambiguities and to engaged in activities that—although sometimes difficult to characterize-bordered on treaty violation.[3] It is prudent, therefore, to assume that should

[3] There is reason to believe that the Krasnoyarsk radar, when complete and ready for operation, will violate the ABM Treaty.

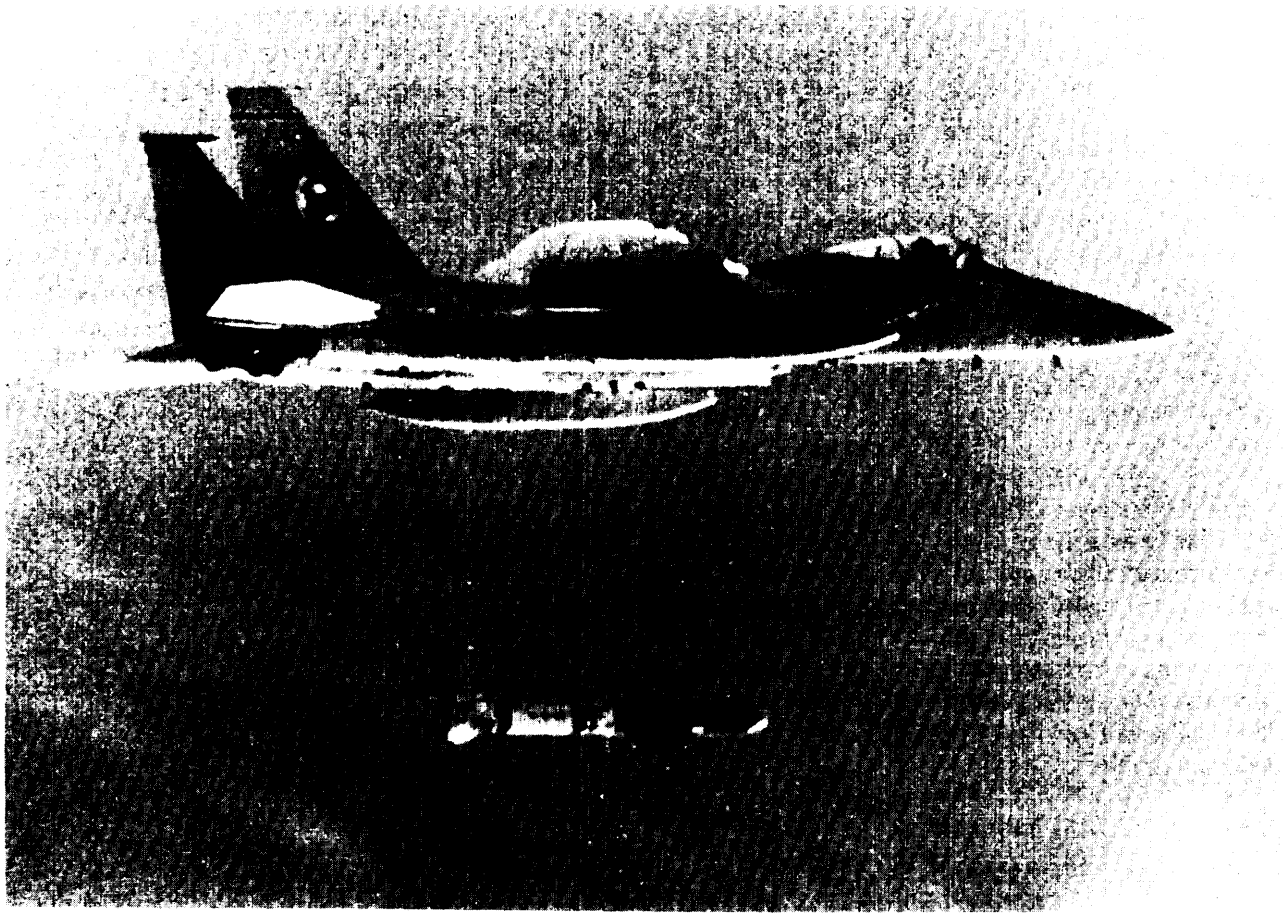

Photo credit: U.S. Air Force

F-15 launched, MV anti-satellite weapon currently under development in the United States.

an ASAT test ban be negotiated, the Soviets would comply only to the extent that the United States was able to verify its compliance. This being the case, it is important to examine some of the problems associated with monitoring the wide range of Soviet activities that might be related to A SAT weapon development.

Scope of Monitoring Task

One barrier to verifying compliance with a test ban 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 a number of areas in the Soviet Union or its immediate airspace. This area, although large, is relatively well determined and is amenable to close inspection by space-based photographic reconnaissance satellites. The region where space activities must be monitored starts at altitudes of about 100 km and can range well past geosynchronous orbit at 36,000 km. In addition, advanced ground-based ASATs could be located anywhere in the Soviet Union and air-based ASATs might even operate from non-Soviet airfields.

Although the volume of space is indeed large, space-based ASAT activities must start on the ground. Relevant ground sites, including launch facilities, can be observed by an extensive array of U.S. monitoring facilities; launches of ICBMs and similar vehicles from Soviet territory can be detected. To some ex-

tent, the problems created by the large volume of space are offset by the fact that space is transparent and accessible to monitoring. Current weaknesses in ground-based surveillance systems can be mitigated by putting surveillance systems into space.

If the Soviets were to develop air-based, ground-based, or "pop-up" directed-energy weapons, these would require extensive testing. It is likely that some portion of this testing could be conducted out of the sight of (e.g., indoors or underground) U.S. monitoring assets. However, full development would probably require some in-space testing against targets. 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 might be detectable by national technical means. Nonnuclear, spacebased systems would be quite large and might emit detectable amounts of hydrogen fluoride or other gases.

Problems of Discrimination

Verifying treaty compliance is complicated by the growing number and variety of Soviet space launches. Although the launch rate may decrease in the future as the Soviets develop longer lived satellites, space surveillance requires a body of experience with each additional type of satellite in order to classify its function and discriminate between unusual activity and routine behavior. The functional characteristics distinguishing ASAT weapons, such as space mines, from other satellites may not be readily observable. Some occurrences might have multiple interpretations. For example, a satellite fragmenting in orbit could be accidental, the test of a self-destruct mechanism (either to avoid capture or to prevent large components from falling back to Earth), or the test of a space mine.[4] All national technical means have imperfect discrimination, and the physical differences between permitted and prohibited satellites may be small.

Although the annual number of Soviet launches is large, the number of new satellites or satellites engaged in "unusual activities" is relatively small. Even if U.S. national technical means of verification could not by *direct observation* distinguish between space mines and normal satellites, other indicators, such as orbital parameters, proximity to other—particularly U.S.—satellites, and other sources of intelligence might supply the needed information. If in addition to a test ban the treaty also included some mechanism for resolving ambiguities—e.g., the Standing Consultative Committee established in SALT I–the problem might be further resolved.

Assuming that the difficulties associated with deliberate ASAT systems were resolved, it would still be necessary to reach some agreement concerning tests of advanced, ground-based, BMD systems. Should conventional ground-launched BMD systems be developed—similar to the system recently demonstrated in the U.S. Homing Overlay Experiment (HOE)—they may have some limited ASAT capability.

Covert Development

There are numerous ways for the Soviets to engage in covert ASAT development. It is possible that space mine or orbital interceptor tests could be masked as legitimate rendezvous operations or satellite repair missions. ASAT weapons might be directed against points in space or space debris, thereby obviating the need for recognizable target satellites. ASAT vehicles or their targets could be instrumented to store test data for broadcast over the Soviet Union or for deorbit in a reentry capsule, thereby preventing the United States from intercepting test information. Nuclear-armed ICBMS or ABM launchers such as the Soviet GALOSH might also be tested (though not detonated) in a manner which would be difficult to characterize. Relatively low-powered lasers capable of blinding satellite sensors are already available and

[4] One could, of course, ban all deliberate explosions in space. If such a ban were made part of a more general test ban, there would be less ambiguity to resolve.

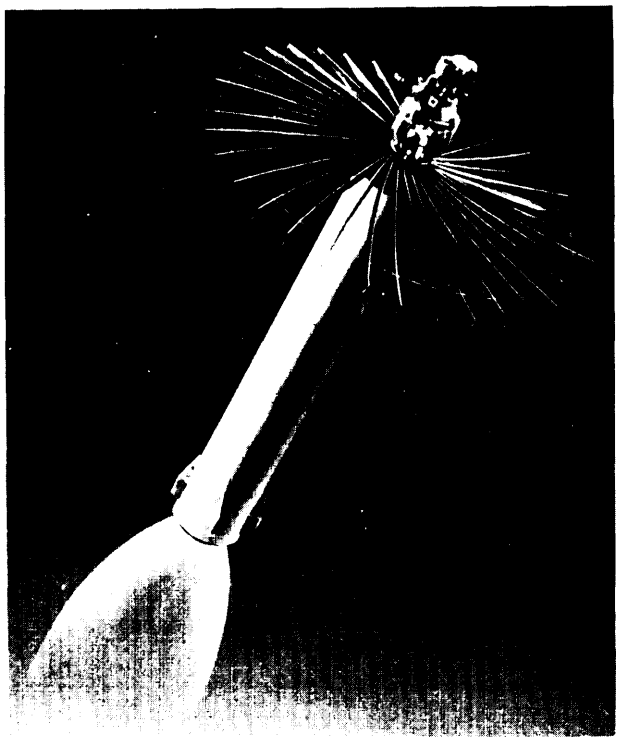

Photo credft U S Department of Defense

Artist's conception of the nonnuclear ABM interceptor recently tested i n the Homing Overlay Experiment (HOE). The current Soviet GALOSH nuclear ABM interceptor or future, nonnuclear systems based on HOE technology could complicate the process of monitoring an ASAT weapon test ban.

might be tested without being clearly identified as being ASATS.

It is, on the other hand, possible to exaggerate the threat posed by covert development. The United States is sufficiently familiar with the operational characteristics of the current generation of Soviet ASAT interceptors to make its covert testing unlikely. The development of a new system would require an extensive testing program, some portion of which we would almost certainly identify. New or unusual orbiting vehicles would be noticed, especially maneuvering ones. Monitoring equipment could be developed that would detect the laser illumination of Soviet satellites, and which could aid in monitoring Soviet directed-energy facilities. (See table 6-1, below). Soviet efforts to hide covert testing might serve to narrow down the regions where the United States needs to concentrate its verification efforts. In any case, it is likely that an ASAT test limitation agreement would provide the means by which parties could inquire about suspicious activities.

Utility of an ASAT Test Ban

Considering both the limitations of U.S. monitoring capabilities and the possible ill-intentions of the Soviet Union, what then is the value of an ASAT test ban? To answer this question completely, one must examine the specific test bans being considered in combination with possible technical countermeasures (this is done in chapter 7). However, some preliminary generalizations can be helpful.

Some of the satellites that the United States relies on for critical information are now vulnerable and few in number. With respect to these specific systems, a small degree of Soviet cheating under a test ban agreement might have a significant effect on U.S. security. On the other hand, the United States has been quite successful at monitoring past Soviet space activities and the deployment of more capable monitoring assets—e.g., space-based surveillance systems–could substantially aid the process of treaty monitoring.

It is important to note that modest satellite survivability measures would reduce the risk posed by current ASAT weapons and could do much to reduce the risk posed by c-vert weapons development. In the absence of an agreement limiting ASAT weapon development, the United States must still monitor Soviet activities but modest survivability measures might not be effective. Without limitations, advanced ASATS would pose a greater risk to a larger number of satellites and failure to effectively monitor these advanced ASATS could create a significant danger to U.S. national security.

Comprehensive Test Ban

A ban which prohibited all testing "in the ASAT mode" would severely reduce the likelihood that the Soviet Union could successfully develop advanced, highly capable ASAT weap-

Table 6-1 .—Sensor Technology for Compliance Monitoring

Prohibitable action	Observable	Sensors
ASAT attack:		Attack sensors:
KEW[a] impact ., ...	acceleration	accelerometers
Pulsed HEL[b] irradiation	acceleration	accelerometers
Continuous HEL irradiation	heating	thermistors
NPB[c] irradiation	ionization	ionization detectors
Keep-out zone penetration . . .	position of thermal radiation source (ASAT)	space-based LWIR[d] thermal image~ [f]
Interception test	positions of thermal radiation sources (ASAT and target)	space-based LWIR thermal image~ [f]
NPB ASAT operation	thermal radiation from ASAT	space-based LWIR thermal imager[e f]
HEL ASAT operation	thermal radiation from ASAT	space-based LWIR thermal image~ [f]
Irradiation of target with NPB	gamma radiation from target	gamma-ray spectrometer
Irradiation of target with pulsed HEL	thermal radiation from target	space-based LWIR thermal imager
Irradiation of target with pulsed HEL	reflected radiation from target	space-based multispectral imager
Irradiation of target with continuous HEL	position of thermal radiation source (target)	space-based LWIR thermal imager
Irradiation of target with continuous HEL	reflected radiation from target	space-based multi spectral imager
Nuclear explosive aboard satellite	gamma radiation from fissile or fusile nuclei activated by cosmic radiation or by particle beams	gamma-ray spectrometer (and optional particle beam generator)

[a] Kinetic-energy weapon
[b] High-energy laser
[c] Neutral particle beam.
[d] Long-wavelength infrared
[e] The LWIR telescope on the Infrared Astronomical Satellite (IRAS) exemplifies demonstrated space-based thermal imager technology, this Instrument is described in *Astrophysical Journal*, 278 (1, Pt 2), L1 -L85, Mar 1, 198-4 (Special Issue on the Infrared Astronomical Satellite)
[f] Radar and passive radio d_i t_{acc} f_m d_{in} methods could also be useful for tracking, if hiding measures are not employed by the penetrating Spacecraft LWIR tracking is emphasized here because it is difficult to counter by such measures.
[g] A target Irradiated by a high-energy neutral particle beam will emit gamma rays, neutrons, and other observable part! cles, just as it WI II, at a slower rate, when bombarded by natural cosmic rays These gamma rays could be detected by a gamma-ray spectrometer such as those which have been earned by Soviet Venus lan and lunar landers and by U.S NASA Ranger and Apollo spacecraft (NASA report SP-387, pp 3.20)

ens. The categories of weapons eliminated might included space mines capable of "shadowing" valuable military assets in any orbit, or directed-energy weapons with kill radii of hundreds to thousands of kilometers. In the absence of an agreement limiting the development of these weapons, each side might seek continually more effective means to attack threatening satellites and to defend valuable assets. This could result in a potentially destabilizing arms race in space. The "instantaneous kill" ability of the most advanced ASATS would be destabilizing in a crisis, since each side would have the incentive to "shoot first" or else risk the loss of its space assets.

A comprehensive test ban would require both the United States and the Soviet Union to cease testing their current generation of ASAT weapons. The Soviet ASAT is already considered operational. Assuming the United States also had an operational ASAT when the agreement entered into force, each side's existing system would pose some threat to the other side. Over time, a comprehensive test ban would gradually erode each side's confidence in its respective weapons, thereby reducing the possibility of their use. If a test ban were combined with additional restrictions on possession or deployment, this might result in somewhat greater security.

A comprehensive test ban would be less effective at reducing the threat posed by weapon systems with "inherent" ASAT capability. ICBMS, SLBMS, and ABM interceptors with nuclear payloads are examples of systems with inherent ASAT capability. Although these systems lack the kind of guidance necessary to intercept a satellite with great precision, the long-range destructiveness of their nuclear payloads makes them potentially effective ASATS. However, some of the ASAT threat posed by nuclear weapons is offset by their very nature. The collateral physical, political, and military consequences of using nuclear

ICBMS *or* ABMs as ASATS could well deter their use in most conflicts short of a terrestrial nuclear war.

The Shuttle's recent success at retrieving and refurbishing satellites strongly suggests the ASAT potential of future maneuverable spacecraft. However, the range, effectiveness and reaction time of even advanced maneuverable systems would be substantially less than that of future dedicated ASATS. Although the development of maneuverable spacecraft would not be inhibited by most ASAT testing limitations, some limits could be placed on operating them in an ASAT mode.

The Soviet draft treaties and the 1983 unilateral Soviet moratorium on ASAT testing suggest that the Soviets would be willing to negotiate about a comprehensive ASAT test ban. To date, the U.S. response to Soviet suggestions has been to point out that since the Soviets have an "operational" ASAT and the U.S. testing program has just begun, a comprehensive test ban would prevent the United States from ever having a reliable interceptor ASAT and would increase the threat posed by a Soviet "breakout." Nonetheless, the United States has continued to express interest in ASAT negotiations and has not ruled out the possibility that it would agree to some kind of test limitations.

Limited Test Bans

Should a comprehensive test ban be considered undesirable or nonnegotiable, it might still be worthwhile to limit testing to the current generation of ASATS or to ASATS only capable of attacking satellites in low-Earth orbit. A ban which limited each side to testing its current ASAT would have three advantages: 1) a ban on testing new types of ASATS would reduce the likelihood that advanced ASATS, such as space mines or space-based directed-energy weapons, would be developed; 2) the threat to critical early warning and communication satellites would be diminished; and 3) the United States would retain the ability to negate Soviet low-orbiting, targeting, and data collection satellites judged to pose a threat to U.S. surface forces.

Photo credft U S Department of Defense

Ocean recovery of what is believed to be an unmanned scale model of a new Soviet space plane. The development of maneuverable spacecraft would not be inhibited by most ASAT testing limitations, but some restrictions might be placed on operating such spacecraft "in an ASAT mode. "

If a limited test ban could restrict each side to its current, low-orbit, ASAT capability, it would, in effect, create high-altitude "no attack zones. This might encourage adversaries to move some Earth monitoring space assets into those zones. The development of high-altitude data collection systems would re

'If advanced directed-energy weapons with kill radii of thousands of kilometers are developed, such "no attack zones" might be meaningless.

quire considerable time and expense. For the next decade and perhaps beyond nations would probably be forced to operate their current low-altitude systems.

Although it is possible that some reconnaissance satellites might be able to function from higher orbits with some degradation of performance, radar satellites-useful in tracking surface ships-would have substantially greater difficulty. Current systems employ active radar, which means that the strength of the return signal decreases as the fourth power of the range to the target. The substantial increase in range necessary to take advantage of a high-altitude "no-attack' zone would severely degrade the performance of current systems. It is possible that, over time, improvements in technology could solve the problems created by the increase in range. Nonetheless, by the time this occurred new ECM and EOCM capabilities might also be developed that could help to negate systems taking advantage of high-altitude "sanctuaries."

PROVISIONS RESTRICTING ASAT POSSESSION OR DEPLOYMENT

An agreement which sought to restrict the possession or deployment of ASAT weapons could be either comprehensive or limited. A *comprehensive ban* might prohibit the possession or deployment of any deliberate "anti-satellite system. A *limited ban,* on the other hand, might allow the possession of some ASAT weapons but not others, or establish limitations on allowable ASAT capabilities or on the number and kind of deployments.

In order to establish a comprehensive ban on the possession or deployment of ASAT weapons, it would first be necessary to come to an agreement as to what exactly was being banned. As explained above, the existence of systems that have an inherent ability to attack satellites complicates the process of eliminating all ASAT *capability.* A ban on all systems with ASAT capabilities would be so broad as to be unworkable since it would include ICBMS, SLBMS, ABMs, and maneuverable spacecraft such as the Shuttle. On the other hand, a ban on deliberate ASAT systems alone might allow the development of non-ASAT systems having sophisticated ASAT capabilities. For this reason, the most effective comprehensive ban on possession and deployment would probably be one which was also accompanied by a prohibition on testing non-ASAT systems in an ASAT mode.

Many types of limited-possession regimes can be imagined. The United States and the Soviet Union might decide to keep the ASATS they are currently testing, but prohibit the possession or deployment of more advanced systems. Alternatively, each side might be allowed to have one designated system in addition to the one they are currently testing; the capabilities of this additional system might or might not be limited (e.g., low-Earth orbit capability only). Still another regime might limit the parties to ground-based ASAT weapons and ban possession of weapons that would be based in space.

In all of these limited-possession regimes additional restrictions on the number and location of allowable ASAT deployments could be added.

Monitoring Compliance With Limitations on Possession and Deployment

A comprehensive ban on the possession or deployment of the existing Soviet ASAT weapon would raise some important monitoring problems. The launch vehicle for the Soviet ASAT is used in several other non-ASAT roles. These launchers will remain available even if the Soviet ASAT weapon is banned.

Since the ASAT weapon itself is small, it would be difficult for the United States to verify with high confidence that the Soviets had not clandestinely retained a stockpile.

A limited possession ban that granted either side the right to possess and deploy the ASAT weapon it was currently testing would raise fewer verification problems. Significant Soviet cheating would involve covertly testing and developing a new and unproven advanced ASAT weapon, rather than simply hiding an existing system. As discussed above, it is likely that such a development program would include some testing requirements that were observable.

Given the small size of the current Soviet A SAT weapon, restrictions on the number of A SAT weapons that could be deplcyed at each launch site would be difficult to monitor in the absence of onsite inspection. Even onsite inspection would not provide complete security, since ASATS could be covertly stored and easily transferred to the launch area when needed. The United States would have higher confidence at monitoring restrictions on the allowable number of launch sites. Restriction on launch facilities would increase the time between A SAT launches and decrease the probability of sudden, multiple kills. A combination of restrictions on both the allowable number of launch sites and on the number of ASAT weapons that could be stored at each site could reduce the likelihood of a surprise attack or, at minimum, reduce the effect of such an attack.

Utility of Limitations on Possession and Deployment

A comprehensive ban on ASAT possession and deployment is complicated by: 1) the existence of the Soviet, and, in the near future, the U.S. ASAT weapons; 2) the fact that the lack of possession or deployment could not be monitored with high confidence; and 3) the fear that a ban on possession and deployment—even if monitored with high confidence—would not eliminate the knowledge of how to build these systems, and that the forces might be reconstituted at some time in the future.

Balancing these three concerns is the understanding that for the Soviets to retain some A SAT weapons in violation of a possession or deployment ban would not in itself be threatening—they must also be able to use these A SAT weapons in a way that is militarily significant. Differences of opinion exist as to the military significance of minor violations of a ban on possession and deployment. Some argue that the Soviets must be able to launch a sufficient number of A SAT weapons with sufficient rapidity to gain an important military advantage. To do this, the ASAT weapons and launch vehicles would have to be pre-mated and held in readiness, activities that would probably be observable. Others believe that the Soviets would not have to launch a mass A SAT attack in order to gain important military advantages. They point out that in some limited war scenarios, destroying a very small number of critical satellites could have grave consequences. Therefore, there might not be a need for a large number of observable, pre-mated A SAT weapons and launchers.

Assuming the United States did have advance notice of Soviet A SAT activities, it could respond through diplomatic channels or through a Standing Consultative Committee, if established. Even short-term notice of intent to use A SAT weapons would allow the United States time to maneuver its satellites or take other appropriate action.

The fact that every element of an agreement cannot be monitored with high confidence does not necessarily mean it has no value. It is extremely difficult to monitor the “no nuclear weapons in space’ provision of the Outer Space Treaty and yet the United States continues to adhere to it. Presumably, this is because the benefits of the treaty outweigh the risk posed by potential Soviet cheating.

[a]The U.S. ASAT weapon currently under development is quite small, However, the Soviet monitoring task is easier because the U.S. ASAT weapon requires large and distinctive support equipment and because significant expenditures for military facilities, personnel. and weapons procurement would be revealed in the annual authorization and appropriate ion process of Congress or by the popular press.

Even if a ban on possession and deployment could not be monitored with high confidence it would, at minimum, oblige the Soviets to conduct future A SAT weapons tests covertly. This would complicate maintenance of the current system, make upgrades difficult and advanced ASAT development less likely. The combination of these effects would make U.S. satellite survivability programs more effective and might discourage the use of ASAT weapons.

Space systems with inherent rather than intentional ASAT capabilities would be difficult to restrict by a comprehensive ban on possession or deployment. Nonetheless, such systems pose only a modest threat to critical U.S. assets. Those systems which employ nuclear warheads (e.g., ICBMS, SLBMS, ABMs) might only be used in a terrestrial nuclear war or at the risk of precipitating one. They would also risk damage to the attacker's own satellites. Future maneuverable spacecraft, although capable of some limited ASAT activity, would not be able to provide the rapid, multiple-kill capability likely to be obtained from future dedicated ASAT systems, and are therefore a considerably lesser threat.

A regime which banned only *deliberate ASAT systems* and disregarded systems with some *inherent ASAT capability* would still be useful in as much as it would reduce the threat of the most highly capable and destabilizing future ASATS systems. Nonetheless, a ban on the possession and deployment of ASAT systems would probably be most valuable if accompanied by a prohibition against the testing of non-ASAT systems in an A SAT mode.

The 1983 Soviet draft treaty contained an example of a comprehensive ban on possession. Article 2(4) of the draft treaty would have required that parties undertake, "Not to test or create new anti-satellite systems and to destroy any anti-satellite systems that they may already have. " Given the past statements of Soviet officials and the draft treaties proposed by the Soviet Union, it is likely that the Soviets would be willing to negotiate a comprehensive ban on *possession*. It is less clear whether they would be willing to negotiate some form of limited ban. If their primary concern is protecting all of their space assets, then a limited ban might not be acceptable. If, on the other hand, their purpose in negotiating any ban is to limit the development of more effective ASATS or spacebased BMD technologies, then there might be some partial bans that they would find acceptable.

PROVISIONS RESTRICTING ASAT USE

Perhaps the least complicated ASAT agreement would be one that prohibited hostile acts against satellites. Such an agreement would probably not attempt to limit specific ASAT systems, but would instead prohibit the *use* of all ASAT *capabilities*. Although a "no use' agreement could not strictly be considered "arms control, " in as much as both parties would be free to develop and deploy any number and kind of advanced ASAT system, it might usefully define what constituted a "hostile act" against a satellite. This agreed definition of "hostile act" might serve to avoid some future conflict brought about by a confusion of intentions. It would also establish a satellite attack as an unambiguous warning of further aggressive intent.

Although a "no use" agreement might not substantially reduce the threat of ASAT attack, it could serve as a useful component of other, broader arms control agreements. The definition of prohibited acts that might reasonably result from the negotiation of a "no use' agreement could lead to a clearer understanding of the systems capable of performing those acts. This, in turn, might assist in the negotiation of agreements that prohibited the testing, possession, or deployment of ASAT weapons.

Monitoring Compliance With a "No Use" Agreement

Compliance with a "no-use" agreement would be relatively easy to monitor. This is particularly true for the current generation of ASAT weapons. The monitoring task would become slightly more difficult if the Soviets were to follow the U.S. example and develop an air-launched interceptor. This would allow them to launch an ASAT attack outside of the Soviet Union-perhaps even from the western hemisphere if the appropriate facilities were installed in Cuba.

If it were possible to covertly develop ground-based directed-energy facilities or more flexible air-based facilities, these might be used to damage the sensors of a U.S. satellite in such a manner as to mimic an equipment malfunction. This is particularly true when the object of an attack is not to destroy the satellite, but rather to "blind" or "dazzle" delicate sensors.

On the other hand, the effective use of on-board monitoring equipment could substantially reduce this threat. To a limited degree, satellites now have some on-board "state-of-health" monitoring equipment. It is possible to augment these sensors to determine whether a failure is due to an internal flaw or whether it has been externally induced. These sensors might, for example, measure incident laser light, rises in temperature, or sudden accelerations. The inclusion of "stateof-health' monitoring equipment on satellites combined with a future spacebased surveillance system could provide the necessary ingredients to verify a "no use" treaty with high confidence.

Utility of a "No Use" Agreement

In order to judge the utility of a "no use" agreement it is first necessary to understand what such an agreement could and could not accomplish. Even if a "no use" agreement could be monitored with very high confidence, in an environment of unconstrained ASAT development, a "no use" treaty might make only a small contribution to protecting U.S. space assets. Should nations eventually possess directed-energy weapons or space mines with an instantaneous and multiple kill capability, there will be significant advantages to being a first user of these weapons. Nations may find themselves in the position of having to use or lose their offensive space-based assets. If the measure of effectiveness of a "no use" agreement is how well it protects U.S. satellites in an otherwise unconstrained environment, then one would have to conclude such an agreement was of limited value.

Although the U.N. Charter and the Outer Space Treaty both implicitly prohibit hostile acts against the satellites of other countries, there may be some value to obtaining a formal agreement that such hostile interference is a violation of international law and potentially a cause of war. A "no use" ASAT treaty would, like the Geneva protocol on use of poisonous gases, establish more clearly the "law of civilized nations. " Codifying what is already implicit in international law might serve to inhibit the willingness of nations to attack satellites in a crisis before hostilities have broken out on Earth and perhaps even for some period of low intensity conflict.

Although a "no use" agreement would not, in itself, substantially reduce the risk or the effect of an ASAT attack, it would serve as a useful addition to other, more comprehensive, ASAT limitations. For example, an agreement that restricted ASAT testing would benefit from the clear statement that hostile acts against satellites were forbidden. Such an agreement would assist in developing the principle that the goal of ASAT limitations was to protect space assets and to keep space from becoming an area of unrestrained conflict and not simply to control the development of one or another class of offensive weapons.

It is likely that some type of "no use" agreement would be acceptable to the Soviet Union. It would, of course, be necessary to clearly define what constituted "use" under the agreement. In their 1983 draft treaty, the Soviets defined "use" as meaning "to destroy, damage, disturb the normal functioning or change

the flight trajectory. " Although the United States might agree in principle with the intent of such a provision, it is unlikely that it would accept this exact language. The Soviet phrase "disturb the normal functioning" might be interpreted as prohibiting the use of electronic countermeasures, and this interpretation would probably be unacceptable to the United States.

The 1983 draft treaty of the Union of Concerned Scientists (UCS) is similar to the Soviet draft except the phrase "disturb the normal functioning" is replaced by "render inoperable. " The UCS language is, from a U.S. perspective, probably more acceptable, since it would seem to cover only actions that harm the satellite and not those that make its job harder. In the absence of formal negotiations, it is impossible to assess Soviet intentions or willingness to compromise on this point.

PROVISIONS RESTRICTING SPACECRAFT OPERATION AND ORBITS

Whether or not the United States and the Soviet Union agree to restrict ASAT weapons or capabilities it might be useful to negotiate a set of "rules of the road" for military space operations. These rules could serve the general purpose of reducing confusion and encouraging the orderly use of space, or they could be designed specifically to aid in the defense of space assets. Examples of general rules might include agreed limits on minimum separation distance between satellites or restrictions on very low-orbit overflight by manned or unmanned spacecraft. These general rules might also be used to establish new, stringent requirements for advance notice of launch activities. Specific rules for space defense might include declared and possibly defended "keep-out zones, " grants or restrictions on the rights of inspection, and limitations on high-velocity fly-bys or trailing. It might also be desirable to establish a means by which to obtain timely information and consult concerning ambiguous or threatening activities.

Precedents can be found for each of the general rules suggested above. The clearest example of international acceptance of "rules of the road" is the 1960 multilateral agreement on "International Regulations for Preventing Collisions at Sea. "[7] This agreement established the rule of international conduct on the high seas and provided the basis for the 1972 Soviet-U.S. treaty on the "Prevention of Incidents On and Over the High Seas."[8] In this latter agreement, the United States and the Soviet Union established more specific rules for the operation of their respective warships.

In the civilian communications field, nations have agreed to work with the International Telecommunication Union (ITU) to develop rules to insure orderly use of the geostationary orbit and the radiofrequency spectrum. Those nations possessing military satellites might wish to establish an organization, or more limited working groups, to develop similar technical rules of conduct for military space activities.

The Chicago Convention of 1945 established the fundamental principle of state sovereignty over territorial airspace. [8]The 1967 Outer Space Treaty established the equally important principle that space should be freely available for the use and exploitation of all nations.'" Since the beginning of the space age, nations have wrestled with, but failed to re-

[7] 33 U.S.C. 1051: T. I.A.S. 5813

[6] 23 U.S.T. 1168; T. I.A.S. 7379.

"'Convention on International Civil Aviation" (Chicago 1947), 61 Stat. 1180, 15 U. N.T.S. 295, T. I.A.S. 1591

"" Treaty on Principles Governing the Activities of States " in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Jan. 27, 1967 (Article I) 18 U.S.T. 2410, T. I.A.S. 6347.

solve the question of how to characterize the boundary between airspace and outer space. " As one author has observed, the very important difference between these two regimes is that "states shoot at aircraft not authorized to be in their airspace; they do not shoot at satellites passing over that airspace. "[1] This distinction will become increasingly harder to make as maneuverable space vehicles become more capable. Will nations continue to allow overflight of their territory by military spacecraft which are also capable of aerodynamic flight? Practical and internationally consistent "rules of the road' may be necessary to resolve this problem.

Article IV of the "Convention on Registration of Objects Launched into Outer Space" currently requires signatories to supply the Secretary-General of the U.N. with information concerning its space objects and launches. However, since the Convention requires only that the signatories supply this information "as soon as practicable, " it is of little use in clarifying ambiguous activities in a timely manner. Article 4 of the "Agreement on Measures to Reduce the Risk of Outbreak of Nuclear War Between the United States of America and the Union of Soviet Socialist Republics" also requires that "each Party . . . notify the other Party in advance of any planned missile launches if such launches will extend beyond its national territory in the direction of the other Party. " Unfortunately, since this article does not apply to space launch vehicles it is of little use as a means to protect space assets. As space launches become more numerous and varied, an agreement providing for *timely* notification of launch and information on the characteristics of the vehicle may be essential to avoid crisis through confusion.

International law recognizes that the concept of sovereignty extends to more than a nation's land mass. For example, a country's territorial waters and contiguous airspace are considered to be sovereign and defendable elements of that country. Extrapolating from this concept, one method for protecting satellites would be to negotiate or declare "keep-out zones" around the most critical space assets. The agreement or declaration of these "keep-out zones" might also include the right to defend these zones once declared. Precedent for the concept of "keep-out zones" can be found in the history of the SALT negotiations pertaining to submarines. During the course of these negotiations a number of proposals were discussed such as, "nesubmarine zones' which would have prohibited missile-carrying submarines from operating in certain parts of the ocean, and "no-ASW zones" (anti-submarine warfare) that would have allowed the unhindered operation of submarines in select areas to ensure that reliable retaliatory forces would exist to deter a possible first strike.

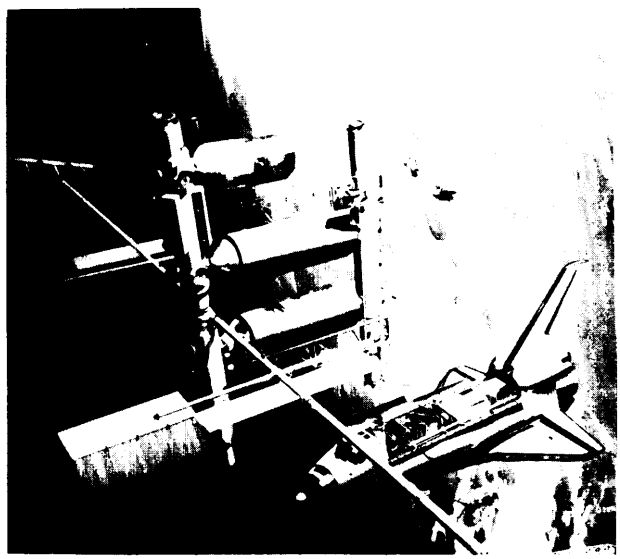

Photo credit Nat/onal Aeronautics and Space Adm/n/strat/on

Artist's conception of the U.S. Space Shuttle servicing a Space Station. As commercial and scientific space activities increase, internationally accepted "rules of the road" may be necessary to ensure that both military and nonmilitary space activities are conducted i n a safe and orderly manner.

[1] "This question has been considered almost annually in the U.N. Committee on the Peaceful Uses of Outer Space but has yet to be resolved. The position of the United States has been that such a delimitation has not been necessary and, indeed, might impede beneficial space activities.

[2] "Anti-Satellite Weapons, Arms Control Options, and the Military Use of Space, " William J. Durch, U.S. Arms Control and Disarmament Agency, contract No. AC3PC103, July 1984, p. 3.

Negotiated or declared "keep-out zones" would have to be reconciled with Article II of the 1967 Outer Space Treaty which states, "outer Space . . . is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means. "Keep-out zones" might be considered by some nations to be contrary to the Outer Space Treaty's ban on "national appropriation. " A counter argument might hold that current international practice with respect to communication satellites in geosynchronous orbit already incorporates a variation of the "keep-out zone" principle. Current geosynchronous orbit must be space several degrees apart in order to avoid frequency interference. Therefore, such a satellite precludes the placement of other satellites near its position in the orbital arc.

In order to reduce uncertainty regarding the purpose of certain satellites and the tension likely to result from unauthorized close approach, it might be useful to establish rules regarding inspection, high-velocity fly-by and trailing. Such agreements might allow close-approach and inspection under certain circumstances (e.g., prior consent) but might otherwise ban high-velocity fly-by and trailing—either of which could be a prelude to satellite attack.

One of the functions of a regime of rules in space would be to reduce instances where provocative or threatening activities are observed but not explained. To resolve this problem, a forum or a "hot line" might be established through which questionable space activities could be discussed in a timely manner. Precedent exists for this in the 1971 "Agreement on Measures to Reduce the Risk of Outbreak of Nuclear War, which requires the United States and the Soviet Union to notify each other "in the event of signs of interference with [early warning systems] or with related communication facilities, if such occurrences could create a risk of outbreak of nuclear war. " The 1971 agreement might be strengthened to require consultation regarding activities that might threaten satellites and not just activities which create a risk of nuclear war.

Monitoring Compliance With a "Rules of the Road" Agreement

The ability to monitor individual "rules of the road" with high confidence would vary directly with the specific measures adopted. As a general rule, however, monitoring "rules of the road" would be easier than monitoring other "arms control" regimes. The primary purpose of such rules would not be to restrict substantially the activities of the parties, but rather, to make the intentions behind these activities more transparent. Although the degree of protection for U.S. space assets to be gained from a "rules of the road" agreement would be less than from other arms limitation regimes, the costs are also correspondingly less for failure to completely verify compliance. One must assume that in the absence of ASAT arms control, both ASAT development and satellite survivability programs will be given high priority. This being the case, offensive and defensive measures would be available to respond to violations of "rules of the road.

Utility of a "Rules of the Road" Agreement

The "rules of the road" discussed above– if implemented in the absence of restrictions on ASAT weapon development—would not remove the threat of ASAT attack. If they were defended, "keep-out zones" would probably offer the closest thing to security in such a regime. Space mines designed to shadow satellites and detonate on command would lose a great deal of their utility if held at bay by a defended keep-out zone. If these zones were sufficiently large, or if satellites were appropriately shielded, they might even be effective against nuclear space mines. Keep-out zones would be less effective against advanced directed-energy weapons with kill radii of thousands of kilometers. However, these might be controlled by other arms control measures.

"Keep-out zones" combined with defensive satellites (DSATS) would offer substantial—though still incomplete–protection but would likely be extremely expensive. As an alternative to defended "keep-out" zones, the United States might wish to develop redundant systems and an ability to rapidly reconstitute lost assets.

"Rules of the road" would be substantially more effective at encouraging the orderly use of space by the military and at reducing the chances of escalation or misunderstanding in a crisis. Even in the absence of controls on ASAT weapons it would be valuable to have a multinational consensus concerning ambiguous activities such as close-approach, very low-orbit overpass, and high-velocity fly-by. If the "rules of the road" were part of other limitations on ASAT weapons and capabilities they would likely contribute to the effectiveness of these agreements and make their implementation more manageable.

Whether "rules of the road" were negotiable would depend on the specific provisions chosen. The negotiations pertaining to such rules might require the United States, the Soviet Union, and perhaps others, to sit down and discuss secret and extraordinarily sensitive issues relating to the operation of military space assets. Some rules, such as very low-orbit overflight by manned, reusable vehicles, may be so politically sensitive as to not be amenable to discussion. Other rules, such as "keep-out zones" and minimum separation distance for satellites, may not be desirable be cause they are not technically possible at altitudes where the majority of current U.S. and Soviet satellites are located. On the other hand, some rules, such as high-velocity fly-by, or close inspection might lend themselves to discussion and agreement.

The United States and the Soviet Union may wish to adopt "rules of the road" as a result of their increased use of space for military-including ASAT—purposes, or because they are engaged in negotiations designed to limit the arms race in space. "Rules of the road" might be an attractive companion agree ment to far-reaching limits on A SAT weapon development. On the other hand, in the total absence of ASAT weapon limitations, there would be a need to clarify ambiguous activities before it became necessary to "use or lose' offensive space weapons. The negotiability-or lack thereof–of "rules of the road" can only be discovered as a result of serious negotiation between interested parties.

BMD AND ASAT TREATIES OF LIMITED DURATION

Each of the regimes examined above could be negotiated as a treaty of indefinite or limited duration or, alternatively, as one which remains in force as long as periodic reviews are favorable. Each of these alternatives has its advantages and disadvantages. Treaties of indefinite duration are more effective at discouraging the pursuit of banned activities, yet require a greater degree of foresight regarding the long-term interests of the signatories and can foreclose technological options for the indefinite future. [3] Treaties of limited duration allow parties to take advantage of future technological options, yet can encourage aggressive development programs designed to reach fruition at the termination of the designated period. Treaties which call for a periodic reassessment of agreed limitations in theory have great flexibility, yet, in practice, often result in a strong presumption that they should be continued.

[3] 'Treaties of unlimited duration usually contain a clause which allows the signatories to withdraw from the treaty if their "supreme national interests" are threatened. In addition to ''supreme national interest clauses, " treaties may also contain specific unilateral or agreed statements regarding specific understandings about related events. For example, The 1972 ABM Treaty contains a unilateral statement by the United States which links the continued viability of the treaty to "more complete limitations on strategic arms. "

The United States might, for example, enter into a treaty limiting ASATS with the explicit and public reservation that we would withdraw from this treaty if and when we were ready to test and deploy a ballistic missile defense system in ways that the ASAT Treaty would forbid. Alternatively, we might take the public position that we intended to restrict our BMD activities so as to remain within the limits of an ASAT Treaty. While the former position would suggest a treaty of limited duration and the latter a treaty of unlimited duration, this need not be the case. It would be perfectly possible to sign a treaty of unlimited duration, with the standard provision allowing for withdrawal, accompanied by a clear statement of some of the conditions under which we intended to withdraw.

From one point of view, the exact language in a treaty regarding its duration is less important than the intentions of the parties. After all, there have been numerous examples of treaties of unlimited duration that were violated soon after they were signed and examples of treaties of limited duration that continued in force after they had expired (e.g., the "Interim Offensive Agreement" signed at SALT I). The real issue is whether the parties believe that adherence to the treaty in question continues to be in their national security interest.

The Reagan Administration has recently indicated that it intends to conduct ASAT tests to gather information useful in advanced BMD research. " Given the close connection between these two technologies, an ASAT treaty of even limited duration would require modification of current SD I program plans. Thus, to the extent that the United States wishes to maintain the most rapid pace of advanced BMD research within the bounds of the ABM Treaty, such a treaty would not be desirable. Conversely, to the extent that the United States wishes to slow the pace of Soviet BMD research and is willing to defer decisions regarding the testing of space-based or space-directed weapons, an ASAT treaty of limited duration could contribute to that result.

"The purpose of tests "in an ASAT mode" would be to investigate advanced technologies without violating the ABM Treaty. The Department of Defense recently told Congress that, '{To ensure compliance with the ABM Treaty the performance of the demonstration hardware will be limited to the satellite defense mission. Intercepts of certain orbital targets simulating anti-satellite weapons can clearly be compatible with this criteria. " "Report to the Congress on the Strategic Defense Initiative, " Department of Defense, 1985, app. B, p. 8.

COMPLIANCE MONITORING, VERIFICATION, AND RECOURSE

Verification of compliance with an arms control treaty provision involves three distinct processes: monitoring the activities of other parties to the treaty, interpretation of the information obtained by monitoring, and, assessment of the risk which such activities pose to U.S. security. Each of these processes presents a different set of problems and opportunities to the intelligence community. Should violations or potential violations of treaty obligations be discovered during the verification process, then it becomes necessary to decide what, if any, action is to be taken in response. Verification of compliance and recourse are discussed in greater detail below.

Monitoring

When discussing the ability of the United States to monitor Soviet treaty compliance, it is important to distinguish existing and planned-capabilities from potential capabilities. Existing and planned monitoring capabilities are described in chapter 4. Some of the existing systems used to monitor compliance with SALT and other arms control agreements would be useful for monitoring compliance with possible ASAT arms control provisions.[16]

"Some of these capabilities have been described in general terms by Congressman Les Aspin in "The Verification of the SALT II Agreement," *Scientific Amen"can,* vol. 240, No. 3, February 1979, pp. 38-45.

For example, capabilities to monitor the construction and dismantling of ICBM launchers –the number of which is constrained by the SALT II agreement-could also be used to monitor the construction and dismantling of launchers for boosters used for ASAT weapons.

By investing in new monitoring systems and personnel, future monitoring capabilities can be made more comprehensive than existing capabilities. To a limited extent, one can actually "buy' more monitoring capability. (See table 6-l). However, such additional capabilities would, in most cases, require years of work and substantial expenditures of funds. As in weapon system procurement, it will be necessary to judge "how much is enough"-i.e., to determine the level of investment above which the value of monitoring capability improvement obtainable per dollar ceases to be worth a dollar.

The fact that future monitoring systems could be more capable than current systems does not mean that all monitoring problems can be solved by spending more money on advanced technologies. Some activities will always be unmonitorable (e.g., some forms of underground testing), other dual-purpose activities (e.g., manned spaceflight) will often be difficult to characterize. Although future technologies will increase our ability to monitor the activities of other countries, similar technologies may make the job of treaty verification more difficult. Specific examples of these problems are presented above in the discussions of specific treaty provisions.

Interpretation

Once indications of a potentially prohibited activity have been detected by monitoring systems, the data must be further interpreted to determine the intent of the activity and how the activity affects specific treaty agreements. For example, suppose that while a space-weapon ban is in effect, the deployment or construction of a large mirror is observed in space. In this case, the monitoring data might be scrutinized to determine whether the mirror was capable of reflecting intense laser beams and changing its pointing direction quickly—as a prohibited weapon system might—or whether, instead, it was only capable of reflecting low-intensity radiation and changing its pointing direction slowly, as communication system or telescope components might. [16] The ability to make such a determination would depend both on the sophistication of the monitoring system employed and prior knowledge regarding similar activities.

Even if the monitoring system provides data sufficient to clearly identify the nature of a questioned activity, it still remains to be determined whether that activity is prohibited by the language of the relevant treaty. In the example of a mirror deployed in space, there would remain the question of whether deployment in space of any large mirror capable of reflecting intense laser beams would be a violation. Since similar mirrors have been proposed for peaceful purposes (e.g., propulsion of laser-powered rockets[17]), even if the relevant agreement defined weapons in terms of their capabilities rather than intended uses, there could be ambiguity as to the legality of deploying such mirrors.

When ambiguities are foreseen, treaty language can be worded to avoid them. However, history has demonstrated that it is extremely difficult to foresee all the significant ambiguities that could arise in an arms control agreement.

Assessment

If monitoring data are interpreted to indicate that an activity prohibited by a treaty (or possibly inadvertently allowed by ambiguity of the treaty) is taking place (or about to take place), the risk which the activity poses to U.S. security must be assessed. This assessment must take into consideration at least three factors: 1) the threat to U.S. national security posed by the specific violation; 2) assuming the

[16] The large deployable reflector (LDR) under development by NASA is an example of such a component.

[17] R.R. Berggren and G.E. Lenertz, "Feasibility of a 3@ Meter Space Based Laser Transmitter, " NASA-CR-134903, 1975 [NTIS accession number N-761 1421].

violation, the extent to which the relevant treaty still contributes to U.S. national security; and 3) the ability of the United States to take actions which will prevent, mitigate, or compensate for damage that might be caused by the violation. The result of such an assessment will often imply the appropriate nature of the recourse to be pursued.

Recourse

Given the many different activities that ASAT arms control could restrict and the numerous ways that such agreements could be violated, it is difficult to make generalizations about how the United States might or should respond. Faced with a clear violation of a major treaty provision that seriously jeopardized U.S. national security, the United States would be wise to withdraw from the treaty in question. If, on the other hand, the existence of a violation was uncertain and it pertained only to a subsidiary portion of an otherwise valuable treaty, then it might be appropriate to seek consultation to resolve this particular activity while leaving the treaty otherwise intact.[18] Alternatively, unilateral defensive countermeasures or R&D on treaty compliant offensive measures might be pursued to hedge against breakout. The hardest questions are those that arise somewhere between these two examples.

ASAT arms control raises a number of questions common to all high-technology treaty restrictions. For example, if one party violates a test ban on advanced directed-energy ASATS and then, when confronted with the violation, declares its intent not to repeat this violation, what is the appropriate response? Some would argue that the damage has been done. One side has had the opportunity to verify a technology which it may have been developing covertly over a period of years. The side which remained in compliance has lost not only the information it could have gotten from similar tests, but potentially, years of research experience. Others might argue that limited testing or minor ambiguities offer no real and enduring military advantage.

Other responses to clear or uncertain treaty violations include negotiating modifications to the agreement or matching cheating with identical or equivalent conduct. Negotiating modifications can be a long and contentious process, particularly if the negotiations require one party to admit to treaty violations or ambiguous conduct. Given the differences between Soviet and U.S. force structure and technology base, matching cheating with identical conduct is often not a useful alternative. For example, the United States may not desire to build a Krasnoyarsk-style radar. On the other hand, matching cheating with equivalent conduct (the so-called "parallel interpretation" alternative) runs counter to notion that a treaty should have one common understanding which is accepted by both parties.

[18] Others have argued that the mere fact that a treaty has been violated is as important as the national security impact of the violation. For example, Colin Gray writes:

> The Soviet noncompliance issue is not important as a matter of ethics or because the sanctity of international legal norms must be upheld . . Nor is Soviet cheating primarily important in terms of military advantage and disadvantage . . (T)he greatest danger . . . results from the loss of U.S. credibility. . . (W)ar is more likely to explode out of a mutual diplomatic miscalculation (than a military imbalance), That miscalculation could be rooted . in a Soviet lack of respect for the quality of determination in U.S. policy.

Colin Gray, "Moscow is Cheating, ^{5}' *Fore&n Policy*, No. 56, fall 1984, pp. 141-152.