finally achieved an initial operational capability of five satellites in March 1981. One satellite failed two months later, however, and the network did not regain operational status until March 1982. Reliability problems now appear to have been largely corrected. [redacted]

45. [redacted]

46. We believe the Soviets also will develop a new system of satellites to provide coverage of the launch areas of long-range SLBMs. Deployment of such a system can increase Soviet warning time of SLBM attack by up to 15 to 20 minutes, depending on the location of the SSBNs. It could probably also provide coverage of launches of land-based ballistic missiles from Europe and Asia. Soviet development of an SLBM (submarine-launched ballistic missile) detection system may be in advanced stages, and we expect initial flight tests in 1984. Full operational capability is expected by 1990. [redacted]

- New construction at the current LDS ground station may be related to the development of a geosynchronous launch detection system possibly including the capability for SLBM launch detection. The large (25 meter) antennas currently under construction are similar to those supporting the LDS program. The construction at this [redacted] ground site should be completed in 1984. [redacted]
- Soviet filings with the International Frequency Registration Board (IFRB) call for a four-satellite network of geostationary satellites called Prognoz. The stated use for the satellites in the Prognoz network—the study of atmospheric processes, the state of the world's oceans, and natural resources—is sufficiently vague that it could have a military mission. The westernmost satellite in the Prognoz network will be positioned at 24 degrees west, the same position occupied by the only Soviet developmental LDS placed in geosynchronous orbit in 1975 and now inactive. It can cover all of the Atlantic and some of the Indian Ocean. The easternmost satellite (80 degrees east) will allow the coverage of almost all the Eastern Hemisphere ocean areas, including the Indian Ocean and part of the Pacific Ocean, from which western SLBMs, including the Trident C-4, could be launched at European USSR targets. [redacted] Further, according to the filings, these geosynchronous positions are to be filled by the end of 1984, coincident with the completion of the construction at the LDS ground site. [redacted]

Nuclear Detection

47. We have not identified a Soviet satellite that provides data on nuclear events. However, all Soviet satellites in synchronous and semisynchronous orbits provide extensive coverage of the Earth's surface. Other possible candidates are scientific satellites that are placed into highly elliptic orbits (five times synchronous). According to Soviet open sources, these satellites collect data on solar radiation to improve the forecasting of the effects of solar proton flares. However, scientific papers associated with this satellite program have addressed nuclear detection from space, inferring that solar forecasting satellites may have a secondary mission of nuclear detection. [redacted]

Aircraft Surveillance

48. We believe the Soviets will perceive a need to detect and locate US aircraft in flight over certain critical routes around the world. This need could potentially be satisfied by advanced space systems using nonimaging IR or real aperture radar sensors. Although the detection of very small vehicles such as cruise missiles will most likely not be possible for some time, overhead detection of large aircraft, such as bombers and cruise missile carriers, will soon be a technological possibility for the Soviets. [redacted]

49. Soviet experience with space-based real aperture radars extends back to the first RORSAT in 1971. The development of sufficiently large antennas that can be properly deployed in space appears to be a

critical technology for a space-based radar for detecting aircraft. A 10-meter-diameter, 2-GHz antenna was tested in 1979 on Salyut 6. However, further development and testing would be required before an antenna of sufficient size or accurate shape could be obtained for this mission. We believe a 10-meter-diameter, 6- to 9-GHz antenna, or an equivalently larger antenna operating at a lower frequency (30 meters at 2 GHz), could be tested, probably on a manned space station, before 1985 and would be a major step toward acquiring the required technology. [redacted]

50. An operating system of space-based radars for aircraft detection would require several satellites. It could take one of several forms because factors such as radiated power, search rate, detection range, and area to be covered must be considered. An example of a conceptualized system is three satellites in elliptical 7,000-km polar orbits that could provide continuous coverage of the northern polar area. [redacted]

51. A space-based infrared system capable of performing this task would probably operate in the far infrared region (8 to 14 microns) and would be based on detecting the temperature difference between the aircraft and the Earth background. This type of detection requires that the sensors be small enough that the aircraft would occupy a significant amount of the area covered by each element. To provide continuous coverage of a significant area on the Earth requires a large number of small sensor elements (on the order of 100 million elements). [redacted]

52. For both systems the communications link is the key to the operational capability of the surveillance system. The link between ground station and sensor satellites should permit the operator at the ground site to have direct access to satellites at all times. Therefore, satellite-to-satellite data relay is mandatory for any low-orbit system. [redacted]

53. Two methods of processing the sensor return signals are possible: on board the satellite or at a central ground site in the USSR. Both methods have difficulties associated with them:

- Onboard processing requires the development of a minicomputer larger than that currently used and a space-related processing capability for handling extremely large amounts of data. However, having a signal processor on board the spacecraft would permit the real-time transmission of target data directly to the user. It also allows for a much narrower bandwidth for the data link (on the order of 1 megahertz versus 100 MHz) as compared with the method for central ground-site processing. Having the signal processing performed on the satellite also has the potential of achieving a higher level of ECCM (electronic counter-countermeasure) capability for the downlink. Conceivably, onboard processing of the raw sensor data could enable the target location data to be transmitted from the spacecraft to an Airborne Warning and Control System (AWACS) or interceptor aircraft without going through the ground station.
- For ground-based processing, the raw sensor data would most likely be digitized on board and then transmitted to the ground site in real time via direct data link when the surveillance satellite is within view of the site or via satellite-to-satellite relay data link when the surveillance satellite is out of view. Although the ground-site processing approach requires the least hardware in the spacecraft, it does demand a very wide bandwidth for the downlink. A downlink bandwidth of up to 200 megabits per second is required.
- The high data requirements in real-time signal processing anticipated for space-based sensors incorporating moving target indicator, target discrimination, signature analysis, and computer-driven control functions will require an onboard central processor. The requirement cannot be circumvented by downlink and ground-based processing. Such ground-based support would require extremely high data rates probably not achievable with current digital circuitry. Soviet integrated circuit technology probably lacks the maturity to provide the high data rates for sophisticated processing either on board or for multiplexed downlinks. [redacted]

54. The required technology level will be difficult for the USSR to achieve and success will depend on

how well many difficult problems are resolved, including weather, detectors, and data processing. We believe there is a low-to-moderate chance that orbital flight tests of a space-based radar system will be conducted in the early-to-middle 1990s and a moderate chance by the year 2000. We believe it less likely that a space-based infrared system will be pursued. If they do elect to develop an infrared system, a prototype could be tested in the mid-1990s. [redacted]

Communications and Data Relay

55. The USSR is currently increasing its use of communication satellites for its military and government communications. However, unlike the United States, it has retained and enhanced its ground-based high-frequency (HF) communications and has added flexibility and redundancy with its various microwave, troposcatter, and landline communications systems. Nevertheless, comsats will increasingly be used to support intelligence, military, and political activities during the next 10 to 20 years. The projected developments will have the dual advantages of significantly improving the speed, flexibility, and reliability of command and control and other communications, while concurrently improving the security of those communications. [redacted]

56. Current and future Soviet comsat systems are summarized in table III-4. The USSR currently operates six comsat systems. Four of these—Molniya 1, Molniya 3, Statsionar, and Statsionar T[5]—use satellites in high-altitude (semisynchronous and geostationary) orbits. These satellites use wideband transponder systems for real-time reception, amplification, and retransmittal of communications signals. The other two comsat systems—designated as multiple-payload communications satellites and single-payload communications satellites—are in low-altitude orbits. These satellites record Soviet communications for transmittal at a later time (store-dump). With the exception of the television relay satellites, all existing Soviet comsats are used extensively and in some cases exclusively to support the Soviet military and political leadership and the intelligence services. Proliferation of comsat capabilities has favored early delivery to those units with nuclear weapons or with nuclear weapons release responsibilities. [redacted]

Molniya 1

57. The Molniya 1 comsat system consists of [redacted] four satellites. [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

---

[5] The Statsionar system (currently utilizing both Raduga and Gorizont satellites) is to occupy 15 orbital positions. The Statsionar T system consists of the Ekran television satellite at one orbital position. A proposed Statsionar T2 system may supplement or replace the current Statsionar T system. [redacted]

Table III-4
Current and Prospective Soviet Comsat Systems

Satellite System	Number of Satellites in System	Orbit
Current		
Molniya 1	8	Semisynchronous
Molniya 3	4	Semisynchronous
Statsionar	15 [a]	Geosynchronous
Statsionar T	1	Geosynchronous
MPCS	16-24	1,500 km circular
SPCS	3	800 km circular
Future		
Gals	(6) [b]	Geosynchronous
Volna	(4) [b]	Geosynchronous
	(4) [b]	Geosynchronous
Luch	(4) [b]	Geosynchronous
Luch-P	(4) [b]	Geosynchronous
Statsionar T2	1 [c]	Geosynchronous
Potok	3	Geosynchronous
Satellite data relay system (SDRS)	3	Geosynchronous

25X1

[a] The Soviets have filed for 15 geostationary positions with the IFRB for their Statsionar system. To date, seven of these positions have been occupied by two different types of satellites (four Raduga satellites and 3 Gorizont satellites).

25X1

This table is CIA Statute

25X1

25X1 CIA Statute

25X1

25X1

25X1

Multiple- and Single-Payload Comsats

25X1

63. 25X1 the multiple-payload communications satellite (MPCS) system, 25X1

25X1

25X1 The Soviets maintain 16 to 24 of these satellites—all in a 1,500-km circular orbit. 25X1

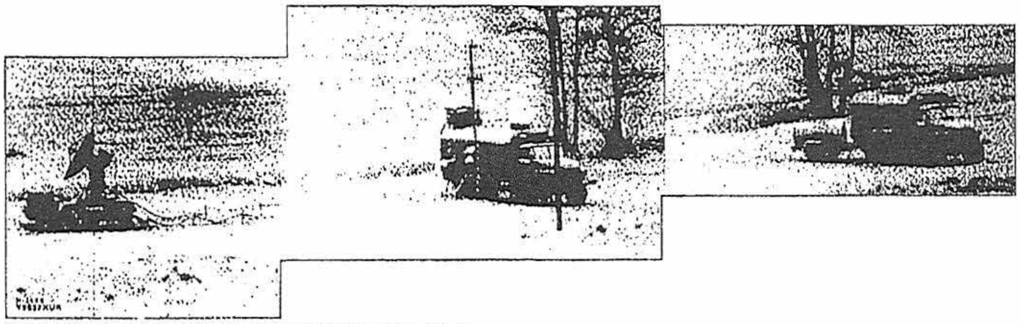
25X1

64. 25X1 the single-payload communications satellite system (SPCS), 25X1 25X1 25X1 The Soviets maintain at least three and as many as six of these satellites—all in 800-km circular orbits. 25X1

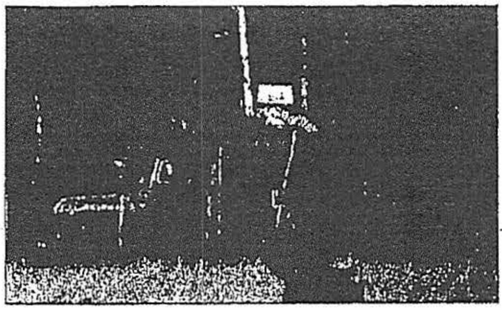
25X1

~~Top Secret~~ [redacted]
[redacted]

Figure III-8
Soviet Mobile Communications Satellite Terminals



Park Drive terminal deployed in operational mode. This mobile comsat terminal [redacted]



New Woodbine terminal photographed in East Germany. This mobile comsat terminal [redacted]
[redacted]

[redacted]
300272 6-83

[redacted]

[redacted]

The Direction of Comsat Developments

[redacted]

[redacted]

[redacted]

[redacted]

67. The USSR is actively pursuing a comprehensive program for geostationary communications systems that could include satellites that serve more than one communications network, intersatellite crosslinking, and laser communications links. Four communications systems are being developed: Volna, Gals, Luch, and Luch-P. These systems may be colocated on satellites in the Statsionar system. Figure III-9 compares the orbital positions of satellites in the current and planned geosynchronous communications systems. We believe that one way the Soviets will meet the requirements of these new systems will be through the use of "hybrid" satellites—that is, satellites that carry transponders for more than one communication network. The first hybrid satellite, Gorizont 5 launched in March 1982, carries Statsionar C-band (4 to 8 GHz), Volna L-band (1 to 2 GHz) and Luch K-band (11 to 14 GHz) transponders. [redacted]

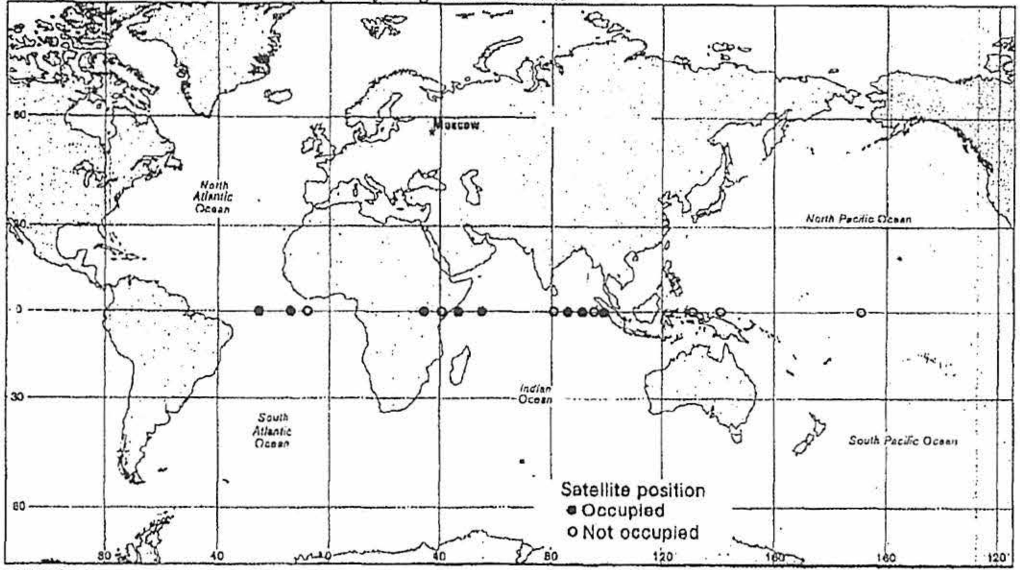
68. We project that a system of four hybrid communications satellites carrying transponders for the Statsionar, Volna, and Luch systems will support civilian users primarily although they will carry both civilian and military communications. Transponders of the even-numbered positions of the Volna system are to be used with air- and sea-mobile terminals while transponders of the Luch system are to be used for telephone, telegraph, TV, and radio transmissions. (s)

69. The proposed geostationary locations and allocated frequencies further suggest that transponders of the Statsionar, Gals, Luch-P, and Volna (odd-numbered positions only) networks may be combined on single hybrid satellites to form a six-satellite multiple-band communications system with near worldwide coverage for government and military command and control communications. The frequencies to be used in the Gals network (8 GHz uplink/7 GHz downlink) are internationally recognized for military communications satellites. Satellites with Gals transponders will have both global and regional beams. In addition, Soviet filings indicate that two satellites will have spot beam capabilities directed at regions in the North Atlantic and North Pacific suggesting naval roles. [redacted]

70. We expect the entire Statsionar, Gals, Volna, Luch, and Luch-P communications satellite systems to be completed by the late 1980s. Although the Soviets have filed for more than 40 network positions (see figure III-9), we believe they could meet these requirements with as few as 14 satellites carrying hybrid payloads. As the new comsat systems become operational, we expect some of the current satellites in the Molniya 1 and possibly the Molniya 3 systems to be phased out [redacted]

71. In addition to the comsat networks, we believe a three-satellite Potok data transmission satellite system and a three-satellite satellite data relay system (SDRS) will be established in geostationary orbits during the mid-to-late 1980s. The Potok system is designed to transmit digital information between central Earth stations and peripheral Earth stations. The purpose of the Potok system remains unclear but may include military missions. SDRS is designed to relay data from low-orbiting satellites, including the manned Salyut type, to Earth terminals near Gus 'Khrustalnyy in the western USSR and near Nikolaevsk-na-Amure in the eastern USSR. Such a system will greatly improve the real-time control of low-orbiting satellites and their timely transmission of data. Potential applications include the real-time transmission of data from low-orbiting intelligence collectors, timely redirection of collection activities, and on-demand orbit adjustments of low orbiters (for example, to counter a US ASAT attack). [redacted]

Figure III-9
Soviet Geostationary Communications Satellite Network Filings With International Frequency Registration Board



634925 8-83

Geosynchronous position	25°W	14°	8.5°W	35°E	40°	45°	53°	80°	85°	90°	95°	98°	130°	140°	170°W
Network position numbers Statsionar Gals Volna* Luch Luch-P	■	■	□ 11	■	□ 12	■	■	□ 13	■	■	□ 14	▨	■	■	■
Total filings 41	4	3	1	3	1	4	3	1	5	3	1	2	3	3	4

■ Hybrid military comsat
■ Hybrid civil comsat
▨ Direct-broadcast TV satellite
□ International comsat

~~Secret~~

*Volnas 9 and 11 have not been filed officially with the IFRB.

72. New Soviet comsat systems will use advanced communications technologies that will result in the capability to relay billions of bits of data per second by the early 1990s. Also, spread spectrum signals will provide better antijam and anti-intercept protection. These advances will provide more reliable communications with higher data capacities to an increasing number of users. By 1990, lasers will be used experimentally for intersatellite relay and possibly with other comsat systems to achieve even greater bandwidth and communications security. In the early-to-middle 1990s we believe an advanced Soviet commu-

nications satellite system will be put into orbit and operate at high frequencies, up to 30 GHz, and will have increased capacities over current systems. These systems could support the expanding manned space programs and real-time sensor satellites. CIA

73. Soviet satellite communications research has included efforts to develop a satellite-to-submarine laser communications link. The research was initiated about 14 years ago and involves experimentation with a blue-green laser that can be used to communicate with submerged submarines. 25X1 25X1 25X1 A laser communications link would be able to handle extremely broadband, short-duration signals. Such a system could enhance the security and survivability of SSBNs on patrol. There is a moderate likelihood that testing of laser communications components will take place in space in the mid-to-late 1980s, perhaps on board a manned space station. If tests are successful and sufficient resources are committed, a small network of laser satellite-to-submarine communications satellites could be operational as early as the mid-1990s. CIA Statute

Navigation

74. Development of naval support satellite (NAVSAT) systems began in the mid-1960s to provide Soviet naval forces with accurate and timely navigation signals 25X1 The first-generation system, 25X1 25 25X1 was phased out in 1979. The second- and third-generation systems—introduced in late 1974 and late 1976, respectively—25X1 25X1 25X1 25X1 CIA CIA

75. The second-generation system, NAVSAT 2, consists of six satellites in near Earth orbits. 25X1 25X1 25X1 According to a 1978 announcement, the NAVSAT 3 third-generation system (four satellites in near Earth orbit) has the purpose of providing navigation support to their maritime and fishing fleets. 25X1 25X1 25X1 CIA

76. In July 1982 a NAVSAT 3 equipped with two special radio transponders for relaying distress signals from ships and aircraft was placed into orbit, as part of the joint US, Soviet, Canadian, and French COSPAS-SARSAT program. This program was first publicized in June 1980 when the Soviets submitted their contribution for the joint project to the IFRB. The Soviet project is administered by the Ministry of the Merchant Fleet and utilizes three ground stations in the Soviet Union to process the signals transponded by the satellites. The location accuracy for emergency transmitters is reportedly within 2 kilometers. CIA

77. In early 1982 the Soviets filed with the IFRB for a Global Navigation Satellite System (GLONASS). These filings indicate that the GLONASS network is designed for worldwide aircraft radio navigation. It will have nine to 12 satellites that will be positioned in three orbital planes with three to four satellites in each plane for positional accuracies possibly within 30 meters. In many respects GLONASS appears similar to the US Global Positioning System (GPS) currently being established. If, as announced, the nine- to 12-satellite system is developed, it will lack a three-dimensional (latitude, longitude, and altitude) position-fix capability. Such a capability exists with the US GPS system and would require an 18- to 24-satellite network with the Soviet design. CIA Statute

78. A GLONASS prototype was launched in October 1982, when a single SL-12 Proton vehicle was used to launch three satellites in the Cosmos series into orbits very similar to those indicated in the filings for

GLONASS. Soviet announcements further indicated that these satellites were intended to develop "equipment of a space navigation system . . . to locate civil aviation planes and merchant marine and fishing ships." We believe that, if tests are satisfactory, an operational network of nine satellites (three satellites in three planes) will be established by 1986. [redacted]

79. Even after GLONASS is operational, the NAVSAT 2 system probably will be retained to support navigation and communications requirements of the Soviet Navy. NAVSAT 3, however, is principally used by the merchant fleet and could easily be replaced by GLONASS. Even though the COSPAS-SARSAT agreement calls for two Soviet satellites, a COSPAS package could be placed on another satellite if the NAVSAT 3 network were reduced or deactivated. [redacted]

80. The US TRANSIT navigation satellite system is currently used by Soviet ships and aircraft to supplement their own Doppler navigation satellites. We expect continued Soviet procurement of Western receivers, so that Soviet ships and aircraft can use both GLONASS and GPS for navigation. [redacted]

Mapping, Charting, and Geodesy

81. Accurate maps, charts, and Earth gravitational models are required for a variety of military missions, including precise targeting information for ballistic missiles. Soviet use of space systems for such purposes began in the 1960s when geodetic and photographic-geophysical (PHOTOGEO) satellites were developed to improve the targeting data for strategic missile forces. [redacted]

82. Geodetic satellites were used to develop and refine geodetic and gravitational models of the Earth. These satellites were first launched in 1968 and continued to be launched at a rate of about two per year until 1978. They were equipped with a flashing light system that served as an acquisition aid for the tracking sites of two Soviet optical tracking networks. One network had sites inside the USSR and was operated by the SRF, while the other, operated by the GRU, was deployed covertly in Soviet diplomatic establishments around the world to connect the geodetic grid of the USSR with targets in other countries. [redacted]

83. The last satellite in the original geodetic series, launched in 1978, ceased activity in September 1981. In the same month, the first of a new generation of geodetic satellites (GEOSAT 2) was launched. [redacted]

84. PHOTOGEO satellites are designed to collect mapping and geophysical data on worldwide ocean and land surfaces. Other photoreconnaissance satellites also provide useful information to Soviet cartographers. An average of two PHOTOGEO satellites have been launched each year since the series was introduced in 1971. [redacted]

85. In early 1981 the first flight test (Cosmos 1246) of a totally new series of photoreconnaissance satellites, the PHOTOGEO 2, was conducted. We believe that, like the original PHOTOGEO, the primary mission of these satellites is to support Soviet mapping, charting, geophysical, and geodetic studies. [redacted]

86. The new generation geodetic and photogeophysical satellites will provide more accurate target data for ballistic and cruise missiles. Both satellite types will be operational by the mid-1980s. Used in conjunction with each other, new generation geodetic and photogeophysical satellites can provide the data needed to

develop an improved gravitational Earth model, Earth surface grid system, and more accurate missile launch and target points. Improvements in SLBM accuracy require refined data on local gravity in the vicinity of the launch platform. [redacted]

Meteorological

87. Meteor 2 satellites provide meteorological data both for civil weather forecasting and military support. Probable military functions include scheduling and routing aircraft and ships, executing force movements, scheduling tests of optical devices that propagate through the atmosphere, such as lasers, and scheduling other operations and exercises. Another possible use includes support for Soviet photoreconnaissance satellite targeting. The Meteor 2 system is operational, with two to four active satellites typically in orbit. Normally, two satellites are used per day. A two-satellite constellation can cover all of the Earth's surface in 24 hours, whereas one satellite would miss some regions near the Equator. Each satellite carries visible, near-infrared, and far-infrared scanners that can provide day and night real-time and recorded cloud-cover imagery. Each satellite also uses an Automatic Picture Transmission (APT) link, the same as that used by US weather satellites. [redacted]

88. Eventually, a three-tier meteorological satellite system will be developed consisting of a low-altitude manned space station, medium-altitude satellites (the current Meteor 2 series), and a system of geostationary satellites. The manned space station will probably include sensors for collecting meteorological data which differs from that provided by unmanned satellite sensors. The Geostationary Operational Meteorological Satellite (GOMS) originally was scheduled for launch in 1978 in support of the Global Atmospheric Research Program, but was delayed because of technical problems. We expect a launch in 1983-85. GOMS will be positioned over the Equator at 76 degrees east and will provide visible and far-infrared cloud-cover imagery every half hour. Soviet planners will thus have access to more timely cloud-cover data over the Indian Ocean and most of Europe, Africa, and Asia than are provided by the Meteor 2s, which typically pass within range of a given location every six hours. GOMS also will reportedly relay Meteor 2 cloud-cover imagery, either directly or through other APT-equipped stations. This will allow reception in the Soviet Union of real-time or near-real-time cloud-cover data over a larger portion of the Earth than could be achieved by either the Meteor 2 or GOMS systems independently. This capability would be useful for optimizing the use of Soviet photoreconnaissance satellites. [redacted]

Calibration

89. Radar support satellites (RADSATs) have been used since the early 1960s to calibrate ABM engagement radars located around Moscow and at the Sary-shagan Missile Test Center. Both the RADSAT 1s (first generation) and the RADSAT 2s (second generation), which replaced the RADSAT 1s in 1976, have been [redacted]

90. In 1976 third-generation RADSATs (RADSAT 3s) were introduced, conducting multipurpose missions, including ABM radar calibration as well as research and development activities. [redacted]

25X1 [redacted]

25X1 [redacted]

93. We believe RADSAT 2s will continue to be used to calibrate ABM radars. 25X1 [redacted] 25X1 [redacted] 25X1 [redacted] CIA Statute [redacted]

CHAPTER IV

SPACE SYSTEMS IN WARTIME

1. In addition to the characteristics already described, an evaluation of Soviet space systems must include:

- Augmentation and replacement.
- Space system defenses.
- Space warfare capabilities.
- Likelihood of interference with US space systems [redacted]

Augmentation and Replacement

2. The USSR currently maintains about 110 active satellites in orbit. Some indication of the Soviet surge launch capability was demonstrated in 1982 when 28 space launches were conducted in 56 days, bringing the number of active satellites to an alltime high of 129. We expect Moscow to maintain about 110 to 140 satellites active over the next five to 10 years. Of these, at least 90 will be in support of military activities. We believe that some of these satellite systems would be augmented during crises or prior to war in order to optimize the RORSAT, EORSAT, ELINT, METSAT (meteorological satellite), and photoreconnaissance networks. Table IV-1 compares the current Soviet satellite networks with what we would expect to see after the networks were augmented [redacted] Table IV-2 depicts our estimate of 1993 Soviet space networks in peacetime and in crisis. [redacted]

3. 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 control facilities are vulnerable, and we have no evidence of current or developmental land-based mobile launch or control facilities. We believe, however, that a mobile control capability using either ships or ground-based mobile terminals will be developed. A capability to relay commands to manned spacecraft via ships that receive the commands from Moscow already has been demonstrated. We believe the establishment of a mobile command capability could be accomplished within the next few years and would significantly increase the survivability of space system ground segments. A survivable launch capability is more difficult to establish. Although ballistic missile submarines and ICBMs in hardened silos could be modified for satellite launches, we believe such a capability has not yet been developed because we have seen no evidence of testing. As solid-propellant, mobile ICBMs are deployed beginning in the mid-1980s, we believe that an emergency launch capability for small communications satellites could be available, possibly as early as the late 1980s. A similar system with near-real-time photoreconnaissance satellites could be available by the early 1990s if the Soviets are able to develop a lightweight photoreconnaissance satellite. However, 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 prior to the onset of general nuclear war, when they would presumably be destroyed. [redacted]

4. The estimated launch rate and local storage capabilities for the current series of Soviet space launch vehicles (SLVs) are described in table IV-3. We believe these capabilities are adequate to meet Soviet augmentation requirements of about 40 satellites within a three- to four-week period. The major limiting factors are the availability of propellant and adequate crews for sustained operations. [redacted]

Table IV-1
1983 Augmentation of Soviet Military Support Satellites in Crisis

System	1983 Peacetime Configuration	Number of Satellites in Crisis[a]
Photoreconnaissance		
Medium resolution	1-2	2-4
High resolution	1	2-4
ELINT reconnaissance		
ELINT 2	1	1-2
ELINT 3	5-6	9-12
EORSAT[b]	0-2	2-4
Radar ocean reconnaissance (RORSAT)[b]	0-2	4-7
Launch detection	9	9-12
Communications		
Molniya 1	8	8-12
Molniya 3	4	4-6
MPCS	18-24	18-24
SPCS	3-5	4-6
Statsionar	4-8	5-10
Navigation		
NAVSAT 2	6	9-12
NAVSAT 3	4	4
Meteorological	2	2-4
Manned	1	0-2
Totals	**67-85**	**83-125**

[a] This column reflects additional payloads launched to augment existing systems and to pre-position spares in orbit.
[b] EORSAT, RORSAT, and ASAT all use the same SL-11 launchpads.

This table is [redacted]

[redacted]

Table IV-2
Projected 1993 Augmentation of Soviet Military Support Satellites in Crisis

System	1993 Peacetime Configuration	Number of Satellites in Crisis
Photoreconnaissance		
Electro-optical high resolution	0-1	1-2
Electro-optical medium resolution	2-3	4-6
ELINT reconnaissance		
High-altitude ELINT	4	4-6
EORSAT	0-2	2-4
Radar ocean reconnaissance		
Improved RORSAT	0-2	4-7
Launch detection		
LDS 2	9	9-12
Synchronous LDS	4	4-6
Communications and data relay		
Molniya 1	4	4
Statsionar	15	15-20
MPCS	18-24	18-24
SPCS	3-5	4-6
Potok	3	3-5
SDRS	3	3-5
Navigation		
NAVSAT 2	6	9-12
NAVSAT 3	4	4
GLONASS	9-12	12-15
Meteorological		
Meteor 2	2	2-4
GOMS	1	1-3
Manned		
Cosmos 929-type	0-1	1-2
Large space station	1	1
Space plane	0-1	2-4
Totals	**88-107**	**107-152**

This table is [redacted]

5. The demonstrated pad turnaround time for the SS-6-based systems (SL-3, -4, and -6) is 24 hours. Propellants for the SS-6-based systems are loaded from railcars at the site into the launch vehicle on the pad. This may be a constraining factor on the number of surge launches of SS-6-based systems, as it takes about 17 propellant railcars to service a single SL-4 launch. The maximum number of assembled SS-6-based systems that can be housed within the assembly and checkout facilities at Tyuratam and Plesetsk is about 42. We are uncertain what the payload mix may be because payloads launched by the SS-6-based systems include ELINT 3, Molniya 1 and 3, HI-RES (high resolution) 2, MED-RES (medium), LDS, PHOTOGEO 2, Progress, Soyuz T, Meteor, and Meteor 2. Assuming adequate propellants and sufficient ground

Table IV-3
Soviet Quick-Launch Capabilities

Launch System	Number of Launch Pads	Estimated Pad Turnaround Time	Estimated Maximum Storage Capacity [a]	Estimated Maximum Initial Launch Rate [b] *(per day)*
SL-3, -4, -6	6	24 hours	42	6
SL-8	5	12 hours	43	10
SL-11	2	RORSAT/EORSAT: 4 to 5 hours	7	6 to 10
		ASAT: 2 to 3 hours	15	6 [c]
SL-12, -13	4	15 days	36 [d]	1 per day for 4 days
SL-14	2	4 to 5 hours	8	6 to 10 [e]

[a] These figures are the maximum storage capacity without providing room for handling and preparation of the launch vehicles.

[b] This column does not consider constraints on optimal launch times (for example, satellites can only be launched during certain time windows to perform their missions effectively). The major limiting factors are the availability of propellant and adequate crews for sustained operations. The sustained launch rate probably would be half of this maximum launch rate.

[c] Target dependent: maximum of two launch opportunities per day per target.

[d] 1985 capacity.

[e] Judgment uncertain. Little data.

This table is ~~Secret~~ CIA Statute

crews are available, we estimate that by using both ranges six vehicles could be launched on the first day. Propellant loading time and crew availability will probably drop the sustained rate to about three launches per day. CIA Statute

6. Minimum pad turnaround time for the SL-8 is assessed at 12 hours. Propellants for the SL-8 are loaded into the erected launch system from storage facilities at the launchpad. We believe the maximum surge capacity for the SL-8 at Kapustin Yar and Plesetsk is 10 launches per day. However, the payload mix is again uncertain because the SL-8 launches ELINT 2, NAVSAT, SPCS, and MPCS. CIA

7. The EORSAT and RORSAT share the SL-11 launch facilities with the ASAT orbital interceptor. The minimum required on-pad time for the SL-11–launched EORSAT and RORSAT is not known; 25X1 25X1 25X1 We believe this time could be reduced to four to five hours. The ASAT requires only two to three hours to launch 25X1 25X1 Currently, there are storage facilities for 22 SL-11 boosters and payloads. We believe that the majority of these boosters would be used for ASAT missions. CIA Statute

8. Facilities at Tyuratam for the SL-12/13 consist of four launchpads and by 1985 an estimated storage capacity for about 36 boosters. The SL-12/13 launch system has a demonstrated pad turnaround of 15 days. The SL-12/13 payloads include the Raduga, Gorizont, and Ekran geostationary comsats; the GLONASS navigation satellite; the Salyut space station; and the Cosmos 929–type spacecraft. CIA Statute

9. The SL-14 launch facilities at Plesetsk are similar to the SL-11 facilities at Tyuratam, but are not believed to be capable of launching EORSATS, RORSATs, or ASATs. Our SL-14 data base is not large, but with the launch facilities available at Plesetsk, including the in-pad erector, four and a half hours is probably a reasonable turnaround time. Third-generation ELINT satellites and scientific payloads are launched by the SL-14. CIA Statute

10. Satellites probably will be stored in orbit for use during a conflict. We have not identified any Soviet satellites currently being stored in orbit. 25X1 25X1 25X1 In a crisis situation, when hostilities are likely, the number of satellites in orbit probably would be increased and augmented

over a long time in an attempt to establish spares without alerting the enemy [redacted]

[redacted]

[redacted]

Space System Defenses

12. We believe current and prospective US antisatellite capabilities including the air-launched miniature vehicle (ALMV), electronic warfare (EW) capabilities, and laser weapons will stimulate Soviet measures to increase satellite systems survivability. Various measures could be taken to enhance the survivability of Soviet space assets, including active means (for example, maneuvering to avoid interception) and passive means (for example, hardening to protect against nuclear or laser damage). Table IV-4 summarizes the various defensive options and the likelihood of implementation, [redacted]

[redacted]

Maneuverability

13. The most obvious defensive countermeasure to enhance satellite survivability is maneuvering. Many high-value Soviet satellites (for example, RORSAT, EORSAT, photoreconnaissance, and the Salyut manned space station) currently have the inherent capability to maneuver. This capability could be used to avoid an attempted US direct attack on Soviet space assets. By selective manuevering, our ability to detect, track, and home on target would be degraded. However, frequent defensive maneuvers would significantly degrade the intended missions and operational life of the Soviet satellites. We expect future Soviet satellites will carry more fuel to extend their manuevering capability. [redacted]

Table IV-4
Soviet Satellite Defensive Measures

[redacted]

This table is ~~Secret~~ [redacted]

14. To implement a defensive manouver against the projected ALMV successfully, some warning of an attack would be required. [redacted]

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16. Satellite lifetime is significantly reduced by maneuvering. 25X1

25X1

25X1 CIA

Decoys

25X1

25X1 There is a low-to-moderate likelihood that decoys will be utilized as a defensive measure on future generations of Soviet satellites. [redacted]

Satellite-to-Satellite Missiles on Manned Spacecraft

18. In view of the increasing importance of space systems, an active defense capability may be developed to defend against US systems such as the space shuttle. A defensive missile system is 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. 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 satellite-to-satellite missiles. The missiles were to be about 1 meter long, and, [redacted] would be carried in a pod. [redacted] We believe there is a low likelihood that the Soviets will deploy such missiles on manned spacecraft in the 1980s. In the 1990s as manned space complexes become more important, we believe the likelihood will increase to moderate. [redacted]

[redacted]

[redacted]

[redacted]

Satellite Hardening

[redacted]

[redacted] Fiber optics could be employed to reduce the vulnerability of solar cells to radiation effects. We believe Soviet electronics are at least as well protected from nuclear effects as equivalent US equipment. Also, we believe the technical capability is available to harden electrical systems against electromagnetic pulse effects. [redacted]

22. [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. The Soviets currently possess the technological capability to implement this countermeasure. [redacted] Similarly, experiments have indicated that silicon nitride may help in protecting solar cells against an IR laser attack. [redacted]

23. A direct collision by an ALMV interceptor, at closing speeds of 4,000 to 12,000 meters per second, would cause major structural damage and massive mechanical shock to the entire spacecraft, disabling the satellite. However, a direct hit on a solar array without hitting the satellite body would not lead to a sure kill. The resulting hole would be larger than that caused by a single pellet hit, but the parallel-series circuitry probably used in the array could still leave enough power output available to allow continued operation. However, the hit could cause an incorrectable tumble rate. [redacted]

Signature Reduction (Stealth)

24. [redacted] Various methods of RCS reduction investigated by the Soviets include ferrite paints, composite materials, and aerosols. [redacted]

25. A possible passive countermeasure against the ALMV is IR signature reduction. [redacted]

[redacted]

Defense Against Damage to Support Systems

26. The Soviet Union's space support system, the facilities necessary for operating, monitoring, and controlling the spacecraft, is based primarily within the USSR. [redacted]

[redacted]

Space Warfare Capabilities

28. Current Soviet space warfare capabilities are limited to an ASAT orbital interceptor, ground-based test lasers with probable ASAT capabilities, and the technological capability to conduct electronic warfare against space systems. The ABM/Space Defense Forces—a component of Voyska PVO, the Soviet air defense organization—is responsible for antisatellite and antimissile forces. It controls the network of radars