Averting a Brobdingnagian Skeet Shoot: Arms control measures for anti-satellite weapons

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American and Soviet negotiators seated themselves at the bargaining table in Helsinki and convened the first round of talks on arms control measures for anti-satellite (ASAT) weapons. On December 24, 1979, while preparations were underway for a fourth round of ASAT talks, the Soviets invaded Afghanistan, making it impossible to continue “business as usual” on arms control with the Soviet Union.

No one would counsel the resumption of ASAT negotiations if it were contrary to U.S. interests in light of recent Soviet behavior. However, the problems which brought the United States to the negotiating table in the first place have not disappeared. They promise only to get worse. The United States therefore still has a compelling reason for exploring effective and verifiable arms control measures for space weapons: at a time when satellites are becoming progressively vital to our national security, we do not have any other means for reliably protecting our satellites against future ASAT weaponry.

The opportunity that the United States now has before it to place constraints upon arms competition in the broad reaches of outer space is ripe but perishable. The ASAT technologies currently available to the United States and the Soviet Union are crude but suggestive. Should the momentum of ASAT programs increase, it is evident that the two sides will provoke each other into expending billions of dollars, all in preparation for a “Brobdingnagian skeet shoot” from which neither side is likely to derive a net advan-

1. This colorful image, recalling the land of giants in Gulliver’s Travels, was offered by Paul Warnke, chief U.S. negotiator at the first round of ASAT talks.

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tage in security. The ASAT negotiations themselves retarded this moment-

um, because the Soviets voluntarily suspended their ASAT testing program

while the talks were in progress. But with the negotiations now in abeyance,

the Soviets resumed testing on April 18, 1980, with the launch of Cosmos

1174. Moreover, a U.S. intelligence report in May asserted that there is

“evidence of a Soviet project to develop a space-based laser weapon that we

believe may have an anti-satellite application. . . . such weapons may be

available for operational use in the mid- to the late 1980s.” Clearly there is

an urgency to exploring arms control prospects.

Since this novel area of arms control touches on issues not widely discussed

in public, it is well to review the matters at stake and to suggest what an

effective ASAT agreement should contain.

**Anti-Satellite Weapons: Present and Future Technology**

At an increasing rate, satellites are being exploited by the United States to

perform a variety of civil and military tasks, including communication, me-

teorology, navigation, surveillance and reconnaissance, warning of military

attack, and monitoring of arms control agreements. As reusable launch boost-

ers such as the Space Shuttle reduce the cost of placing satellites in orbit and

make sustained manned operations feasible, the list of tasks will expand.

At present, the United States and the Soviet Union together have about

150 active satellites in orbit. By the mid-1980s that number will rise to around

200. The total investment represented by these satellites cannot be fixed,

because neither side will acknowledge the precise number or cost of military

and intelligence satellites. Only rough yardsticks are available. The U.S.

Defense Department, for instance, is establishing a set of complex commu-

nications networks (FLTSATCOM, AFSATCOM, DSCS, etc.), with satellites

incorporating costly protective features to guard against such threats as elec-

tronic jamming. Funding for development, procurement, and launching of

these military systems has been $200–300 million annually for the past several

years and will continue at these levels into the 1980s. It would not be

surprising, therefore, if the satellites currently maintained in orbit by the

United States or the Soviet Union represented $5–10 billion worth of invest-

ment—a figure that begins to rival the cost of major strategic weapons sys-

tems, such as Trident.

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2. The total number of no-longer-functioning satellites still in orbit is much greater, and the total number of objects in orbit, including debris, is larger still.
The value of satellites, however, is not properly weighed in terms of their investment costs alone. Our growing dependence upon satellites for carrying out a variety of vital missions is a more pertinent index of their importance—and in turn, of the importance of protecting them through arms control measures. This dependence varies from case to case. In many instances, the missions performed by satellites were previously carried out by earth-based facilities: in the communications area, for instance, by undersea cables and radio transmitters; in the navigation area, by such radio beacon systems as LORAN. Satellites are now preferred for these missions because they can perform with higher efficiencies. Many of the ground-based networks that they replaced have subsequently been dismantled. Nonetheless, satellites may not be indispensable for these tasks. If we fail to reach an ASAT agreement which protects satellites, the United States could presumably revert to ground-based systems, though this would mean higher costs, continued dependence upon overseas installations, and a U.S. military presence in foreign nations that might be difficult to ensure.

For certain other missions, however, satellites provide unique capabilities that cannot readily be duplicated by ground-based systems. Overhead photographic surveillance, so crucial for military intelligence and crisis monitoring during regional conflicts, is an important example. It would be feasible technically to carry out such missions by less exotic means than satellites—by U-2s for instance. But the political obstacles to securing broad consent among nations for such surveillance overflights are so overwhelming that, as a practical matter, satellites are indispensable. Hence, it is a matter of concern that satellites are quite vulnerable to an array of techniques for attacking them or interfering with their missions.

These vulnerabilities are a problem for virtually any satellite, not just those belonging to military or intelligence agencies. No attacker is going to grant free passage to a militarily useful communications or meteorology satellite, simply because it carries the emblem of a civilian agency or international corporation. An article in the Soviet press published on the eve of the first ASAT talks for instance, offered a well-informed discussion of the interchangeability of U.S. and NATO satellites for military communications purposes. So the protection of a vast number and variety of satellites is at issue here.

3. Col. A. Zhovanki, “Long-Range Communications: Problems and Solutions” Krasnaya Zvezda, June 7, 1978. Under the Defense Department’s GAPFILLER program in the late 1970s, for example, the U.S. Navy met its Fleet Satellite Communications requirements by leasing channels on the civilian MARISAT satellites.
Until recently, the United States devoted relatively little effort to diminishing the vulnerability of its satellites. Since the costs of launching a complex satellite were typically above $20 million and rose as the weight of the satellite increased, it was penny-wise to cram every available ounce with equipment and to omit survivability features (such as armor plating, anti-jamming devices, evasive maneuvering capabilities, shielding against lasers, etc.). Some intrinsic "hardness" against attacks or interference occurred as an incidental benefit of general efforts to make satellites more durable in the hostile environment of space. But far more extensive and costly defensive measures would be necessary, if the Soviets incorporate the best technology into ASAT weapons—and even then the protection would be marginal at best.

As matters stand now, the best technology has not yet been applied to ASAT weapons. There is at the present time a breathing spell during which the future can still be shaped. This has not been due to a lack of imagination or foresight on the part of ASAT designers. Schemes for shooting down satellites predate satellites. The first study of ASAT systems commissioned by the U.S. Air Force was undertaken in the mid-1950s, before the Soviets had launched Sputnik. Even at that time, it was evident that a variety of techniques for attacking satellites were conceivable. And since ASAT weapons come in great variety, an ASAT arms control agreement must be couched in broad terms to encompass all possibilities.

The earliest U.S. studies of ASAT systems focused on two basic approaches: either a "killer satellite" interceptor that would be placed in orbit and then maneuvered to its target, or a direct-ascent interceptor that would rise from the earth and promptly intercept the target when it passed overhead. With either technique, the target could be destroyed by a nuclear warhead or by some non-nuclear means. A nuclear warhead would have a kill radius of tens or even hundreds of miles, depending upon the intrinsic hardness of the target to nuclear radiation. But the drawbacks are that the radiation would also damage friendly satellites at great distances from the enemy target, and by breaching the nuclear threshold, such a warhead could escalate a conventional confrontation to higher levels of violence. Non-nuclear warheads avoid these problems, but their kill radii are also smaller, and so they require more precise interceptor accuracy and timing in order to get the warhead close enough to the target to do damage.

"Killer satellite" interceptors were the earliest means devised for getting the accuracy needed with non-nuclear warheads. Launched so that it has an orbit and speed roughly comparable to the enemy target, a "co-orbital" interceptor can then make last-minute maneuvers while closing on the target
at relatively low speeds. The interceptor must guide itself during the last moments of attack, so it requires a homing system, e.g., an active search radar or optical scanner. (Guidance from the ground would be insufficiently precise or timely for the last phase of engagement.) If the maneuvering capability of the interceptor can be made great enough, and if the detection range of the homing device is greatly extended, then the relatively low closing speeds provided by a co-orbital approach would not be necessary at all. The interceptor could instead be boosted in direct-ascent from its ground site to detect, pursue, and destroy a target passing overhead. Such a system could be highly effective against satellites in lower orbits (that is, those below about 1,000–2,000 nautical miles), because its swift approach would give the target little warning or time for evasive measures. In the past, however, technology has not been available to meet these more rigorous maneuvering or homing requirements for non-nuclear interceptors. Schemes for direct-ascent systems relied instead upon nuclear warheads that did not require great accuracy, but which had the drawbacks noted above.

The first U.S. Air Force anti-satellite program (SAINT) was a co-orbital interceptor that was to inspect and destroy targets. The project appears to have been a stalking horse for other Air Force space projects, rather than a fully-conceived ASAT effort. In any case, SAINT never advanced beyond the research and development phase and was cancelled in 1962. The U.S. ASAT mission then became an orphan, temporarily given shelter under the Army’s ABM program by those who recognized that, in principle, the ABM test facilities on Kwajalein Island in the Pacific could also work reasonably well as a nuclear-armed direct-ascent ASAT system against low altitude satellites. In 1964, prodded by concerns over a Soviet orbital bombing threat (FOBS and MOBS), the Air Force resumed ASAT missions by establishing nuclear-armed Thor IRBMs on Johnston Island in the Pacific. The location was appropriate for intercepting Soviet satellites on their initial orbital passes, but the THORS were costly and clumsy instruments. The facility was closed down in the early 1970s.

The United States has now reverted to non-nuclear direct-ascent ASAT schemes, derived from ABM research. Contracts were awarded in 1977 to the Vought Corporation to develop a Miniature Homing Vehicle (MHV), weighing 34 pounds, to be launched from the ground or from an aircraft on a relatively inexpensive booster. For FY 1980, the Defense Department

4. The favored scheme is an air-launch using a modified SRAM as booster; cost estimate for the booster alone, $1 million each.
budget request for R&D on this MHV system was $63 million. Since the MHV interceptor is designed to destroy its target by ramming it, very high accuracies (near-zero CEP against targets closing at speeds greater than 17,000 mph) will have to be achieved. Comparable marvels have been produced by American technology in the past, but there are knowledgeable critics whose doubts about the feasibility of the MHV will not be laid to rest until flight tests actually succeed against orbiting targets. The first space tests of the MHV will reportedly not occur until 1982. If the United States were instead to pursue a less exotic co-orbital interceptor, using off-the-shelf hardware, a rudimentary ASAT system could probably be demonstrated in short order. For the moment, however, the United States does not have a weapon system specifically dedicated to the ASAT mission, despite expenditures of several hundred million dollars on various schemes over the past twenty years.

The Soviets have undoubtedly also explored a variety of ASAT approaches. In 1964, a PKO division of the Soviet PVO-Strany strategic defense forces was established, charged with the mission of "destroying the enemy's cosmic means of fighting." By 1967, preliminary tests of an ASAT system had begun. The system is based on a co-orbital interceptor that destroys its target with a non-nuclear warhead after first maneuvering to cross the path of the target. In the early 1970s, the Soviets ceased flight tests of the interceptor, and then resumed them in 1976, with roughly four interceptor launches per year. The moratorium undertaken during the ASAT negotiations produced another hiatus from May, 1978 to April, 1980. Substantial advances in weapons technology have occurred since the mid-1960s when the Soviet ASAT was designed, and an interceptor based on the older hardware would have inherently limited capabilities, reliability, and growth potential. Public accounts of the Soviet tests periodically given by the Defense Department, for instance, indicate that the interceptor has executed the steps necessary for target destruction in only about 50 percent of the tests. (Classified intelligence data on the Soviet program, of course, is much more precise and specific.)

This co-orbital interceptor assembled from the cumbersome technology of the 1960s requires a large launch booster comparable to the bigger Soviet ICBMs, and even with that it could only reach satellites in lower orbits.  

5. Protivo-Kozmicheskaya Oborona: literally, "anti-cosmic defense."
6. TRW, the American aerospace firm, has published data estimating the weight of the Soviet ASAT interceptor at about 4,500 pounds, identifying the booster as a missile adapted from the
Intercepting targets at geosynchronous orbits (i.e., "stationary" satellites at altitudes of 22,300 nm) would require a booster comparable to the U.S. Saturn-B rocket that launched the 85 ton Skylab. An extensive ASAT system based on such boosters would not only be extremely costly, it also would not be a fast-reaction system, since launch preparations for such boosters can require weeks or months. The Soviet interceptor itself has limited fuel for maneuvering, and thus is largely restricted to attacking when the target is in an orbital pass that would carry it almost directly over (i.e., in-plane with) the ASAT launch site—something that happens only once every twelve hours for any particular satellite in lower orbits.

Nonetheless, against satellites lacking defensive countermeasures, the demonstrated Soviet ASAT system could be, as Defense Secretary Brown has remarked, "somewhat troublesome." The lower orbits reachable with the Soviet ASAT are the ones used by the United States for many of its photo-reconnaissance, electronic intelligence, meteorological, and navigation satellite networks. With limited Soviet ASAT maneuverability and reliability, it could take days to weeks for the Soviets to eliminate entire U.S. satellite networks; but surprise attacks on a handful of U.S. satellites would be within the capabilities of the current Soviet system.

These Soviet and American programs by no means exhaust the range of possible ASAT schemes. The missions of some satellites can be impeded, even without sending interceptors against them, by using various methods of interference such as electronic jamming. Many satellites, as part of their mission (e.g., communications or navigational assistance), must pick up very weak radio signals, amplify them, and relay them on to other stations. In addition, satellites may require periodic "housekeeping" instructions radioed from earth so that they remain in appropriate orbit and orientation. Under some circumstances, an adversary may be able to use powerful transmitters, such as early warning radars or large space-communication antennae, to jam or even burn out the sensitive receivers on satellites and thus block their use. Similarly, the Soviets now have satellites capable of scanning the oceans with radar and detecting the echoes reflected back from ships on the surface. (The Soviets' Cosmos 954, which scattered radioactive debris over northern Canada when it fell from orbit in September 1977, was a satellite of this

Soviet SS-9 ICBM, and listing the launch dates and orbit configurations for Soviet targets and ASAT interceptors. The highest altitude listed for the interceptor in these tests was about 1,250 nm. See TRW Space Log 1977. The bulk of American non-geosynchronous satellites orbit the earth at altitudes of 100–20,000 nm.
Such satellites are vulnerable not only to active jamming of the radar receiver, but also to a variety of passive countermeasures, such as decoy ships or “corner reflectors” that could confuse the radar by making small vessels appear as large ships.

The susceptibility of current satellites to such interference is difficult to estimate, because success with such techniques is highly dependent upon whether the attacker has good information about the satellite’s electronics, whether he has jamming transmitters geographically distributed so they can overwhelm satellites at appropriate times, etc. These factors will vary from case to case, depending upon where, when, and in what form conflict occurs. But broadly speaking, these techniques are likely to be more disruptive to the tactical than to the strategic missions of satellites, and they are likely to be more successful against high altitude and geosynchronous satellites, rather than low orbit satellites. An exception would be low orbit radar reconnaissance satellites, which appear to be particularly vulnerable to “spoofing.” Interference must, therefore, be considered as part of the ASAT problem.

All this is rather prosaic ASAT weaponry. There is yet another whole class of potential ASAT weapons: directed-energy or “beam” weapons, such as lasers or charged-particle beams. By blinding, overheating, or even destroying fragile satellite components, such systems could work well as ASAT weapons. Among many specialists there is doubt that practical particle-beam weapons can even be built; fewer doubts exist about the feasibility of high-power laser weapons.

Ground-based laser weapons would have limited effectiveness against most satellites, even with power outputs in the megawatt range. Both cloud cover and the atmosphere rob laser beams of substantial power. The tendency of a laser beam to spread out over distance also complicates the task of bringing destructive energy to bear on distant satellites. Consequently, the threat from such weapons would be posed primarily to low orbit satellites. Airborne lasers would get above much of the atmosphere, but there are limits to the power output and lethal range of a laser that must be fitted into an airplane. A multi-megawatt orbiting laser weapon, on the other hand, could

7. The technical reason for this is that jamming requires line-of-sight, or even main-lobe access to the satellite’s antenna as well as in-band power delivery greater than that of the satellite’s own users. These conditions are easier to meet in tactical situations, where the satellite’s users are probably nearby and operating with low-power transmitters, or where the high orbit of the satellite exposes it to line-of-sight access by powerful jamming transmitters in a wide geographical area.
operate above the power-robbing effects of the atmosphere and would be capable of damaging targets hundreds of miles away in outer space. But there are daunting technological challenges (and uncertain cost) to be faced in generating and aiming the explosive force of a multi-megawatt space laser, and even Defense Department enthusiasts of such weapons concede that they would not be available to the United States before the mid-1990s. Nonetheless, the destructive potential and probable cost of such futuristic weapons are sobering enough to suggest what unbridled arms competition in outer space might entail.

The seductive attraction of ASAT weapons is that in the absence of arms control restraints, it appears that technology will favor the offense over the defense. Plating satellites with armor or other protective coatings might work as a defense against unsophisticated conventional warheads or ground-based lasers, but not against the more advanced possibilities. (An MHV interceptor, for instance, colliding at speeds over 17,000 mph could defeat the armor of a battle tank.) Giving satellites the capacity to maneuver out of harm’s way when attacked, or the capacity to destroy oncoming attackers with their own defensive lasers are suggested defenses. But a satellite defense system would first have to detect oncoming ASAT weapons, using active radars or optical scanners, and thus it would be susceptible to a crafty attacker who could jam or confuse the sensors and exhaust maneuvering engines or defensive lasers. One could envision satellites of the future burdened with thousands of pounds of defensive measures, just to protect a few hundred pounds of vital equipment. An alternative scheme advocated by some in the Defense Department would involve “convoying” satellites under the protection of huge defensive laser satellites. But satellites with different missions could not readily be clustered together into “convoys” without severely compromising their missions. And in any case, the protecting satellite would itself be subject to the problems of jamming and exhaustion just mentioned.

The vitality of satellite defenses could be restored if a cap were placed on offensive ASAT weapons, and this is what ASAT arms control would do. Consider, for instance, that a promising defensive technique for satellites would be simply to multiply the total number of satellites, so that the attacker’s prospects of destroying them all in time to have a decisive impact upon a conflict would be diminished. The U.S. Space Shuttle will make satellite systems much cheaper, by reducing launching costs and by permitting retrieval or repair of satellites, thus reducing the need for overly durable and redundant equipment on them. By duplicating and diversifying missions
among a greater number of cheaper satellites (and storing some duplicates in orbit in an apparently inert condition to disguise their missions or presence), the defense could present a formidable challenge to any would-be attacker. The effectiveness of this approach declines, however, if the attacker has plenty of cheap, reliable ASAT interceptors available. And this underscores the importance of exploring ASAT arms control measures promptly.

As yet, neither the United States nor the Soviet Union has tested or deployed such an efficient ASAT device. Nor is there any immediate prospect of a cheap interceptor capable of reaching the large number of high-altitude and geosynchronous satellites. Even the U.S. MHV device would require a Minuteman-class booster to carry it up to geosynchronous altitudes. Yet undoubtedly, if ASAT competition continues without restraint, such devices will be developed and deployed. It is in this sense that the United States faces a ripe but perishable opportunity to avert greater threats to its satellite systems.

The Path to Arms Control for ASATs

Despite the attractiveness of an arms control approach to ASAT threats, it was not given broad consideration within the U.S. government until recently. Instead, policy tended to vacillate between indifference to the threat and strictly offensive responses to it, that is, acquiring our own ASAT capability. The Soviet ASAT program is over a decade old, and there were several interagency study groups assembled within the U.S. government during those years to examine U.S. policy on ASAT systems. Repeatedly the judgment had been made that neither the Soviet ASAT capability nor the increased Soviet military use of space satellites warranted U.S. investment in an extensive ASAT system. In a period of tight military budgets, the emphasis had been upon using limited funds to improve U.S. exploitation of space, rather than on trying to threaten Soviet satellites.

The turning point came literally in the final days of the Ford Administration, when a National Security Council decision memorandum instructed the Defense Department to begin a new ASAT program. The precipitating event was the resumption of Soviet ASAT testing in 1976. Arguments were already being made within the State Department, urging the administration to seek an ASAT arms control agreement. Instead, Secretary of State Kissinger argued that the U.S. should redress any asymmetry in ASAT capabilities between the sides before any arms control restraints were considered. The
directive by the Ford Administration to go ahead with the MHV system did call for a study of arms control options, but it did not include any concrete proposal for inviting the Soviets to ASAT talks. Kissinger may have felt it was premature to make such a proposal; or indeed, he may not have favored negotiations at all.

The case made by the Defense Department for acquiring an ASAT system, however, had a number of defects. The initial argument was that the United States ought to match the Soviet ASAT capacity as a means of deterring attacks on U.S. satellites. Yet if the U.S. is indeed becoming more dependent upon satellites for its military effectiveness, then it is well to bear in mind that destroying Soviet satellites in a rage of retaliation will not restore our own satellite capabilities.

Deterrence has other shortcomings as well. It is not obvious that the mere threat of U.S. retaliation would deter the Soviets from attacking U.S. satellites, because Soviet dependence upon satellites is lower than American dependence. The Soviets have fewer military forces deployed beyond their homeland and thus can rely upon interior (ground-based) lines of communication. Their strategic forces have less need for worldwide communications or navigation aids, since their strategic bomber fleet is so small and their longer-range SLBM submarines can operate near home shores. The role of the Soviet Navy is sea interdiction rather than the more demanding task of sea control, and thus it may be less dependent upon global communications for coordination and control. For conflicts near the Soviet borders, ground-based surveillance and reconnaissance systems can fill gaps created by the loss of satellites. And lastly, Soviet military planning is aimed at short, intense warfare begun with surprise and massive shock. Here the emphasis would be upon commands and data distributed before the conflict begins, when the United States would be inhibited from preemptive attacks on Soviet satellites. (Passive concealment techniques for confusing Soviet radar reconnaissance or intelligence satellites, on the other hand, would not involve such inhibitions.)

In evaluating the efficacy of deterrence, the United States must make some judgments about where conflicts are most likely to occur. If, as seems likely, the vital conflicts would be on the Soviet periphery (in Europe, the Persian Gulf, the Middle East), then the Soviets might well be able to get along without their satellites—which means that a U.S. retaliatory threat would have doubtful deterrence value. The weakness of the deterrence argument was recently conceded by Seymour Zeiberg, deputy undersecretary of Defense R&D for space systems, who oversees the U.S. ASAT project:
The idea of tit-for-tat with satellites to my mind does not make sense because of the great asymmetry in the nature of [U.S. and Soviet] satellites, the deployment of satellites, etc. . . . For example, the Soviets have a very redundant communications system to their forces. They have two of everything. So taking out a communications satellite is not going to extract much of a price from them. If they took out one of our communications satellites, it would be quite different.8

What the Defense Department now argues instead is that the United States needs an ASAT capability in order to initiate attacks on a relatively small number of Soviet satellites that pose a danger to U.S. forces. Of particular concern are the Soviet radar and electronic surveillance satellites that can scan the oceans for U.S. naval forces and provide targeting information for, say, long-range cruise missiles. Even if shooting these satellites down is the only way to cope with them (and that has not been demonstrated), the problem with this argument is that, as the price for having its own ASAT, the United States will also be exposing all of its own satellites to comparable Soviet ASAT threats. If deterrence cannot protect U.S. space systems in a world of ASATs, what then is the alternative?

The answer of the Ford Administration was a rapid surge in spending on "space defense systems," increased in the Defense Department budget from $61 million in FY 1977 to $126 million proposed for FY 1978, and $265 million projected for FY 1979. But these figures were quite misleading. A substantial chunk of the funding was for the MHV program; actual funding fell short of projections ($73.0 million in FY 1979, not $265 million); and only a small portion of the funding was actually devoted to the category of "satellite survivability" (only $19 million of the $73 million in FY 1979).9 Even within this latter category were contained programs for devices, such as impact sensors, that would detect when a satellite had been attacked but would not in themselves make the satellite survivable. There were, and still are futuristic schemes aplenty being studied (laser and charged-particle satellites, "convoying," etc.), but nothing available for the near term that could even cope with our own MHV interceptor. So by insisting upon an ASAT solution to one problem, the military services are exposing themselves to a vast range

9. For FY 1980, funding of $80.5 million was requested for "space defense systems," all of it for various ASAT programs. An additional $30 million was requested for "satellite survivability," of which $11.6 million was for actual survivability technology. Congress has shown reluctance to approve even these modest funding levels.
of problems for the operation of all U.S. military forces, given their dependence upon satellite systems.

Problems of this sort convinced President Carter to add ASAT restraints to the list of arms control topics that he raised with the Soviet Union in the early days of his administration. The matter was broached with Moscow in March, 1977, and the sides subsequently agreed that a joint “working group” on the issue should be established. A year of delay then followed as the United States prepared for substantive negotiations. During this time, policy flesh was added to the spare skeleton of President Carter’s initial proposal by a U.S. inter-agency study group, staffed by representatives from the NSC, the Defense Department, State, the Joint Chiefs, the Arms Control and Disarmament Agency, the CIA, and NASA. By this path, the two sides reached the negotiating table at Helsinki in June, 1978.

Approaches to the Control of ASAT Weapons

Public statements by the Carter Administration regarding its specific goals or proposals at the ASAT negotiations have been quite spare: the United States seeks comprehensive and verifiable limits on ASAT capabilities, and in the event such limits cannot be negotiated, it will acquire an ASAT capability of its own. Nonetheless, we can consider what an ASAT agreement might contain, if it is to serve American security interests.

Currently, the U.S. and Soviet Union are party to a series of international treaties that offer some margin of protection to satellites, although the sides have not directly addressed ASAT weapons in previous arms control talks. None of these existing accords, however, would serve as well in stemming an ASAT arms competition as a new treaty specifically focused on these weapons. For instance, provisions of the Limited Test Ban Treaty (1963) and the Outer Space Treaty (1967) would ban the sides from placing nuclear-armed ASAT weapons into orbit and would prohibit them from detonating nuclear warheads in outer space. But nuclear-armed interceptors are only one (and perhaps the least likely) type of potential ASAT weapon. Hence, the restrictions in these two accords certainly do not exhaust the range of constraints needed.¹⁰

¹⁰ Unofficially, the Soviets have claimed broad scope for the Outer Space Treaty in banning ASAT systems. A TASS broadcast on April 4, 1977, stated that the United States had a “secret program to create means of destroying ‘enemy satellites’” (evidently a reference to the MHV
Acts of interference with satellites are also in partial measure covered by several agreements. Article II of the Accidents Measures Agreement (1971) addresses interference with early warning systems, of which satellites would be one part, if such interference “could create a risk of outbreak of nuclear war.” But this accord only obligates the sides to “notify each other immediately” when such interference is detected. By implication, however, if such acts of interference could indeed pose a risk of war, then the two sides would be obliged to refrain from such interference with early warning systems under the Agreement on the Prevention of Nuclear War (1974). There are also a number of general regulations governing radio-frequency interference contained in the Convention of the International Telecommunications Union, whose intention is to provide for the orderly use of the airwaves. Further constraints on interference are contained in the agreements of SALT I and II, where interference with satellites serving as part of “national technical means of verification” is prohibited.

The deficiency of these accords is that they govern only some attacks with ASAT weapons and only certain forms of interference. They do not address the whole range of threats nor other provocative aspects of an arms competition such as testing or deployment of ASAT systems. The goal of a new ASAT agreement would be to supplement, not to supplant the obligations of these existing treaties.

There are two basic approaches that could be taken in drafting an ASAT agreement: define in detail what an ASAT weapon consists of and ban all such weapons; or, ban the testing, deployment, or use of any weapon in a manner appropriate for attacking satellites. The contrast here is between banning things and banning actions.

Banning itemized things has numerous difficulties. Overly explicit itemizations of things which are prohibited can provide a road map for circumventing the intent of a treaty while remaining within its letter. However fertile the imaginations of treaty draftsmen in anticipating possible ASAT weapon designs, there will always be new technologies or techniques that

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project). TASS asserted that even an R&D program along these lines was “in direct violation” of the Outer Space Treaty. It is not clear what to make of this assertion, since by the same principle, the ongoing Soviet ASAT interceptor program would also have been in violation of the Treaty. In an equally broad interpretation, the TASS broadcast held that the U.S. Space Shuttle program was also banned under the same treaty. Officially, the Soviets have asserted that the Outer Space Treaty does not prohibit them from taking whatever action they choose against satellites engaged in military or other hostile acts against the Soviet Union.
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will be overlooked. A treaty highly explicit in its definitions entails the risk of implying that any unspecified item is thus not subject to constraint. Yet another problem is that many of the capabilities that would be incorporated in an ASAT weapon (e.g., homing and maneuvering capabilities) may also be present in other space vehicles. Any attempt to ban all hardware with such capabilities could cripple non-ASAT space programs. Similarly, attempts to define and prohibit all equipment technically capable of electronic interference with satellites could cripple vital early warning radars and space communications systems (and could tell the other side precisely how vulnerable our satellites were to which kinds of electronic interference).

The inadvisability or simple impossibility of minutely defining all the restricted features of all conceivable ASAT weapons thus draws our attention to the second approach: banning ASAT activities, regardless of the equipment used. A model for this approach is the ABM Treaty, which broadly specifies and then restricts systems according to their use, i.e., any “system to counter strategic ballistic missiles or their elements in flight trajectory” (Article II.1). An ASAT agreement following this approach would contain two major obligations: 1) each side would agree not to use, not to deploy, and not to test any weapon or system for damaging or destroying satellites; and 2) each side would agree not to interfere with the functioning of the other’s satellites. Testing in this context would refer to tests against targets in space. Other R&D on ASAT technologies, if confined to the laboratory, would not be subject to constraint. A ban on all R&D would be exceptionally difficult to verify, and as long as tests of ASAT prototypes against targets in simulated attacks are banned, neither side need fear that the other will acquire a high-confidence, agile ASAT system on the basis of lab work alone.

Treaty provisions along these lines would provide a number of benefits. The benefits from a prohibition on interference would be more modest but still worthwhile. It would be impractical to ban all equipment technically capable of interfering with satellites, so a ban only on acts of interference would not in itself eliminate all dangers. However, it would enhance the effectiveness of satellites in the normal course of things (something worth having especially in the case of intelligence satellites), it would diminish the chance of provocative acts involving all satellites, and it would prohibit the Soviets from practicing interference techniques on our satellites.

Major benefits would come from the ban on testing, deployment, and use of weapons for damaging or destroying satellites, for this would stunt the growth of offensive ASAT technologies while giving free rein to defensive
measures for protecting satellites. These provisions are crafted to have minimal adverse impact upon other, non-ASAT space programs. And some may regard this as a weakness rather than a virtue. A critic with imagination, for instance, might argue that the maneuverable Progress resupply vehicles used by the Soviets in their Salyut manned space laboratory program could also be used to ram U.S. satellites, and thus must be banned if an ASAT agreement is to have any value. But this casts the alternatives too starkly. While some residual hazards from other space vehicles are conceivable, it is hard to see them as a compelling reason for abandoning ourselves entirely to unrestrained ASAT competition. Our ability to protect our satellites through some modest defensive measures will obviously be greater if the residual ASAT threat comes only from hardware designed for other purposes, banned from ASAT testing, and pressed into service only in an ad hoc way during conflict. An ASAT agreement should not induce us to be complacent about the survivability of our satellites. But it does offer a promising, indeed the only prospect of reducing the survivability problem to manageable proportions.

There are additional provisions necessary in an ASAT accord. The Soviet Union has already tested an ASAT interceptor, and this asymmetry must be addressed. There are strong voices in the U.S. government, particularly in the military services, which urge delay in any negotiations until the United States has tested a comparable ASAT capability. But advocates of this policy have not proposed a U.S. ASAT system “comparable” to the Soviets’, that is, based upon 1960s technology. The U.S. MHV would be orders of magnitude more advanced. Moreover, a general promise from the United States to negotiate restraints “someday” when we catch up to Soviet capabilities does not offer the Soviets much incentive to restrain their own ASAT program. In the interim, they might well conduct ASAT tests with an improved interceptor or against higher altitude targets, thus multiplying the defensive problems for U.S. satellites.

To get around these difficulties, some have argued for a two-tier ban, prohibiting high altitude tests altogether while temporarily permitting ASAT tests below some threshold (e.g., below 2,000 nm). This would supposedly give the United States a chance to match the current Soviet capability while preventing the Soviets from extending their threat to higher U.S. satellites. But this proposal has technical flaws. ASAT weapons for attacking higher altitude satellites do have more exacting performance requirements, but systems meeting these rigorous standards could be constructed and amply tested
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against targets below the threshold altitude. The practical consequence of a two-tier ban, therefore, would be the same as having no test ban at all.

The preferable course for dealing with the current asymmetry in ASAT capability is to require the Soviets to dismantle their present ASAT system. Getting them to give up a military capability in which they enjoy a current lead will not be easy. Yet the Soviets must certainly anticipate that the United States will engage them in a costly ASAT competition if there is no ASAT ban. Hence, the issue for the Soviets is the same as for the Americans—is it profitable to push arms competition in an arena where neither side can hope to sustain an operational advantage? Soviet willingness to accept limitations and even substantial reductions in strategic arms at SALT (including abstaining from extensive ABM defenses altogether) suggests that the Soviets are open to such arguments.

Compliance with these ASAT restrictions would be verified by the extensive intelligence and space surveillance facilities already available and being acquired by the United States. The Space Detection and Tracking System (SPADATS) currently enables the U.S. to detect, classify, and maintain an updated computer catalog of the identity and orbit of all space objects—currently in excess of 4,000 satellites, pieces of debris, etc. The completion of the GEODSS high-altitude tracking system now under construction will enable SPADATS to monitor objects as small as one foot in diameter in orbits up to 23,000 nm. The array of electronic and optical sensors deployed around and over the Soviet Union permits comparable tracking and classification of Soviet missile and space launches. Together these facilities would verify the ban on ASAT testing, deployment, and use by monitoring for telltale features of an ASAT program. These would vary from weapon to weapon, but any ASAT system would expose itself at many points to detection: e.g., direct-ascent, co-orbital, and space-based laser interceptors would require launch preparations, launching, and maneuvering to altitudes and orbital planes appropriate for ASAT attacks; ground- or space-based lasers or charged particle weapons would involve the rapid discharge of high levels of energy and possible waste products of power generation; in all cases, the damage, intense heating, destruction, or displacement from its orbit of a target could be detectable.

We should consider that the Soviets might press along with a variety of untested ASAT weapons as far as laboratory work could carry them, looking ahead to using untested systems in a conflict; or alternatively that they might conduct covert tests in the guise of other space programs. But neither of
these schemes would be very promising. The more technically sophisticated a weapon is, the more military planners will insist upon full-scale testing. Indeed, if the kill mechanism of the weapon requires high accuracy (as all non-nuclear and laser ASATs would), full-scale testing could be indispensable to confirm whether the design works at all. Given past surprises and catastrophes in test programs of advanced weapons, few military commanders would be satisfied with an ASAT device tested only in the lab or covertly, in pieces, under the cover of other space programs. Moreover, any covert program would have to reckon with the close scrutiny to which Soviet space programs are subjected by U.S. intelligence agencies, with their long experience at sifting the unusual from the familiar. To have confidence in successfully and repeatedly evading such scrutiny, the Soviets would have to know in minute detail what U.S. intelligence looks for and has already learned.

Verifying the treaty provision on interference would require additional monitoring facilities beyond those used to monitor testing. But again these are facilities that the U.S. is acquiring and will continue to improve upon. Precisely because attacks on, or interference with our satellites might be a prelude to other hostile acts, the United States has an interest in knowing when its satellites are being tampered with and by whom, even in the absence of an ASAT agreement. Detectors mounted on satellites for monitoring the nature and source of interference are therefore needed in any case, and they can also serve the purpose of verifying the prohibitions in an ASAT treaty. In fact, an ASAT accord would considerably enhance the usefulness of such detectors in providing warning. Unless deliberate interference with satellites is banned, U.S. satellites would be vulnerable to repeated "spoofing," until a string of such false alarms had dulled our alertness to an actual attack. Under a general ban on interference, any episode of this sort would be a red flag warning us to pay attention.11

The most troublesome verification problem will be posed by the current Soviet ASAT system. The Soviet system uses a number of components and facilities that are shared with other Soviet space missions and weapon systems. The verification issue here is not one of knowing whether the Soviet

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11. All communications and electronic intelligence satellites have some inherent capability for detecting and locating radio-frequency interference. President Carter, in a Presidential Decision Memorandum of May, 1978, has ordered that monitoring and survivability equipment be incorporated in all future U.S. satellite systems. The Defense Department has already begun to implement the President's directive.
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ASAT system proper has been dismantled or is no longer being tested. The question is whether it could be rapidly re-assembled on a jury-rigged basis, using these shared facilities. The United States would have a hedge against this problem, because it would be free to implement survivability measures to make its satellites progressively less vulnerable to the older technology embodied in the Soviet ASAT interceptor. And a prolonged period of not testing the system would also erode Soviet confidence in any such "breakout" schemes. Nonetheless, the thoroughness of Soviet dismantling efforts will be an important issue in public evaluation of any potential ASAT treaty, and Soviet willingness to go the extra mile on this matter will undoubtedly be taken as a hallmark of Soviet earnestness in ASAT arms control.

The Soviets have thus far shown important signs of taking these ASAT issues seriously. As head of their ASAT delegation, the Soviets appointed Oleg N. Khlestov, an authority on space law with service as the Chief of the Treaty and Legal Department in the Ministry of Foreign Affairs. At the first round of talks in Helsinki, the Soviets insisted upon labeling the sessions as no more than "preliminary consultations," reflecting the uncertainties of dealing with a novel topic. But by the second round in Bern (January 23–February 16, 1979), they were willing to make the symbolic transition to "negotiations seeking concrete results." Round three in Vienna (April 23–June 17, 1979) was equally frank and businesslike in the exchange of viewpoints and tentative proposals. The Soviet willingness to suspend their ASAT testing program while the talks were in progress may also be taken as a sign of seriousness. Certainly the United States loses nothing by continuing to explore Soviet interest in ASAT constraints along the lines sketched here. The Defense Department's R&D program on ASAT systems is vigorous enough to protect our other options, should ASAT talks come to naught.

Conclusion

Arms control proposals have not enjoyed a congenial political atmosphere in the United States, even before the Soviet invasion of Afghanistan. As a consequence, advocates of arms control have often been more zealous in asserting the virtues of their proposals than prudence would counsel. That temptation should be resisted in the case of an ASAT agreement. The limitations on ASAT competition outlined here are no panacea; they offer to contrain the threats to U.S. satellites to manageable proportions, not to eliminate each and every threat now and forever. As such, these measures
will be unsatisfying to those who insist that, to be acceptable, arms control accords must be foolproof and comprehensive in averting all threats.

The virtues of an ASAT agreement are best measured by considering its most likely alternative—an unbridled competition in space weaponry. Enthusiasts of the U.S. MHV project may speak with delight, as one White House aide did, of "sweeping the skies clean in twenty-four hours." Yet if the MHV is going to be as nimble as its project managers claim, then clearly the United States ought to be planning now for a transition to lesser dependence upon satellites. For in the absence of agreed restraints, there is nothing to prevent the Soviets from acquiring an ASAT capability comparable to the MHV and doing their own sweeping. Yet instead, the Defense Department has been doing just the opposite, drifting toward greater reliance upon space systems. Advocates of the MHV talk as if this growing dependency in the emerging era of space warfare is a problem manageable through an old solution—the doctrine of deterrence—yet even the Defense Department undersecretary overseeing the MHV project sees no promise in that doctrine.

Constraining threats to U.S. interests through the exercise of enlightened mutual restraint on the acquisition of weapons is a practice that does not come easily to American policymakers. It requires both vision and discipline to break from the habit of believing that any weapon which can be built ought to be built; that any advantage within grasp, however fleeting and costly in the long term, ought to be seized. We will not have acted wisely if, from untempered force of habit, we reject this opportunity to explore limits on arms competition in outer space.