ANTISATELLITES (KILLER SATELLITES)

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ISSUE DEFINITION

According to the U.S. Department of Defense, the Soviet Union has an operational capability to destroy satellites in near Earth orbit by using a type of antisatellite (ASAT) termed a "killer satellite." The United States had an operational ASAT system using ground-based missiles, but it was deactivated in 1975; a new ASAT device using miniature homing vehicles launched from F-15 aircraft is now being developed. Both the United States and the Soviet Union are performing research on laser and particle beam weapons which may ultimately have ASAT applications. During 1978 and 1979, the United States and Soviet Union held ASAT limitation talks, but no further talks have been scheduled. In the fall of 1981, the Soviets introduced a draft treaty at the United Nations to ban weapons from space, although it apparently would not include the ground- or air-based systems now in use or development. The Soviets continue to test their ASAT system, and President Reagan has reaffirmed the U.S. commitment to developing an operational ASAT system.

Should the United States develop an operational ASAT capability, or should the focus instead be on renewing the stalled ASAT limitation talks, or should there be some combination of the two approaches? If the United States pursues an ASAT system, is the current effort related to air-launched missiles sufficient, or should a ground-based option be pursued? Should research into laser and particle beam weapons be accelerated? In the absence of an ASAT limitation treaty, should the United States place more emphasis on means to ensure the survivability of critical military satellites and their associated ground stations and data links?

BACKGROUND AND POLICY ANALYSIS

Numbers in parentheses and designated "#" refer to footnotes. The BACKGROUND portion of the issue brief is divided into the following sections:

INTRODUCTION

Services provided by Earth-orbiting satellites are used by most nations of the world for purposes such as communications, remote sensing, and meteorological observations. In addition, the United States and Soviet Union make extensive use of space-based intelligence systems. Five countries and one international organization (China, India, Japan, Soviet Union, United States, and the European Space Agency) now have indigenous capabilities to

launch satellites into orbit. The United States and Soviet Union are by far the most frequent launchers of satellites, either for their own use or for other countries. (The Soviet Union launches many more satellites per year than the United States -- in 1981 they had 98 launches compared with our 18 -- most for military purposes. This statistic may be somewhat misleading in comparing capabilities, though, because Soviet reconnaissance satellites have considerably shorter operational lifetimes than their U.S. counterparts and must be replaced more frequently.)

Of the approximately 2,200 successful earth-orbital launches conducted by the United States and Soviet Union between 1957 and 1981, approximately two-thirds have been for military purposes such as communications, reconnaissance (including photographic, ocean surveillance, electronic intelligence, early warning, and nuclear explosion detection), meteorology, geodesy, and navigation (#1). At the present time, approximately 70% of U.S. overseas military communications are routed through space (#2). The Soviets also rely heavily on space systems for their military network. The other countries with launch capabilities have indicated interest in using satellites for military purposes, and China and India have already launched satellites thought to be related to development of a reconnaissance capability.

Antisatellite (ASAT) devices are designed to destroy the operational capability of satellites. The United States had an operational ASAT system from approximately 1963 to 1975, and is now developing a new system. According to a 1977 statement by then Secretary of Defense Harold Brown, the Soviet Union has an operational ASAT capability. In 1977, President Carter announced plans to negotiate an ASAT limitation treaty with the Soviet Union; three rounds of talks were held in 1978 and 1979, but further discussions between the two countries have been indefinitely postponed. On Aug. 11, 1981, however, the Soviet Union submitted a draft treaty to the United Nations which would ban all weapons from space.

TYPES OF ANTISATELLITES

The term "antisatellite" (ASAT) is generically used to describe any device that can be used to destroy the operational capability of satellites in Earth orbit. These devices can be based on the ground, in airplanes, or in space. Ground- and air-based systems can involve (1) the direct ascent launch of a missile carrying either a nuclear or non-nuclear warhead; (2) co-orbital devices with explosive warheads; or (3) use of a directed-energy weapon such as a laser beam. Space-based systems could involve explosive "space mines," conventional interceptors, or directed-energy weapons. Variations of these systems might be used against ballistic missiles enroute to their targets as well (see Issue Brief 81003, Antiballistic Missiles).

Nuclear warheads have a relatively large kill radius, which is an advantage in terms of not requiring highly accurate targeting systems, but a disadvantage in that the resulting radiation would affect both friendly and enemy satellites. Another consideration is that the use of nuclear weapons in space is prohibited by treaty, although the United States did have an ASAT capability using nuclear warheads from approximately 1963 to 1975. (Some western experts believe that the Soviet Union has had a similar capability since the early 1960s.)

Non-nuclear warheads for ASATs could involve explosive devices or impact

vehicles. Explosive devices are the orbital type now being tested by the Soviet Union. The interceptor must maneuver close enough to the target so that shrapnel produced by the interceptor's explosion will destroy the target's operating systems. The interceptor could be launched to attack a satellite at a specific time, or it could be placed in orbit in a dormant state and activated when needed (a "space mine"). Impact vehicles are the type being developed by the United States. In this system, highly accurate targeting mechanisms are required to bring the interceptor into a direct collision with the target satellite.

Directed-energy weapons (lasers or particle beams), which would also require highly accurate targeting mechanisms, are now being researched in both the United States and Soviet Union. Some western analysts believe that the Soviets already have an operational ground-based laser ASAT system. The United States is currently conducting airborne tests of a laser system, the technology for which may have ASAT applications in the future. Lasers can be used to "blind" the sensors on a satellite, or if sufficient power is available, to destroy the satellite through heating. Particle beams (charged or neutral atomic particles -- electrons, protons, or neutrons) could destroy a satellite through heating or by disrupting its electronics.

A major advantage of directed-energy weapons is that their destructive energy travels at the speed of light, denying the target sufficient time for any possible evasive maneuvers. Also, several targets could be engaged consecutively in very short periods of time. The major disadvantage is that the systems require great amounts of energy and large associated structures, making them difficult and expensive to construct in space. The alternative, basing laser systems on Earth and aiming them up into space, presents difficulties because the Earth's atmosphere tends to disperse the beam, and only a small fraction of energy reaches the target. For particle beam weapons, Earth-basing would present the possibility of the path being deflected by the Earth's magnetic lines.

Laser weapons have been tested within the atmosphere already, and supporters of such efforts maintain that space-based lasers for ASAT purposes might be available within this decade, although critics suggest they may be 20-30 years in the future. Particle beam weapon technology is generally considered to be much further behind lasers.

SOVIET AND U.S. ASAT PROGRAMS

Soviet Union

Ground-Based Systems

The Soviet Union may have several different ASAT systems, but only one, a ground-based co-orbital system, has been publicly termed "operational" by the U.S. Department of Defense. Rumors of a direct-ascent nuclear ASAT and of a ground-based laser have never been confirmed by either U.S. or Soviet officials.

Co-orbital. The system attracting the most attention is a ground-based, explosive type of ASAT system in which an interceptor is launched by a variant of the SS-9/Scarp launch vehicle. The interceptor's orbit can be elliptical so that it intercepts the target either at apogee (highest altitude) or perigee (lowest altitude); co-planar (co-orbiting) with the

target; or variable ("popping-up" from a lower orbit using on-board propulsion) (#3). Once within range, the interceptor maneuvers very close to the target satellite and explodes, impacting the target with shrapnel.

The Soviet Union has conducted 20 tests of this antisatellite system (#4). From October 1968 to December 1971, seven tests were made. A four-year, three-month hiatus followed, with tests resuming again in February 1976. What prompted the resumption in ASAT testing is unknown, although some western analysts have speculated that it might have been meant as a warning to the Chinese, who launched their first reconnaissance satellite in September 1975. (The test also came within a year of the deactivation of the U.S. ASAT system.) Nine more Soviet ASAT tests were made from 1976-1978, at which time testing was again suspended during the ASAT limitation talks between the Soviet Union and United States (see below). In April 1980, after it became clear that the United States would postpone both ratification of the SALT II treaty and further ASAT limitation talks, testing was resumed, with one test conducted that month. Two more tests were made in 1981.

An ASAT target was launched on June 6, 1982, the day before the opening of the U.N. Second Special Session on Disarmament. The interceptor was launched on June 18, 1982; press reports were mixed as to whether the test was successful or not.

Assessing how many of the tests have been "successful" is difficult, since the intentions of the Soviets are not known. According to the media, only one target has actually been destroyed by an ASAT (the March 1981 test), but this has been disputed by other western observers. In all other cases, apparently the interceptor has either been commanded to reenter the atmosphere, or it has been exploded in orbit after moving away from the target. Some western analysts have even suggested that there are two ASAT programs: one to inspect a target but not destroy it, and the other to serve the destruct function. One possible method of measuring success is to consider a test in which the interceptor maneuvers to within 1 kilometer of the target as being sufficient to have inspected the target, or to have destroyed it if that action had been desired. Using this measure and media accounts of the tests, 13 of the 20 Soviet ASAT tests have been successful.

This system so far is limited to altitudes and orbital inclinations achievable with the SS-9 rocket and its associated launch pads. All ASAT interceptors to date have operated between 62 degrees and 66 degrees inclination and have been launched from the Soviet facility at Tyuratam. The highest altitude reached in a Soviet ASAT test is approximately 2,300 kilometers (1,400 miles) (#5), within the range used by U.S. military reconnaissance, meteorology, and Transit navigational satellites. The U.S. space shuttle also flies within this range. Other U.S. military satellites (the DSCS and FLTSATCOM communication satellites and early-warning satellites, for example) are placed in geosynchronous orbit at 35,800 kilometers (22,300 miles) over the equator. Still others, such as the NAVSTAR navigation satellites, are placed at altitudes between these ranges (NAVSTAR operates at 20,000 kilometers). The Soviets have not yet demonstrated a capability to destroy these higher altitude satellites. Conceivably, much larger launch vehicles could be used to reach higher altitudes, although this capability has not been demonstrated.

Direct-Ascent. In a July 16, 1962, interview with American newspaper editors, Soviet Premier Nikita Khruschev stated that the Soviet Union had a missile that could "hit a fly in outer space." Some western experts interpreted that statement as indicating a Soviet ASAT capability and

speculated that it could refer to a Galosh missile armed with a nuclear warhead (similar to the U.S. ground-based ASAT system discussed below), possibly based near Moscow or at the Sary Shagan development facility near the Chinese border. The existence of such an ASAT system and its current status cannot be confirmed from the public record.

Directed-Energy. Rumors have also persisted for several years that the Soviets have an operational ground-based ASAT system using a laser to blind the sensors on enemy satellites. These reports have never been confirmed either by the Soviets or by official U.S. sources. In 1975, for example, an American early warning satellite and two other Air Force satellites were "illuminated" by a strong infrared radiation source from the Soviet Union. At that time, the question arose as to whether this was a test of a ground-based laser device, but the U.S. Department of Defense (DOD) later stated that the effect was caused by a high intensity fire resulting from a rupture in a natural gas pipeline. DOD officials have estimated that the Soviets are spending three to five times more than the United States on high energy laser research.

Space-based systems

In its Oct. 26, 1981 issue, the magazine Aviation Week and Space Technology reported that the "Soviet Union is operating in low earth orbit an antisatellite battle station equipped with clusters of infrared-homing guided interceptors that could destroy multiple U.S. spacecraft." In subsequent issues, Aviation Week claimed that the "battle station" was the satellite Kosmos 1267, which is docked with the space station Salyut 6. The Soviets had previously identified this satellite as a test vehicle related to constructing modular space stations (as part of their goal of establishing a permanent earth-orbiting space station). The U.S. Department of Defense had no comment on the Aviation Week allegations.

Speculation has existed for several years that the Soviet Union is developing space-based laser and particle beam weapons. Aviation Week and Space Technology reported in October 1978 (see REFERENCES) that the Soviets had conducted eight successful electron beam atmospheric propagation experiments using unmanned Cosmos spacecraft, the manned Soyuz spacecraft, and the manned Salyut space station. There have also been reports that space-based lasers have been tested. None of these reports has been openly confirmed by either Soviet or official U.S. sources, although the head of the directed-energy office at the U.S. Defense Advanced Research Projects Agency (DARPA), Douglas Tanimoto, has commented that the Soviets "appear to be undertaking major activities to explore the feasibility of developing particle-beam weapons for various military applications. Apparently the Soviet leadership is giving high-level policy attention to the rapid development of directed-energy technology...."

In March 1982, portions of a classified DOD assessment of the Soviet laser effort were inadvertently read into the record by a Member of Congress at hearings. That part of the report suggested that DOD believes the Soviets are capable of placing a space-based laser in orbit in 1983. After further clarification by Undersecretary of Defense for Research and Engineering, Dr. Richard DeLauer, it appears that 1983 is the bottom range of possibilities which DOD considers likely. DeLauer later stated that he believes the Soviets have about a 5-year lead in space-based laser technology over the United States, and that since we could place such a weapon in orbit possibly in 10 years, then the Soviets may do so 5 years from now.

United States

Ground-Based System

Although several systems were discussed in the early 1960's, the only operational ground-based ASAT system developed by the United States used nuclear warheads launched by Air Force Thor missiles from Johnston Island and Army Nike-Zeus missiles from Kwajalein Atoll, both in the Pacific. Tests of the Army system were conducted beginning in May 1963, but the system was deactivated in 1964. The Air Force tested its system beginning in May 1964 and it remained operational until 1975 (#6).

Air-Based System

A new ASAT system is now being developed by DOD in which a miniature homing vehicle (MHV) (#7) would be launched from a two-stage rocket (consisting of a short-range attack missile (SRAM) and an Altair stage) carried by an F-15 aircraft (#8). An inertial guidance system located in the Altair stage would guide the device to the proper location in space. Using infrared sensors, the MHV would locate the target satellite, after which it would separate from the Altair, track the target, and proceed to impact the target with destructive force. This air-launched approach would provide considerably greater flexibility than the system now used by the Soviet Union. Although it is being designed for use against satellites in low Earth orbit, the MHV system could be adapted for use against satellites in geosynchronous orbit as well (in which case it would probably be launched by a ground-based rocket). The prime target for a U.S. ASAT system has been reported to be Soviet ocean surveillance satellites (#9).

In April 1982, Dr. Robert Cooper, Director of DARPA, announced that air-based tests of the system were planned for later in 1982. He also stated that 15 aircraft would be equipped for the ASAT role.

For FY82, DOD was provided with the $148.8 million it requested for ASAT development. The FY83 appropriation for this activity is $218 million.

Space-Based System

From 1960-1962, the United States had a program to develop a satellite capable of rendezvousing with enemy satellites in Earth orbit. Called SAINT, the program never reached the flight test stage. (The Aeronautics and Space Reports of the President for the time period involved here indicate that the acronym SAINT stood for Satellite Inspector. Other reference sources state that it meant Satellite Interceptor, or Satellite Inspection and Negation.)

The United States now has an active program for developing the technology for space laser weapons that could have ASAT applications. Tests of an airborne gas dynamic laser for use against tactical missiles have been conducted by the Air Force. As stated in 1981 by then Air Force Secretary Hans Mark: "These efforts will lead naturally to the solution of problems that will be faced when we are ready to put high-energy lasers in space."

DARPA has a program for developing space-based laser technology which involves three technologies, and is referred to as the "space laser triad" (#11). The first technology, for acquisition, pointing and tracking of the target, is code-named Talon Gold; it will be tested in 1985 aboard the space shuttle as part of the Air Force Space Test Program. The Talon Gold

experiment will test a low power laser against both high-altitude aircraft and space targets (#12). The second technology area, high efficiency infrared chemical lasers, is being developed under the name Project Alpha; it is a ground test program to establish the feasibility of a laser suitable for use in space. Chemical lasers are considered better than gas dynamic lasers for space purposes because they are smaller, require low temperatures and a vacuum (the conditions in space) for operation, and the toxic wastes would not present a disposal problem. Alpha was originally designed to produce 5 megawatts of power, but recent developments may enable doubling that power level (#13). The third technology, mirror and beam control optics, is being studied under the name Lode (large optics demonstration experiment); it is designed to establish the feasibility of large aperture beam control in space. DARPA's high energy laser program is funded at about $100 million per year.

The individual services (Army, Air Force, and Navy) each have their own high energy laser programs, and, together with DARPA, have spent a total of approximately $1.6 billion on high energy laser research. Estimates vary as to when the United States might have space-based lasers operational, with advocates saying they could be available within this decade and critics suggesting it may be 20 to 30 years.

During consideration of the FY83 request for space-based laser research, a debate emerged over whether to continue with the existing research program for developing chemical lasers, or to proceed with a short wavelength laser technology effort. The latter is expected to take longer to develop, but would be a more effective weapon. In the FY83 DOD authorization bill, the House Armed Services Committee deleted all funding for the chemical laser program and added $50 million for short wavelength lasers (H.Rept. 97-482). The Senate (S.Rept. 97-330) supported the existing program, however. In conference, agreement was reached whereby both types of research were supported. The $41 million that had been requested by the Air Force was denied, but all the DARPA funding was approved. The conferees added $20 million for short wavelength laser technology to the $27.6 million that had been requested. The Senate had added language directing DOD to produce an on-orbit laser weapons system as quickly as technology would allow, but this was removed during conference. The bill was enacted on Sept. 8, 1982 (P.L. 97-252). The FY83 DOD appropriation bill was included in the FY83 Further Continuing Appropriation Act (P.L. 97-377), and actions in it were consistent with the authorization bill (although the Senate had tried to restore some of the Air Force funding that had been deleted).

The General Accounting Office released a report on DOD's space laser program, concluding that it should be accelerated. Although the report itself is classified, a four-page unclassified digest is available (see REFERENCES).

The United States began particle beam research in 1958 under a DARPA program called SEESAW. Although SEESAW was terminated in 1972, the Navy established a particle beam research program in 1974 called Chair Heritage; it was transferred to DARPA in 1979. A year later, the Army's program in particle beam research, called Sipapu or White Horse, was also transferred to DARPA. It is generally agreed that particle beam development is many years behind that of lasers.

For FY83, Congress authorized and appropriated $33 million for particle beam research, an increase of $2 million over the request.

Space Shuttle Role in ASAT Programs

The Soviet Union has indicated that it considers the U.S. space shuttle (see issue brief 81175, Space Shuttle) an ASAT-related vehicle on the basis that it can maneuver close to satellites, friendly or enemy. According to the Soviets, the shuttle's Remote Manipulator System (RMS), designed to deploy and/or retrieve satellites in orbit, could be used either to destroy Soviet satellites directly or emplace destructive mechanisms on them. Similar charges could be raised about the remotely controlled Teleoperator Retrieval System. The shuttle will be used to test systems which might have ASAT applications (such as Talon Gold), and could be used to carry components of space-based weapons into orbit for assembly, but the shuttle is not a weapon itself.

Conversely, some concern has been expressed by U.S. sources about the vulnerability of the space shuttle to a potential Soviet ASAT attack, raising the possibility that the shuttle may someday be equipped with a defensive laser system (which could be used for offensive purposes as well).

Reagan Administration Interest in ASATs

The Reagan Administration established an Intergovernmental Group (IG) within the Executive Branch to review and study ASAT policy. The IG is co-chaired by Richard Burt of the State Department and Richard Perle of DOD. The Arms Control and Disarmament Agency (ACDA), the Joint Chiefs of Staff, the National Security Council, the National Aeronautics and Space Administration, the Office of Science and Technology Policy, and the Central Inteligence Agency are also represented on the IG.

The United States has developed an eight-point interim declaratory policy on arms control in space: (1) while the United States has supported attempts to control arms in space, it is deeply concerned about the scope of the Soviet offensive program in space; (2) space systems are national property and have the right of free passage and operation in space without interference; (3) the United States will pursue policies in space which protect and enhance U.S. national security interests; (4) U.S. use of space for military purposes has been non-aggressive, and it is well known and accepted that satellites contribute to monitoring arms agreements and hence to the maintenance of peace and stability in the world; (5) U.S. military activities in space have exhibited restraint, but the United States must respond to the Soviet military threat in space -- our development of an ASAT system is in part a response to that threat; (6) we must not count on immediate progress in the area of space arms control because the issues are complex and present difficult obstacles to international negotiations; (7) arms control in space is inseparable from broad arms control issues; and (8) the U.S. Government is now studying the issue of space arms control policy, and this study must be completed before questions concerning U.S. intentions to resume ASAT negotiations can be answered -- meanwhile, the United States wants to emphasize the hypocrisy of the Soviet position in labeling the space shuttle an ASAT while maintaining the world's only operational ASAT system.

President Reagan reaffirmed the U.S. commitment to pursue an operational ASAT system in his Oct. 2, 1982 pronouncement on U.S. strategic defense systems (including the M-X missile and the B-1 bomber). In his space policy directive issued on July 4, 1982, the President further emphasized his commitment to the ASAT program "with operational deployment as a goal." The policy statement also states that the primary purpose of the ASAT system is to deter threats to space systems and to "deny any adversary the use of

space-based systems that provide support to hostile military forces."

In August 1982, DOD released an unclassified fact sheet (based on a classified study) outlining its space policy: Regarding ASATs, the policy directs the continued development of an ASAT "within such limits imposed by international law," adding that DOD planning "emphasizes adherence to the existing international legal regime which pertains to space" and that DOD would "consider verifiable and equitable arms control measures that would ban or otherwise limit the deployment of specific weapons systems should those measures be compatible with United States national security."

HIGH FRONTIER STUDY

In March 1982, the High Frontier Project of the Heritage Foundation, a conservative think-tank, released a report entitled "High Frontier: A New National Strategy." The report, prepared under the direction of Lt. Gen. Daniel Graham (Ret.), outlines a long term national strategy for space activities, military and civil. Among the recommendations is a proposal to develop a space-based ballistic missile defense/antisatellite system composed of 432 satellites, each armed with 40-50 homing interceptors. The report also suggests that sometime in the future, the system might involve use of space-based lasers, but emphasized that an effective system can be built with today's technology.

ASAT LIMITATION TALKS

The United States relies heavily on space systems for command, control, and communication; approximately 70% of U.S. overseas military communications are now routed through space. The military uses satellites for reconnaissance, meteorology, geodesy, and navigation. The Soviet Union also relies heavily on space systems for military purposes. Thus, it may be mututally advantageous to have an agreement limiting devices that could destroy these space systems.

Several existing treaties affect operations in space, but none prohibits development or use of non-nuclear ASATs. The 1963 Limited Test Ban Treaty and the 1967 Outer Space Treaty prohibit placing nuclear weapons or any other weapons of mass destruction in space, and the 1972 SALT I treaty (Treaty on the Limitation of Anti-Ballistic Missile Systems) prohibits interference with "national technical means of verification," a phrase commonly thought to refer to reconnaissance satellites. Other types of satellites probably would not be protected under that treaty, however. (Attacking another country's satellites might well signal the beginning of a major war, however, which would render treaty provisions meaningless.)

At a Mar. 9, 1977, press conference, President Carter announced that he had approached the Soviet Union about the possibility of forgoing "the opportunity to arm satellite bodies and also to forgo the opportunity to destroy observation satellites." In June 1978, the White House issued a fact sheet summarizing the unclassified portions of President Carter's policy directive on space (PD-37). Regarding ASATs, the fact sheet emphasized that the two countries were at a point where "mututal restraint" could prevent "an unhealthy arms competition in space." The fact sheet noted, however, that in the absence of an agreement limiting ASAT activities, "the United States will

vigorously pursue development of its own capabilities."

Three rounds of ASAT limitation talks were held: June 8-15, 1978, in Helsinki; Jan. 23-Feb. 16, 1979, in Bern; and Apr. 23-June 17, 1979, in Vienna. Further talks were planned, but following the Soviet invasion of Afghanistan in December 1979, the climate for arms control talks chilled and no further meetings have been scheduled.

U.S. objectives at the talks included developing a treaty forcing the cessation of ASAT tests, requiring the Sovet Union to dismantle its system, and providing for verification (#14). How successful the talks were in achieving these objectives is difficult to assess. The Soviets, for example, claimed that the U.S. space shuttle is an ASAT and therefore should be discussed in the context of the limitation talks. As noted earlier, the shuttle may be used to carry experiments with eventual application to the development of ASATs, but is not itself a weapon, and the U.S. rejected the Soviet position.

Another obstacle in achieving an agreement may be Soviet concern over the Chinese space program. Eight Chinese satellites were launched from 1970 to 1978, of which four were reportedly related to reconnaissance. Some analysts have speculated that the 1976 resumption of Soviet ASAT testing was meant as a warning to the Chinese, who launched their first reconnaissance satellite in September 1975.

An April 1981 statement by Soviet President Brezhnev was viewed in some quarters as signalling a desire to return to the ASAT talks. On Apr. 17, three days after the successful completion of the first U.S. space shuttle flight, Brezhnev presented awards to two cosmonauts returning from space and stated: "May the shoreless cosmic ocean be pure and free of weapons of any kind. We stand for joint efforts to reach a great and humanitarian aim -- to preclude the militarization of outer space."

Four months later, on Aug. 11, 1981, the Soviet Union submitted to the United Nations a draft treaty banning the stationing of weapons in space. In a letter to the Secretary-General of the U.N., Soviet Foreign Minister Gromyko noted that existing international agreements "do not rule out the possibility of the development in outer space of such types of weapons which cannot be defined as weapons of mass annihilation." According to Gromyko, "the risk of militarisation of outer space is maintained and recently has been increased." This is an apparent reference to the April 1981 test flight of the U.S. space shuttle. The draft treaty refers to banning "piloted space vehicles of multiple use," another apparent reference to the shuttle. The Soviet Union requested that the draft treaty be placed on the agenda of the 36th session of the U.N. General Assembly in the fall of 1981. The draft was sent to the First Committee from the General Assembly. Eleven nations (led by the Soviet Union) formally introduced a resolution in the First Committee on Oct. 21 providing for consideration of the treaty. The First Committee subsequently referred the matter to the Committee on Disarmament. Concurrently at the U.N., 15 nations (led by Italy) introduced a proposal concerning prevention of an arms race in space by negotiating effective and verifiable agreements, including prohibition of ASATs. This proposal was also referred to the Committee on Disarmament by the First Committee.

President Reagan's position on ASAT limitation talks is reflected in the August 1982 DOD statement on space policy which includes the comment that the policy provides guidance to DOD "to consider verifiable and equitable arms control measures" to ban or limit the deployment of specific weapons systems.

In 1981, Senator Pressler introduced a resolution (S.Res. 129) calling for a resumption of ASAT limitation talks. The resolution lists objectives which are very similar to those promulgated by the Carter Administration. Hearings were held in the Senate Foreign Relations Committee on Sept. 20, 1982. Following the hearings, Senator Pressler introduced a resolution (S.Exec.Res. 7) calling for negotiation of a protocol to the 1967 Outer Space Treaty providing for a complete and verifiable ban on the development, testing, deployment, or use of antisatellite weapons. The resolution was referred to the Senate Foreign Relations Committee.

On Sept. 23, 1982, Representative Moakley and 29 co-sponsors introduced H.J.Res. 607 calling for immediate negotiations for a ban on weapons of any kind in space. The resolution was referred to the House Foreign Affairs Committee. Senator Matsunaga introduced a resolution on Sept. 29 (S.Res. 488) calling for talks with the Soviet Union and other countries with a space capability concerning the possibility of establishing a weapons-free international space station as an alternative to creating competing armed space stations. The resolution was referred to the Senate Foreign Relations Committee.

SURVIVABILITY OF CRITICAL U.S. MILITARY SATELLITE SYSTEMS

In the absence of an ASAT limitation agreement, increasing attention has been given to the issue of satellite survivability -- methods of increasing the chances of critical U.S. military satellite systems surviving attacks by Soviet ASATs.

Several methods to increase survivability exist. For example, most U.S. military satellites are powered by solar panels, which would be vulnerable to a shrapnel attack. Using radioisotope thermal generators (RTGs) instead of solar cells could alleviate this problem, since RTGs can be located inside the spacecraft rather than protruding from the outside. An ASAT would have to have a highly accurate targeting system in order to impact the satellite itself, rather than just exploding near-by.

Another method of increasing survivability now being pursued is to provide critical satellites with a maneuvering capability in order to move away from a possible interceptor (#15). Adequate warning time must be provided for the satellite to escape, and the Air Force is acquiring new space surveillance systems to better monitor activities of satellites in orbit. The ground-based electro-optical deep space surveillance system (GEODSS) is now being procured and will be operational in the early 1980s. Ground-based radar systems now in use are being upgraded as well. Technology for a space-based surveillance network, which might consist of satellites both in geosynchronous orbit and low Earth orbit, is also being studied.

Another approach to survivability is to store spare satellites in orbit (possibly at very high altitudes -- perhaps 115,000 kilometers). Specially designed so that they would not be detected by radar systems, and maintained in a powered down mode so infrared sensors could not detect them, these satellites would be activated in the event primary systems were destroyed. Decoy satellites could also be placed in orbit.

Still other options include hardening the satellites against certain types of radiation, equipping satellites with defensive systems, or constructing a

space-based laser defense system to protect satellites.

A related problem concerns determining when a satellite has in fact been attacked. A satellite can cease operation for many reasons, and confirming that it has been attacked by an ASAT is very difficult. The United States is now placing sensors on board some satellites which will be able to determine whether they have been attacked (#16). Advanced space surveillance systems might also reduce this problem by more closely monitoring the location and maneuvers of non-U.S. satellites.

Survivability of the ground stations and data links required for command and control of satellites is another area being studied by DOD.

The costs associated with techniques for increasing survivability can be high, and decisions must still be made as to which U.S. satellites are critical enough to be equipped with survivability features, as well as determining what level of conflict the satellites should be designed to survive.

ISSUES FOR CONGRESSIONAL CONSIDERATION

The ASAT limitation talks are now stalled, with no further sessions scheduled. Four resolutions have been introduced in the 98th Congress relating to negotiation of a treaty to ban space weapons, but no action has been taken. In the absence of a ban on ASAT weapons, a number of questions arise which may be of concern to the Congress.

1. U.S. ASAT Program

What is U.S. policy concerning the circumstances under which a U.S. ASAT system would be used? Should the decision to develop an operational U.S. ASAT system be based purely on whether the United States needs such a capability, regardless of the implications of a "space arms race"? If a clear need for such a system can be demonstrated, should the U.S. program be accelerated? What is the earliest possible date that the United States could have an operational ASAT?

2. ASAT Limitation Treaty

If the United States still wishes to negotiate an ASAT limitation treaty, should we discontinue the current U.S. ASAT program using F-15 launched miniature homing vehicles (MHVs) to demonstrate our good faith towards achieving such a treaty? Alternatively, should the MHV program be accelerated, thereby providing more negotiating leverage when and if the ASAT talks resume, recognizing that if we develop a superior ASAT, the Soviets might be less willing to negotiate?

How could an ASAT treaty be made verifiable? For example, if the Soviets agree to dismantle their ASAT system and allow U.S. inspectors to confirm that it has been dismantled, how could the United States determine how quickly it might be reassembled? Could the U.S. ASAT capability at Johnston Island be reactivated, and if so, how quickly? Would the ability to reactivate the U.S. system counteract concerns about potential reactivation of the Soviet system? Should the United States develop a ground-based ASAT

system?

What are the implications of the Soviet draft treaty that has been submitted to the United Nations banning weapons from space? Will this action by the Soviets preclude bilateral talks with the United States?

3. Directed Energy Programs

If a decision is made to proceed with development of advanced ASATS, should the program for directed-energy weapons be accelerated? Can additional funding be put to constructive use in these programs, or is the pace of the program dictated by technological developments? The charge has been made that part of the problem in speeding up the space-based laser program is lack of enthusiasm within DOD and industry. If this is an accurate assessment, can that attitude be changed? If not, would additional funding be wasted?

Is the overall management of these programs adequate at the present time, or should a new coordinating mechanism be established in the Executive Branch as proposed by Senator Heflin? Should the high energy laser programs of the Army, Air Force, Navy, and DARPA be consolidated, as has been done with particle beam research?

4. Satellite Survivability

Is adequate funding being provided in the areas of satellite survivability, such as hardening satellites to laser radiation, providing them with the capability to maneuver, placing redundant systems in orbit, etc.? Are decisions on which satellites are "critical" progressing as quickly as possible? Which is the most cost effective of the survivability options? Are the programs for improving space surveillance moving as rapidly as possible? Is additional funding needed? Would these systems be required with or without an ASAT limitation treaty?

5. Space Shuttle

In the absence of an ASAT ban, should the space shuttle be equipped with defensive weapons to counter a Soviet ASAT attack, or is its maneuverability considered sufficient to escape a Soviet interceptor? Should the United States be willing to ban all ASAT-related experiments from the space shuttle to increase the likelihood of negotiating an ASAT limitation treaty? Should we require the Soviets to ban all ASAT-related experiments from their Soyuz/Salyut program in return?

FOOTNOTES

1. Robinson, Clarence A. Space-Based Systems Stressed. Aviation Week and Space Technology, Mar. 3, 1980: 25.

2. Ibid.

3. U.S. Funds Killer Satellite Effort. Aviation Week and Space Technology, Feb. 6, 1978: 19.

4. Information on Soviet ASAT Test compiled from following sources: (1) Soviets Test Killer Spacecraft. Aviation Week and Space Technology, Oct. 30, 1978: 17. (2) Covault, Craig. New Soviet Antisatellite Mission Boosts Backing for U.S. Tests. Aviation Week and Space Technology, Apr. 28, 1980: 20. (3) Soviet ASAT Mission Judged Close Enough For a Kill. Aerospace Daily, Feb. 4, 1981: 172. (4) Soviets Test Another Killer Satellite. Aviation Week and Space Technology, Mar. 23, 1981: 22-23. (5) U.S. Congress. Senate. Committee on Aeronautical and Space Sciences. Soviet Space Programs 1966-1970. Committee Print. Washington, U.S. Govt. Print. Off., 1971; (6) U.S. Congress. Senate. Committee on Aeronautical and Space Sciences. Soviet Space Programs 1971-1975. Committee Print. Washington, U.S. Govt. Print. Off., 1976. (7) Sheldon, Charles. United States and Soviet Progress in Space: Summary Data Through 1980 and a Forward Look. CRS Report No. 81-27 S., Jan. 15, 1981.

5. Ibid.

6. Information on U.S. ground-based ASAT system compiled from the following sources: (1) Anti-Satellite Polaris Being Developed. Aviation Week and Space Technology, Sept. 28, 1964: 18-19. (2) Satellite Killers. Aviation Week and Space Technology, June 21, 1976: 13. (3) Antisatellite Effort Decision Awaited. Aviation Week and Space Technology, Jan. 24, 1977: 19. (4) Remarks of President Lyndon Johnson in Sacramento, California, Sept. 17, 1964 (Public Papers of the Presidents, Book II).

7. Perry Sees Technology Shifts to Soviets. Aerospace Daily, Mar. 4, 1981: 18.

8. Covault, Craig. Antisatellite Weapon Design Advances. Aviation Week and Space Technology, June 16, 1980: 243-7.

9. Priorities Set for Antisatellite System. Aviation Week and Space Technology, Sept. 3, 1979: 57.

10. Robinson, Clarence A., Jr. Strategic Defense Draws Strong Focus. Aviation Week and Space Technology, Apr. 13, 1981: 70.

11. Ulsamer, Edgar. Advanced Technology in Space. Air Force Magazine, June 1981: 99.

12. Defense Advanced Research Projects Agency plans to launch the Talon Gold laser pointing and tracking payload on the space shuttle in 1985. Aviation Week and Space Technology, Apr. 27, 1981: 23.

13. Senate Directs Air Force to Formulate Laser Plan. Aviation Week and Space Technology, May 25, 1981: 53.

14. Chinese Space Gains Hamper Antisatellite

Limitation Treaty. Aviation Week and Space Technology, July 9, 1979: 18-19.

15. Ulsamer, op. cit., p. 101.

16. Priorities Set for Antisatellite System, op. cit.

LEGISLATION

97th Congress

P.L. 97-252, S. 2248

Authorizes appropriations to the Department of Defense for procurement, research, development, test, and evaluation, and for other purposes, for FY83. Reported from House Armed Services Committee on Apr. 13 (H.Rept. 97-482); reported from Senate Armed Services Committee on Apr. 13, 1982 (S.Rept. 97-330). Passed Senate on May 13, 1982; House passed it on July 29. Conference report was filed on Aug. 16 (H.Rept. 97-479), and passed the Senate on Aug. 17 and the House on Aug. 18. Signed into law on Sept. 8.

P.L. 97-276, H.J.Res. 599

FY83 Continuing Appropriation Act. Includes funding for DOD activities through Dec. 17, 1982. Reported from House Appropriations Committee Sept. 16 (H.Rept. 97-834); passed House Sept. 22. Reported from Senate Appropriations Committee Sept. 23 (S.Rept. 97-581); passed Senate Sept. 29. Conference report was filed Sept. 30 (H.Rept. 97-914) and passed House and Senate Oct. 1. Signed into law Oct. 2, 1982.

P.L. 97-377, H.J.Res. 631

FY83 Further Continuing Appropriations. Includes funding for DOD activities through Sept. 30, 1983. Reported from House Appropriations Dec. 10 (H.Rept. 97-959); passed House Dec. 14. Reported from Senate Appropriations Dec. 15 (no written report); passed Senate Dec. 19. Reported from conference Dec. 20 (H.Rept. 97-980); passed House and Senate Dec. 20. Signed into law Dec. 21, 1982.

98th Congress

H.J.Res. 87 (Kastenmeier)

Joint resolution calling for a verifiable comprehensive treaty banning space weapons. Introduced Jan. 25, 1983; referred to Committee on Foreign Affairs.

H.J.Res. 120 (Moakley et al.)

Joint resolution calling for immediate negotiations for a ban on weapons of any kind in space. Introduced Feb. 2, 1983; referred to Committee on Foreign Affairs.

S.Con.Res. 16 (Matsunaga and Pell)

Resolution expressing the sense of the Senate that the President renew the 1972-1977 agreement with the Soviet Union for cooperation in space

activities, and to initiate talks with the Soviet Union and other interested governments on the opportunities for cooperative ventures in space as an alternative to an arms race in space. Introduced Mar. 10, 1983; referred to Committee on Foreign Relations.

S.J.Res. 28 (Tsongas et al.)

Joint resolution calling for immediate negotiations for a ban on weapons of any kind in space. Introduced Feb. 3, 1983; referred to Committee on Foreign Relations.

S.Res. 43 (Pressler et al.)

Resolution expressing the sense of the Senate that the President should negotiate a treaty with the Soviet Union banning antisatellite weapons as a first step toward prohibiting all space-based and space-directed weapons. Introduced Feb. 2, 1983; referred to Committee on Foreign Relations.

HEARINGS

U.S. Congress. Senate. Committee on Commerce, Science, and Transportation. Subcommittee on Science, Technology, and Space. Laser technology development and applications. Hearings, 96th Congress, 1st and 2nd sessions. Dec. 12 and 14, 1979; Jan. 8 and 12, 1980. Washington, U.S. Govt. Print. Off., 1980.

U.S. Congress. Senate. Committee on Foreign Relations. Subcommittee on Arms Control, Oceans, International Operations and Environment. Arms control and the militarization of space. Hearings, 97th Congress, 2d session. Sept. 20, 1982. Washington, U.S. Govt. Print. Off., 1982.

REPORTS AND CONGRESSIONAL DOCUMENTS

U.S. Congress. House. Committee on Armed Services. Department of Defense authorization act, 1983; report to accompany H.R. 6030. April 13, 1982. Washington, U.S. Govt. Print. Off., 1982. (97th Congress, 2d session. House. Report No. 97-482)

U.S. Congress. House. Committee on Foreign Affairs and Senate Committee on Foreign Relations. Fiscal year 1983 arms control impact statements. Washington, U.S. Govt. Print. Off., March 1982.
At head of title: 97th Congress, 2d session. Joint committee print.

U.S. Congress. Senate. Committee on Armed Services. Department of Defense authorization for appropriations for fiscal year 1983 and supplemental authorization for appropriations for fiscal year 1982; report to accompany S. 2248. Apr. 13, 1982. Washington, U.S. Govt. Print. Off., 1982. (97th Congress, 2d session. Senate. Report No. 97-330)

U.S. Congress. Senate. Committee on Commerce, Science, and

Transportation. Laser research and applications. Washington, U.S. Govt. Print. Off., 1980.
At head of title: 97th Congress, 2nd session.
Committee print.

CHRONOLOGY OF EVENTS

03/10/83 -- Senators Matsunaga and Pell introduced S.Con.Res. 16 expressing the sense of the Senate that the President renew the space cooperation agreement with the Soviet Union and explore opportunities for cooperative ventures in space as an alternative to an arms race in space.

02/03/83 -- Senator Tsongas and two co-sponsors introduced S.J.Res. 28, calling for negotiations for a ban on weapons of any kind in space.

02/02/83 -- Representative Moakley and 76 co-sponsors introduced H.J.Res. 120, calling for immediate negotiations to ban weapons of any kind in space.

-- Senator Pressler and 6 co-sponsors introduced S.Res. 43, expressing the sense of the Senate that the President should seek to negotiate an agreement with the Soviet Union banning antisatellite weapons.

01/25/83 -- Representative Kastenmeier introduced H.J.Res. 87, calling for a verifiable comprehensive ban on space weapons.

09/29/82 -- Senator Matsunaga introduced S.Res. 488, calling for talks aimed at establishing an international weapons-free space station as an alternative to the arms race in space.

09/24/82 -- Senator Pressler introduced S.Exec.Res. 7, calling for negotiation of a protocol to the 1967 Outer Space Treaty to provide a complete and verifiable ban on antisatellite weapons.

09/23/82 -- Representative Moakley and 29 co-sponsors introduced H.J.Res. 607 calling for immediate negotiations for a ban on weapons of any kind in space.

09/20/82 -- Senate Foreign Relations Committee held hearings on weapons in space.

07/04/82 -- President Reagan announced his new space policy, which included a reaffirmation of his commitment to developing an ASAT system.

06/18/82 -- Soviets conducted twentieth test of their ASAT system.

05/13/82 -- Senate passed the FY83 DOD authorization bill (S. 2248) after adopting an amendment directing that an orbiting laser weapons system be produced

as quickly as possible.

04/13/82 -- House and Senate Armed Services Committees reported out their respective versions of the FY83 DOD authorization bill. The House recommended a major change in direction for DOD's high energy laser program.

10/02/81 -- President Reagan reaffirmed the U.S. commitment to pursue an operational ASAT system.

08/11/81 -- Soviet Union submitted draft ASAT treaty to the United Nations banning the stationing of weapons in space.

05/06/81 -- Senator Pressler introduced a resolution calling for a resumption of the ASAT limitation talks.

04/17/81 -- Soviet President Brezhnev made a statement interpreted by some as calling for a renewal of the ASAT limitation talks.

04/12/81 -- First orbital test flight of the U.S. space shuttle, a manned reusable spacecraft which will be used for both civil and military space missions throughout the 1980's.

03/14/81 -- Soviets conducted nineteenth test of their ASAT system; considered a success.

02/02/81 -- Soviets conducted eighteenth test of their ASAT system; considered a possible success.

04/18/80 -- Soviets resumed testing of their ASAT system after a two year hiatus during ASAT limitation talks and SALT II consideration. The test is considered a probable failure.

01/03/80 -- President Carter asked the Senate to defer action on SALT II.

12/24/79 -- Soviet Union invaded Afghanistan, cooling American sentiments toward arms control agreements.

06/18/79 -- President Carter and Soviet President Brezhnev signed the SALT II treaty.

04/23/79 -- Third session of ASAT limitation talks began in Vienna, Austria. Further talks have been postponed indefinitely.

01/23/79 -- Second session of ASAT limitation talks began in Bern, Switzerland.

06/19/78 -- White House issued a fact sheet summarizing the provisions of President Carter's Presidential Directive 37 stating that the United States wants an ASAT limitation treaty, but that in its absence, will vigorously pursue development of an ASAT capability.

06/08/78 -- First session of ASAT limitation talks between the U.S. and Soviet Union began in Helsinki, Finland.

05/19/78 -- Soviets conducted sixteenth test of their ASAT system, just three weeks prior to scheduled ASAT limitation talks with the United States. Last test until April 1980; considered a possible success.

02/16/76 -- Soviets resumed testing of their ASAT system, following a four year, three month hiatus. This test, the eighth, is considered a possible success.

00/00/75 -- U.S. deactivated its ground-based ASAT system.

11/00/72 -- SALT II negotiations began between the United States and Soviet Union.

10/03/72 -- SALT I agreements were signed.

12/03/71 -- Soviets conducted seventh test of their ASAT system, the last until December 1976. Test is considered a possible success.

11/00/69 -- SALT I negotiations between the United States and Soviet Union began.

11/01/68 -- Soviets conducted a second ASAT test, this time a possible success, since the interceptor passed within 1 kilometer of the target.

10/20/68 -- Soviets conducted the first test of their space-based ASAT system, which is considered a probable failure, since the interceptor failed to come within 1 kilometer of the target.

09/17/64 -- President Johnson announces that the United States has an operational ASAT system.

05/23/63 -- First U.S. test of an ASAT weapon -- using ground-based missile carrying a nuclear warhead.

07/16/62 -- Soviet Premier Khruschev stated that the Soviet Union had a missile capable of "hitting a fly in outer space," interpreted by some western experts as a reference to an ASAT capability.

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