[redacted]

30. Potential Soviet active EW platforms include many fixed, transportable, and mobile transmitters. The fixed ground sites have the advantage of high-power transmission and accurate pointing and tracking capabilities, whereas mobile platforms, such as tactical EW equipment, space support ships, and aircraft are more widely deployable but generally radiate less power and have less accurate pointing capabilities. [redacted]

31. Fixed ground sites and large ships offer the most severe jamming threat because of their large, steerable antennas (generally 12 to 25 meters in diameter, but up to 70 meters for some ground-based sites), extensive on-site processing, and cooling capabilities necessary for high-power transmitters. These sites and ships would be capable of accurate tracking of target satellites and, assuming a configuration for jamming, could project high power levels. [redacted]

32. [redacted] ground sites in the Soviet Union and one in Cuba have been associated with a SIGINT collection mission against foreign communications satellites. [redacted] Of particular importance is the Lourdes Central Signals Intelligence Complex, near Havana, Cuba. This site provides the Soviets [redacted] land-based coverage [redacted]

33. There are many other sites in the Soviet Union, including over 100 antennas associated with the Molniya communications satellite network, that could be used for active electronic warfare activities. In addition, Soviet missile range instrumentation ships, space event support ships, space operation control ships, and intelligence collection ships operated by the GRU also could be used to conduct active EW against US space systems. Finally, there are some land-based mobile or transportable systems that could be adapted for jamming uplinks. Transportable communications satellite terminals and mobile military terminals have been used in Cuba, Africa, and Asia, as well as in the Warsaw Pact countries. [redacted]

Directed-Energy Weapons

34. For many years, the Soviets have been conducting research and development[16] in several fields of advanced technology applicable to directed-energy weapons. In some areas, they may be close to the weapons prototype stage of development. Research into these applications is, in most cases, at an early stage, however, and major uncertainties remain over the feasibility and practicality of such weapons. [redacted] here are large uncertainties about the size and scope of the Soviets' research efforts in key technologies required for directed-energy weapons, as well as about the status and goals of their weapon development programs. Moreover, directed-energy technologies have a broad range of both weapon and nonweapon applications (for example, laser radars and space object identification systems), and [redacted] We judge, however, that the Soviets have the expertise, manpower, resources, and commitment to pursue the development of those directed-energy weapon and military support systems that prove feasible. Three types of directed-energy technologies—laser, particle beam (both charged and neutral), and

[16] The terms "research" and "development" are used in this Estimate in a broad sense and do not necessarily have the same meaning as these terms when used in arms control agreements. [redacted]

radiofrequency—have varying degrees of application to ballistic missile defense, air defense, and antisatellite operations. The destruction mechanisms associated with these technologies are:

— In a laser weapon, an intense beam of light is aimed at a target by an optical device. The target's surface may be damaged by explosive shock, heating, melting, or vaporizing; optical components can be damaged and personnel injured or blinded.

— In a particle beam weapon, intense beams of electrons, protons, or atoms are produced by a high-energy accelerator and aimed at a target by magnets. Damage to the target occurs from thermal, mechanical, and secondary radiation (nuclear or X-ray) effects.

— In a radiofrequency weapon, electromagnetic radiation at wavelengths close to those of conventional radars is aimed at a target by an antenna. Electronic components, or the target structure itself, may be damaged or destroyed by circuit overloading or thermal effects. CIA Statute [redacted]

High-Energy Lasers

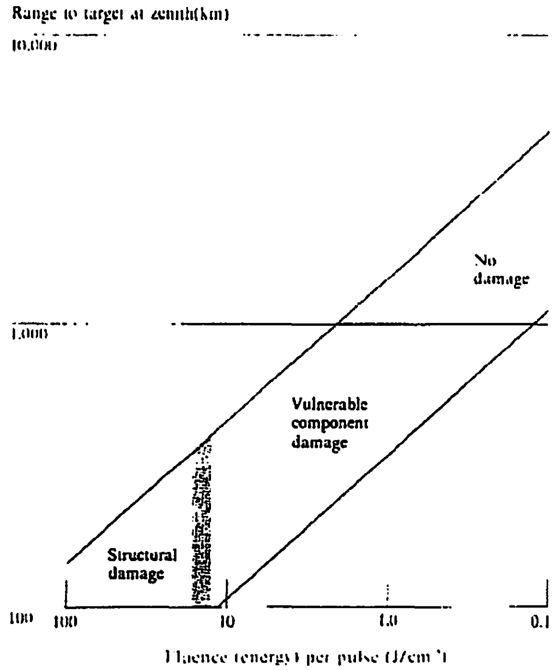
35. Substantial resources continue to be committed to develop high-energy lasers. We estimate from open literature that in the 1970s the number of Soviet scientists and engineers involved in laser research, development, or testing—some of which could be applicable to high-energy laser weapons—more than doubled to about 10,000 individuals. The amount of floorspace dedicated to laser work now totals approximately 400,000 square meters, or about the size of a major Soviet missile design bureau. 25X1 25X1 25X1 [redacted] About 50 academic and industrial organizations, including several central design bureaus, are involved, and at least a dozen laser test facilities and ranges are directly involved in the high-energy laser effort. A laser weapon program of this magnitude would cost roughly $1 billion per year if carried out in the United States. Over 90 additional organizations conducting R&D of lasers and related technologies could be indirectly supporting the effort. 25X1 25X1 [redacted]

25X1 25X1 CIA Statute [redacted]

36. ***Ground-Based Lasers.*** The Soviets are probably developing a 2-megawatt (MW), closed-cycle, carbon dioxide (CO_2), electric discharge laser 25X1 25X1 [redacted] (In addition, they are developing battlefield laser weapons.) 25X1 [redacted] the Soviets are interested in using this type of high-power laser in ground-based ASAT and tactical air defense weapons. The laser is probably state of the art in Soviet lasers of this kind. 25X1 25X1 CIA Statute [redacted]

37. There are two test facilities at Saryshagan that we assess to have high-energy lasers and associated optical equipment with the potential to function as ground-based ASAT weapons. One of these facilities, 25X1 [redacted] of the R&D complex, is probably a laser weapon facility for ASAT or BMD applications. There are a number of candidate devices for this facility. Depending on assumptions regarding the technical characteristics of the system 25X1 25X1 [redacted] it may be able to structurally damage unprotected satellites at maximum altitudes of from 100 to 400 kilometers and may damage vulnerable components up to an altitude of about 500 to 3,000 kilometers (see figure VI-4).[17] The other facility at Saryshagan, Complex D, 25X1 25X1 25X1 25X1 CIA Statute [redacted]

Figure VI-4
Laser ASAT Capabilities, Saryshagan R&D Complex[a]



[a] See paragraph 37 for discussion

[redacted]

307719 12 85

[redacted]

38. There are two possibilities for the altitude capabilities of a laser ASAT at Complex D, [redacted] we estimate that a CO_2 laser ASAT weapon may be able to cause structural damage to an unprotected satellite overhead, in clear weather, to a range of about 200 to 300 kilometers. The laser may be capable of damaging some vulnerable components up to an altitude of about 500 to 700 kilometers.

— If upgraded, [redacted] structural damage could occur to a range of about 400 to 1,000 kilometers, and damage to some vulnerable components could occur up to a range of about 500 to 3,500 kilometers.

[redacted]

39. The degree of damage from a laser attack on an orbiting target is dependent on the power and propagation of the laser beam, the range to the target, and the vulnerability of various target components to the wavelength of the laser radiation. [redacted]

25X1

41. Logical improvements in Soviet ground-based laser capabilities could include better located ground

[redacted] the use of improved technology. Even one or two additional facilities would significantly increase the probability that at least one site would have clear weather at any given time and also would facilitate the engagement of more targets in a shorter period of time. [redacted]

42. In 1981 the Soviets began constructing a large facility that may be a directed-energy weapon on top of a mountain near Dushanbe in the southernmost area of the USSR. It is too early to judge with much confidence what the function of the Dushanbe facility will be, when it might be operational, or what capabilities it will have. However, a directed-energy weapon function—either a laser or a radiofrequency ASAT weapon—seems most consistent with the available evidence. A somewhat less likely, but still plausible, function is deep space surveillance and/or space object identification. [redacted] An alternative view holds that the evidence is insufficient to judge the purpose of the Dushanbe facility.[18] [redacted]

43. Two military facilities under construction on a mountain ridge near Storozhevaya in the southwestern USSR, north of the Caucasus Mountains, are expected to have optical and electronics-related functions when complete. [redacted] The two sites are expected to operate together in a space-oriented function. Although it is still too early to determine with much confidence what the function of the Storozhevaya facilities will be once they are operational, a directed-energy laser ASAT weapon function is one possible explanation. Other possibilities include: space tracking or space-object-identification functions, and control and communications for large manned space facilities and deep space flights. It should be noted that the Storozhevaya complex is so large that it likely is intended to perform more than one function. Some form of space tracking would not be inconsistent with a weapons function, and indeed, could be necessary to support the effective operation of a directed-energy ASAT weapon. An alternative view holds that the evidence is insufficient to judge the purpose of the Storozhevaya facility.[19] [redacted]

44. The Storozhevaya construction effort is larger than that under way at Dushanbe, the possible directed-energy weapon site under construction near Afghanistan, and it has been faster paced. The facilities at Storozhevaya could be completed in about two years, while Dushanbe is not expected to be completed for another three or four years. Although we assess both Storozhevaya and Dushanbe to be space related and to have some sort of optical function, the two projects are quite dissimilar and appear to represent two completely different missions or methods of operation. [redacted]

45. ***Airborne Lasers.*** There is good evidence of a Soviet program to develop airborne laser weapons. [redacted] The most likely laser system for initial deployment is an electric discharge gas laser. Specific missions for a Soviet airborne laser weapon are difficult to determine but could include low-altitude antisatellite applications, escort defense of high-value aircraft (such as AWACS), and defense against high-altitude, high-speed aircraft and cruise missiles. [redacted] Airborne laser weapons are not as adversely affected by clouds and the atmosphere as are ground-based systems. However, airborne lasers suffer from aircraft vibrations and atmospheric turbulence, which adversely affect the propagation and precise pointing of a laser beam. These factors, even if successfully overcome, and other problems such as volume and weight constraints, would probably limit the capability of early airborne lasers, if targeted against satellites, to damage those in orbits below about 1,000 km. [redacted]

46. ***Spaceborne Lasers.*** The Soviets have a project to develop high-energy laser weapons intended for use in space, probably for an ASAT application initially. If successfully developed, these laser weapons could involve either satellites launched on demand or space-

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[18] *The holders of this view are the Director, Bureau of Intelligence and Research, Department of State, and the Assistant Chief of Staff for Intelligence, Department of the Army.* (U)

[19] *The holders of this view are the Director, Bureau of Intelligence and Research, Department of State, and the Assistant Chief of Staff for Intelligence, Department of the Army.* (U)

based weapons maintained in orbit. In the late 1970s, this work was probably in the first of three distinct stages that the Soviets use in the development of a weapon system. During this stage, new concepts are investigated, experimental devices for testing the technology are built and preliminary system designs may be developed. [redacted]

47. To date, the most detailed information on space-based lasers concerns a joint project in 1975-77 involving a Soviet physics institute and a space research institute. Open-source publications by individuals reported to be in the project are consistent with the project's organization. 25X1
25X1

25X1 [redacted]

48. A space-based, high-energy laser weapon offers advantages over ground- or air-based systems. Such systems would be unaffected by cloud cover or other atmospheric conditions. We expect the initial application of a space-based system would be for ASAT, but other applications could include BMD, antiaircraft, and ground target attack missions. As an ASAT system, a space-based laser would have significant advantages over the conventional orbital ASAT interceptor in that it would have multishot capabilities and, depending on orbit, more frequent coverage of targets. It would have a greater capacity to overcome a target's defensive measures, such as maneuvering and decoy deployment. We expect to see laser weapon components tested on manned spacecraft; however, unmanned satellites seem better suited as platforms for operational directed-energy weapons. [redacted]

49. We judge there is a high probability that a prototype high-energy, Soviet space-based laser ASAT weapon will be developed. We estimate there is a moderate (40- to 60-percent) probability that such a prototype will be tested in low orbit in the early 1990s; such an event is less likely in the late 1980s. An alternative view holds that, given the prerequisites for testing a prototype high-energy, space-based laser ASAT weapon (such as major advances in laser technology, laser pointing, and target tracking; a substantial heavy-lift launch capability; and extensive testing of laser components in space), such testing has only a low probability of occurring in the early 1990s and a very low probability in the late 1980s. Finally, the holder of this view notes that for a number of years the Intelligence Community has projected that the Soviets could test space-based lasers much sooner than subsequent developments indicated.[20] [redacted]

50. We note that the psychological impact of the first test of a space-based laser weapon would outweigh its actual military significance. Even if testing were successful, such a system probably could not be operational before the mid-1990s. Development of a space-based laser for antisatellite application is technically difficult, and we are uncertain as to the approach the Soviets would take:

— One candidate for a prototype [redacted] would be a megawatt-class laser. Such a prototype probably could begin testing in the late 1980s at the earliest, but more likely in the early 1990s. If testing were successful, an initial operational system in low orbit—a few satellites, each having a megawatt-class laser weapon with an ASAT range of hundreds of kilometers—could be available by the early 1990s (if tested in the late 1980s), but such an operational system would be more likely to appear in the mid-1990s. The Soviets could elect to pursue a system of higher power (a 5-megawatt-class system with an engagement range out to 1,000 kilometers) for structural damage. Some vulnerable component damage may occur at longer ranges. Test launch and operational dates, however, would come several years later than for a system of the 1-megawatt class.

— A candidate for a space-based prototype, [redacted] is a lower power laser (hundreds of kilowatts) in a low-orbit satellite, with an ASAT range of tens of kilometers. This concept represents an easier technological

[20] *The holder of this view is the Director, Bureau of Intelligence and Research, Department of State.* (U)

[redacted]

In 1981 the Soviets began constructing a facility near Dushanbe that may be directed-energy related. The [redacted]

It is too early to judge with much confidence what the function of the Dushanbe facility will be, when it might be operational, or what capabilities it will have. However, a directed-energy weapon function seems most consistent with the available evidence:

[redacted] Soviet research project for an RFW which investigated using a phased array of eight antennas, although the size of the arrays at Dushanbe is much smaller than that cited by the source. [redacted]

Another hypothesis, somewhat less likely but nevertheless plausible, is:

— *Deep Space Surveillance (DSS) and/or Space Object Identification (SOI).* [redacted]

* *The holders of this view are the Director, Bureau of Intelligence and Research, Department of State, and the Assistant Chief of Staff for Intelligence, Department of the Army.* (u)

Top Secret [redacted] CIA Statute

CIA Statute [redacted]

25X1

[redacted]

25X1 [redacted]

path for testing a prototype laser weapon in space. If the Soviets are pursuing such a program, a prototype could be tested somewhat earlier than a megawatt-class prototype, and, if early tests proved successful, possibly could reach operational capability by the early 1990s. An on-orbit operational system with such a short-range capability, however, would have severe operational limitations, and thus we do not believe the Soviets will develop an on-orbit operational system in the submegawatt class. CIA Statute [redacted]

51. Although we are uncertain of the approach the Soviets would take, there are at least two notions for attacking satellites in higher orbits. One involves a multiple-shot weapon, which is continuously in orbit, and the other involves a launch-on-demand approach:

— In the first case, the Soviets could couple a space-based laser system with the heavy-lift launch vehicle currently under development. If the Soviets successfully test a high-energy laser ASAT weapon in low orbit in the early 1990s, we estimate there is a moderate probability that they will test a laser weapon in geosynchronous orbit by the mid-to-late 1990s. We ascribe a low probability to operational deployment before the year 2000.

— In the second case, a laser weapon could be launched on demand in a crisis, and lower power levels (hundreds of kilowatts) would be acceptable because of the shorter attack distances required. If lower power lasers are developed, existing Soviet launch vehicles could place them in appropriate orbits, allowing engagement of potential US target satellites in all orbital bands. This concept involves placing the laser ASAT into highly elliptical orbits with apogee located near the target when engaging satellites in 12-hour circular or geosynchronous altitudes. Using this concept, operational status against high-altitude satellites may be achieved a few years earlier (late 1990s).

Although space-based lasers, if deployed, will probably be restricted to the ASAT mission for the remainder of this century, technological breakthroughs conceivably could lead to capabilities to destroy ballistic missiles, aircraft, cruise missiles, and ground targets from space in the late 1990s or beyond. [redacted]

52. An alternative view judges that because of the complex nature of space-based lasers and the time required to integrate all the subsystems, the Soviets probably will not successfully complete a test program for space-based, high-energy lasers in low orbit in the early 1990s. Therefore, the holders of this view believe that the Soviets are unlikely to test space-based lasers at high altitudes until about the year 2000. This view also holds that it is unlikely the Soviets could deploy an operational low-power space-based laser for use against geosynchronous satellites before the year 2000. Even though developing the laser component of such a system would be less challenging, formidable technical obstacles—such as acquiring and tracking noncooperative high-altitude targets and coping with the high weapon slew rates necessitated by a close-in approach—would have to be overcome.[21] [redacted]

53. To develop a space-based laser weapon with BMD capabilities, the Soviets would have to achieve significant technological advances in large-aperture mirrors, [redacted] and pointing and tracking subsystems. The Soviets will also require the greater lift capabilities of the heavy-lift booster currently under development. Moreover, system integration would be a complex undertaking, and battle management would present a formidable technical and operational challenge. In view of the technological requirements, we estimate the Soviets could not have a prototype space-based laser BMD system until at least the mid-1990s, or an operational system until after the year 2000. [redacted]

54. Even if a Soviet space-based laser BMD weapon system were deployed, it would probably have a limited capability against current US ballistic missiles unless deployed on a large scale. Many laser weapon satellites would be required to achieve continuous coverage of all possible US ICBMs and SLBMs in the boost phase, before their RVs were dispersed. Once the RVs have been dispersed, the space-based laser defense task becomes much more difficult. The number of satellites required would depend on numerous factors, including the range and pointing/tracking accuracy of the laser weapon satellites. Given the short period during which ballistic missiles are vulnerable to laser radiation, each laser would be able to negate only a few missiles. Moreover, there are potential countermeasures that the United States could employ against low-orbiting weapon systems. Finally, each satellite would have to be part of an extremely sophisticated system posing tremendous problems for the Soviets, involving logistics; reliability; command, control, and communications; and costs. [redacted]

Particle Beam Weapons

55. We have good evidence that the Soviets are conducting research under military sponsorship for the purpose of acquiring the ability to develop particle beam weapons (PBWs). [redacted] We believe they are capable of testing the feasibility of some PBW concepts, but others cannot yet be tested with the technology assessed to be available in the USSR (or the United States). The Soviets have been aware of the potential for PBWs since the 1950s, and we judge there is a high probability that they will attempt to develop PBWs using those concepts they believe are feasible. [redacted]

56. Both charged- and neutral-particle beams can be considered for potential weapons applications—charged particle beams for endoatmospheric applications and neutral particle beams for space. Propagation of charged particle beams in the atmosphere to at least a few kilometers might be possible—although the physical principle has yet to be verified. A short-range (1 km) "radiation-cone" weapon, in which the kill

[21] *The holders of this view are the Deputy Director for Intelligence, Central Intelligence Agency, and the Director, Bureau of Intelligence and Research, Department of State.* (U)

mechanism is the secondary radiation produced by a scattered charged-particle beam, would not require any major technological advances, and we estimate the Soviets could build a prototype by the late 1980s. Because of questions of feasibility and severe requirements on technology, however, we judge that the Soviets are at least 10 to 15 years away from testing any long-range, ground-based PBW prototype for terminal ballistic missile defense. [redacted]

57. A space-based neutral PBW would not be subject to the atmospheric propagation effects that represent a fundamental issue of feasibility for ground-based charged PBWs. Moreover, space-based PBWs are potentially more attractive than lasers for ASAT applications because it is more difficult to harden satellites against the effects of a particle beam than against those of a high-energy laser. On the other hand, neutral particle beams, unlike laser beams, will not propagate downward into the atmosphere and thus cannot reach some lower altitude ballistic missiles. Since the early 1970s, the Soviets have had a research effort to explore the technical feasibility of neutral-particle beam weapons in space, an approach also under investigation in the United States. In this effort, the Soviets have developed technically advanced components, but we judge they have not assembled a complete test system. These weapons would be quite different from the ground-based PBWs; the particle energy and beam current requirements would be much lower, and the systems requirements would be far less stressing. However, the technical requirements for such a system, including precise pointing and tracking, are severe. [redacted]

58. Although we believe the Soviets will eventually attempt to build a space-based neutral PBW, we estimate there is a low probability they will test a prototype of such a weapon before the year 2000. Allowing for our uncertainties in the status of their efforts, we estimate that the earliest they could begin testing a prototype space-based device for:

- Electronics disruption of softer targets such as satellites would be the mid-1990s, and electronics damage before the mid-to-late 1990s.[22] A weapon for the physical destruction of satellites probably could not be tested before the year 2000.
- Electronic disruption of ballistic missiles would be the mid-to-late 1990s, and electronics damage about the year 2000. Physical destruction of targets such as ballistic missile RVs and missile boosters could not be tested until at least several years after a weapon for electronics damage. [redacted]

59. [redacted]

Radiofrequency Weapons

60. The Soviets have conducted research in the use of strong radiofrequency (RF) signals that have potential applications for interfering with or destroying components of enemy missiles, satellites, and reentry vehicles. The Soviets are strong in the technologies appropriate to developing such weapons. Although there are no apparent technological obstacles to prevent the Soviets from developing a prototype RF weapon system, we believe there are demanding system engineering problems to be overcome—for example, the construction of large-beam waveguides. If an RF weapon program exists, the level of effort probably is small compared with the Soviet laser weapon program.[23] [redacted] However, a Soviet project [redacted] revealed interest in high-power electronics that could be applied to RF weapons. This project included investigation of the feasibility of using [redacted] microwave radiation [redacted]

[22] Electronics disruption refers to interference with the operation of electronic devices and may not have permanent effects. Electronics damage means that the radiation absorbed by the electronic devices results in permanent physical damage to the devices. (U)

[23] It should be noted that the facility under construction near Dushanbe is a possible candidate for an RF weapon site (see paragraph 42). If it is, the Soviets are further along in RF weapon development than we currently assess. [redacted]

61. [redacted] The lethal ranges of an RF weapon could extend to geosynchronous altitudes for targets with sensitive electronics (for example, SIGINT satellites), but the effective range against other satellites would be limited to low altitudes. We expect that, if the Soviets were to deploy an RF ASAT weapon, it would be ground based. Such a weapon would cause damage more permanent than conventional electronic warfare techniques, although it would still be difficult for the Soviets to quickly assess the results of an attack. For this type of weapon system, the Soviets would have to build a dedicated RF weapons complex involving very large antennas or arrays of smaller antennas. By the early 1990s, there is a moderate likelihood that the USSR will test a ground-based RF ASAT weapon potentially capable of damaging unprotected satellites. We estimate it is highly unlikely (less than 10-percent probability) that a space-based RF-damage ASAT weapon will be tested before the year 2000. [redacted]

Hypervelocity Kinetic-Energy Weapons

62. In a hypervelocity kinetic-energy weapon, a mass is directed at a target; the mass may range from a stream of microscopic particles to a solid projectile. (Particle beam weapons, in contrast, use subatomic or atomic particles.) The impact causes melting, vaporization, and chemical decompositions that disrupt the target through explosive shock and internal blast pressures. We do not know whether the Soviets have any plans to develop kinetic-energy weapons for strategic applications, but we have recently compiled evidence that they have expended significant resources since the early 1960s in research and development on technologies with potential applications for such weapons. Currently, the Soviets appear to be concentrating their research efforts on technologies applicable to short-range, ground-based systems, which have potential applications for air defense and possibly for defense against tactical ballistic missiles. Kinetic-energy weapon systems potentially could be based in space for defense against antisatellite attacks; with more advanced technology, offensive antisatellite missions or ballistic missile defense could possibly also be achieved. The Soviets' research effort has included investigation of several types of kinetic-energy devices:

— *Electromagnetically launched macroparticle stream devices.* Laboratory research on macroparticle devices apparently began in the early 1960s, and the research may possibly now be moving toward initiation of weapon development. [redacted]

— *Electric railguns.* [redacted]

— *Pulsed magnetic field accelerators (coaxial accelerators).* Research on these accelerators has been under way since at least 1965. [redacted]

63. The engagement range and effectiveness of short-range kinetic-energy weapons depend on the precision of fire-control systems, which could be developed from present Soviet gun air defense systems. In the atmosphere the engagement range will probably be under 10 kilometers; in space it will probably be on the order of a few tens of kilometers. These ranges are significantly shorter than those sought with directed-energy weapons such as lasers and particle beam weapons. For space warfare applications, the relatively short ranges of these kinetic-energy weapons will limit their utility to close-in defense against antisatellite attacks, although it may be possible to use such weapons offensively aboard satellites that maneuver to attack targets at close range. The Soviets probably now have the technology to test a prototype short-range kinetic-energy weapon within several years of a decision to do so. [redacted]

64. [redacted]

[redacted] we estimate there is a very low probability that the Soviets will orbit a prototype long-[redacted] kinetic-energy weapon within the next 10 years. [redacted]

Other Space-Based Weapons [24]

65. In addition to the space warfare systems already discussed, the Intelligence Community continues to look for other potential weapons, including spacemines, space-delivered ground-impact weapons, and space-to-space missiles. The use of spacemines against geosynchronous satellites has raised concern for years because they could be used in time of war with little or no warning. The technology to deploy spacemines is already available. For example, Soviet photoreconnaissance satellites carry a self-destruct mechanism. However, it would be problematic for the Soviets to deploy and operationally maintain, without our knowledge, spacemines in geosynchronous orbit in peacetime for eventual use in a conflict, and we estimate the likelihood of their having such a capability by the year 2000 is very low. [redacted]

66. Satellites could also be used for the delivery of ground-impact conventional weapons from altitudes of tens of thousands of kilometers. Before reentry, the descending vehicles would deploy clusters of small inert reentry vehicles to destroy fixed targets by hitting them at velocities of up to 8,000 meters per second. [redacted] and we estimate the likelihood of such a development is very low. [redacted]

67. In view of the increasing importance of space systems, an active defense capability could be developed to defend against or to attack US systems. Several design bureaus reportedly were working from the late 1960s through the early 1970s on ASAT projects other than the operational orbital interceptor. One of these projects involved the development of a space vehicle that would launch space-to-space missiles. The missiles were to be about 1 meter long and would be carried in a pod. [redacted] Such a space-to-space missile system, probably with a short engagement range, is much more likely to be on a manned spacecraft or space station than an unmanned satellite. Such missiles could home on a signal from an approaching vehicle or could rely on a sensor and guidance system on the space station. [redacted]

[24] Because of the limited analysis performed in this area, we do not have high confidence in the following judgments. [redacted]

68. It would be very difficult to develop such a system that would be effective against what undoubtedly is viewed as the primary threat—the US Miniature Homing Vehicle (MHV)—because of the short engagement times and high closing velocities. However, the Soviets are also apparently concerned about potential threats from the US shuttle. We estimate there is a low-to-moderate likelihood of space-to-space missiles being deployed on Soviet spacecraft in the 1990s for defensive purposes. An alternative view holds that there is a very-low-to-low probability the Soviets will develop defensive space-to-space missiles in the 1990s.[25] Another alternative view holds that the likelihood of the development of a space-to-space missile system with offensive and defensive missions is moderate to high. In particular, if deployed on a space plane, the crew could rendezvous with a satellite, inspect it, report its findings, and if so directed, destroy the satellite under investigation after maneuvering to a safe distance.[26] [redacted]

Space System Survivability

69. We believe current and prospective US antisatellite capabilities including the MHV, electronic warfare capabilities, and laser weapons will stimulate Soviet measures to increase satellite systems survivability. Various measures could enhance the survivability of Soviet space systems, including active means, such as maneuvering to avoid interception, and passive means, such as hardening to protect against nuclear or laser damage. Some of these measures already are inherent, while others will need to be deliberately designed into the spacecraft. [redacted]

70. ***Maneuverability.*** One defensive countermeasure for satellite survivability is maneuvering. Many high-value Soviet satellites, including RORSATs, EORSATs, photoreconnaissance, and the Salyut manned space station, were designed with a capability to maneuver for orbit adjustment. This capability could be used to avoid an attempted US direct attack. Although maneuvering reduces the ability of an ASAT system to detect, track, and home on the target, it also significantly degrades the mission and operational life of the Soviet satellites. Thus, future Soviet satellites may carry more fuel to extend their maneuvering capability. Nevertheless, Soviet satellites are not likely to be able to outmaneuver the US MHV in the

[25] *The holder of this view is the Deputy Director for Intelligence, Central Intelligence Agency.* (U)

[26] *The holder of this view is the Director, Defense Intelligence Agency.* (U)

terminal phases of its engagement, because they will not have sufficient warning time. [redacted]

71. ***Decoys.*** Another potential countermeasure against the MHV is the use of decoys to modify the IR signature of the target satellite [redacted] Soviet concern about the US MHV program may lead them to investigate this potential countermeasure for future generations of Soviet satellites. [redacted]

72. [redacted]

[redacted]

This table is [redacted]

73. ***Satellite Hardening.*** [redacted] Soviet electronics probably are at least as well protected from nuclear effects as equivalent US equipment. Also, the technical capability probably is available to harden electrical systems against electromagnetic pulse effects. [redacted]

74. [redacted] an ongoing Soviet investigation of various techniques to harden major satellite subcomponents against a laser attack. Experiments conducted by both Soviet and US scientists reveal that a vanadium oxide coating may prove useful as a passive countermeasure to a continuous-wave carbon dioxide laser attack. Although technologically feasible, [redacted]

75. ***Signature Reduction.*** [redacted]

Top Secret [redacted]

[redacted]

[redacted]

76. [redacted]

Defense Against Damage to Support Systems

77. The Soviet Union's space support system, composed of the facilities necessary for operating, monitoring, and controlling the spacecraft, is based primarily within the USSR. It is supplemented by Soviet shipborne facilities in order to cover distant areas. [redacted]

78. [redacted]

CHAPTER VII

SPACE OPERATIONS

1. This chapter describes how Soviet space systems probably would be used to support Soviet military forces during routine operations, in crisis, and during conflict.[27] It also describes the relative importance of Soviet space systems under these different conditions. During peacetime, space systems are used for both military and civil missions. In crises, monitoring foreign developments and maintaining communications between Moscow and Soviet forces in the field become the dominant space support role. Just before and during the early stages of hostilities, Soviet space systems can provide warning and timely information on the status of opposing forces. ASAT operations also may be considered at various times as the situation unfolds. But the decision of when to launch ASAT orbital interceptors could pose a dilemma for the Soviet leadership. On the one hand, Soviet leaders are aware that, if they do not use the ASAT orbital interceptors, they may well lose them because of the vulnerability of the launchpads. On the other hand, their use could constitute a further escalation of the conflict and the Soviets would be uncertain of the US reaction. Lower risk options include nondestructive interference with US space systems, probably involving electronic warfare. Should war occur, the loss of Soviet launchpads and ground control sites would seriously degrade Soviet space operations [redacted]

Routine Space Operations

2. A large share of the active satellites support the day-to-day readiness of Soviet forces. For the most part, this support is channeled through Moscow and consists of providing information to support national-level strategic analysis and decisions and, conversely, to disseminate information and decisions. However, naval targeting data are provided directly to ships from EORSATs and RORSATs. [redacted] There would not be any significant changes in this structure during wartime. [redacted]

3. The use of space systems is well integrated into Soviet military operations because of the timeliness and broad scope of support that they provide. At the same time, care has been taken to avoid becoming too highly dependent on space systems: [redacted]

4. Although most of their space assets have a primarily wartime mission, the Soviets nevertheless utilize their satellites to support peacetime military operations and civilian functions:

[redacted]

[27] For a detailed discussion of Soviet views on the transition from peace to wartime, see NIE 11-3/8-84/85, chapter VI. [redacted]

[redacted]

[redacted]

5. Occasionally, systems for primarily civil purposes are also used to support military needs. For example, some earth resources satellites have been used to collect military intelligence. Also, many satellites support both civil and military operations. Navigation satellites, for example, can support both civil and military users, and some carry a transponder to relay international distress signals from aircraft or ships. [redacted]

Crises and Transition to Conflict

6. [redacted] the roles and missions of most Soviet space systems would change very little between peacetime and wartime. The numbers and location of certain systems, however, are likely to change with the concentration of monitoring systems on a particular problem area. [redacted]

Augmentation

7. The Soviets have emphasized efforts to improve the overall readiness of their forces, and these efforts

CIA Statute [redacted]
CIA Statute [redacted]

25X1
[redacted]

25X1 [redacted]

have extended to space systems. Improvements over the last few years include expansion of the space network to over 140 satellites typically on orbit, with over 30 different types of spacecraft. This larger and more sophisticated network is more capable of performing wartime missions than the 110-satellite network of just two years ago. Nevertheless, augmentation of space systems in a crisis continues to be an important part of Soviet military planning. This is in part due to the continued practice of deploying certain Soviet key spacecraft—whose missions are primarily wartime in nature—in reduced numbers during peacetime, with the intention that [redacted] fully augmented before hostilities. [redacted]

8. The capability to augment or replace satellites is a function of launch preparation times, pad turnaround times, surge and replenishment launch rates, numbers and types of satellites required, and the survivability of the specialized launch and control facilities. Current launch and launch-control facilities are vulnerable, and we have no evidence of mobile launch or mobile launch-control facilities currently available or in development. Therefore, the Soviets will continue to depend primarily on their ability to augment existing satellite networks, in a short period of time if necessary, using present fixed space launch facilities before the onset of general nuclear war, [redacted] they would presumably be destroyed. [redacted]

9. The size of any augmentation could vary considerably depending on the situation. Nevertheless, we would expect to see up to an additional 20 to 30 satellites employed if the danger of war were judged to be high by the Soviet leadership. This estimate is down from our estimate of about 40 satellites two years ago, reflecting the increased numbers and [redacted] abilities now on orbit in peacetime. [redacted]

10. Photoreconnaissance satellites currently are probably among the top priorities for augmentation. Satellite systems usually deployed at reduced strength, such as EORSAT and RORSAT, also would be augmented, particularly if the crisis had a naval dimension. ELINT reconnaissance satellites also are likely to be augmented during a crisis, and the need for more weather data also could lead to additional Meteor 2 satellite launches. The capacity of current Soviet comsat networks exceeds current peacetime requirements and could probably handle the increased demands of a crisis with little or no augmentation. In table VII-1, we estimate which systems currently are most likely to be augmented in a crisis and the size of the expected augmentation. Table VII-2 provides our estimate of augmentation for 1995. Key changes from 1985 include the increased [redacted] and the manned spaceplane. [redacted]

11. In a crisis, competition for space-based imagery resources could be intense, with simultaneous requirements to monitor regional crisis spots, the European theater, and strategic targets in the United States, such as SAC bases and port areas. Both film-return and electro-optical imaging systems would be stressed by these requirements because orbital adjustments designed to optimize coverage of one area could interfere with coverage of others. Ground-recovery (for film return) and processing equipment, personnel, and satellite-tracking and computation facilities could be overloaded by the increase in satellite numbers, and processing [redacted] by rapid increases in coverage. [redacted]

12. Crisis or conflict also may lead to the more frequent launch of photoreconnaissance satellites, especially if they deorbit film buckets earlier than usual in order to provide more timely data. Such operations [redacted] However, Soviet planners would have to trade off improved timeliness against decreases in total coverage and the loss of limited assets. The key variables would be the numbers of available replacement satellites, boosters, propellant, and other scarce items, and the expected length of the crisis and war. Too many early deorbits could lead to a shortage of photoreconnaissance assets later on during an extended conflict. However, in the future, the IMSAT will probably be used to image the more time-sensitive targets in a crisis, thereby reducing [redacted] deorbits of the film-return systems. [redacted]

13. Soviet capabilities for augmentation are improving. We estimate that, in most cases, augmentation to a full network can be achieved within three to four weeks, and could be within as little as two weeks. This can be accomplished either by launching additional satellites, by activating satellites stored on orbit, [redacted] although they vary considerably in capabilities to launch spacecraft quickly. [redacted] During that time period, the Soviets launched a wide variety of satellites and optimized [redacted] of their reconnaissance assets. [redacted]

Table VII-1
Configuration of Soviet Military Satellite Networks, 1985

System	Peacetime Network [a]	Crisis, War Network [b]
Systems requiring little or no augmentation		
Reconnaissance		
Photogeo-2	0-1	0-1
25X1 [redacted]		
Launch detection		
LDS-2 (semisynchronous)	9	9
LDS-2 (geosynchronous)	2	2
Communications		
Molniya 1	8-10	8-12
Molniya 3	8	8-10
Statsionar	15-16	18-20
SPCS	3-5	5-6
MPCS	18-24	18-24
RELSAT (developmental)	2	2-3
Navigation		
NAVSAT 2	6-8	6-8
NAVSAT 3	4-5	4-5
GLONASS (developmental)	8-10	8-10
Ocean research	1	1-2
Manned		
Salyut space station	0-1	0-1
Systems likely to be augmented		
Reconnaissance and targeting		
Medium-resolution photo	1-2	2-4
High-resolution photo	0-1	2-3
IMSAT (developmental)	0-1	0-2
ELINT 3	6	9
EORSAT	1-3	2-4
RORSAT	0-2	4-7
Meteorological	2-4	4-6

[a] This column reflects typical size of network, which varies as replacement satellites are launched and before older satellites fail.
[b] Estimated size of network to be achieved by additional launches or activating pre-positioned spares in orbit.

This table is CIA Statute [redacted]

Table VII-2
Projected Configuration of Soviet Military Satellite Networks, 1995

System	Peacetime Network [a]	Crisis/War Network [b]
Systems requiring little or no augmentation		
Launch detection		
LDS (geosynchronous)	4	4-6
Communications		
Molniya 1	8-10	8-12
Molniya 3	8	8-10
Statsionar	18-20	20-22
SPCS	3-5	5-6
MPCS	18-24	18-24
SDRS	3	3-5
Potok	3	3-5
Navigation		
NAVSAT 2	6-8	6-8
NAVSAT 3	4-5	4-5
GLONASS	24	24
Ocean research	1	1-2
Manned		
Space station	1	1
Space station module	0-1	1-2
Shuttle	0-1	0-1
Systems likely to be augmented		
Reconnaissance and targeting		
High resolution photo	0-1	1-2
IMSAT	1-4	4-8
ELINT follow-on	6	9
EORSAT	1-3	2-4
RORSAT	0-2	4-7
Meteorological	2-4	4-6
Manned		
Spaceplane	0-1	2-4

[a] This column reflects typical size of network, which varies as replacement satellites are launched and before older satellites fail.
[b] Estimated size of network to be achieved by additional launches or activating pre-positioned spares in orbit.

This table is [redacted]