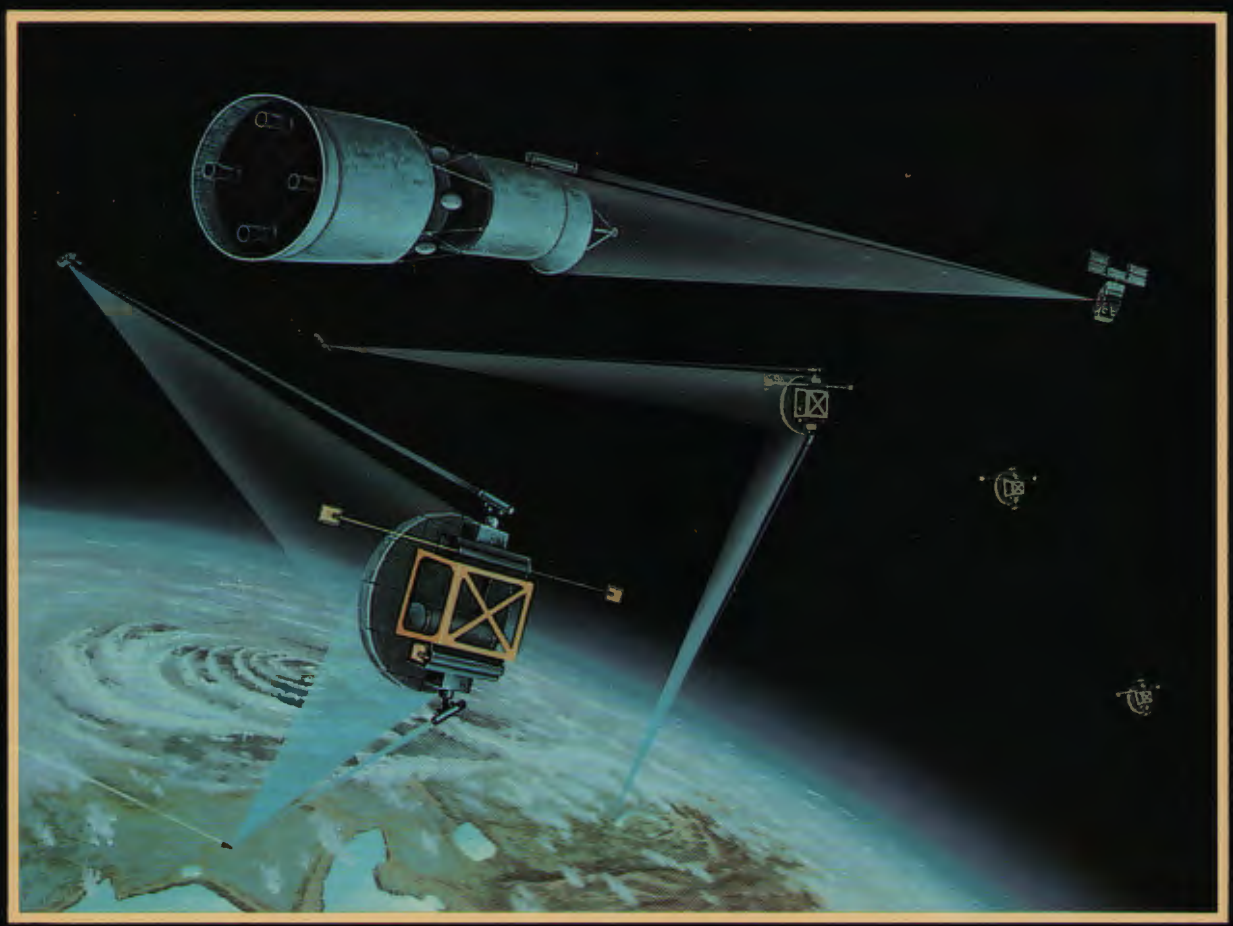
THE SOVIET SPACE CHALLENGE



THE SOVIET SPACE CHALLENGE

"Mastery of Space is an Important Prerequisite for Achieving Victory in War"

Dictionary of Basic Military Terms, USSR, 1965

The illustrations of Soviet military facilities and weapon systems included in this publication are derived from various US sources; while not precise in every detail, they are as authentic as possible.

PREFACE

Space is frequently considered a remote and mysterious realm. In fact, the region of space that occupies our greatest concern is about 160 miles from earth, or closer than New York is to Washington D.C. For scientists and defense strategists that is but a "stone's throw."

As with the oceans on earth, space is used every day for scientific exploration, communications, and national defense. This publication is about one aspect of space that is enormously important and generally poorly understood — the use of space by the Soviet Union for military objectives.

Space has long been used by both the United States and Soviet Union for national security. There is nothing unusual about this, nor is there necessarily anything sinister about a nation's desire to enhance its security and protect its people by using the resources of space. To believe otherwise would be similar to objecting to the use of the seas, the air above our country, or our land itself for national defense. What is crucial in the use of space for defense is not the fact that space is one of the mediums for defense, but the strategic goals of the nations in space and the capabilities of those nations to carry out their goals.

Most of the Soviet space program is not generally made public. As this publication documents, the greatest part of the Soviets' effort in space is dedicated to their military objectives. For the past three decades, since the inception of the space era, the Soviet Union has worked steadily to acquire a military capability in space. Because the Western democracies, particularly the United States, have directed a large part of their space resources and technology toward other goals, and sometimes have lacked clear goals, we have allowed the Soviet Union to come dangerously close to achieving its military objectives in space. The Soviets have methodically designed their space systems to fight a war in space. For over 30 years, Moscow has worked steadily to acquire the capability for military control of space. As the pages that follow show, the Soviets' efforts have been impressive indeed. For example:

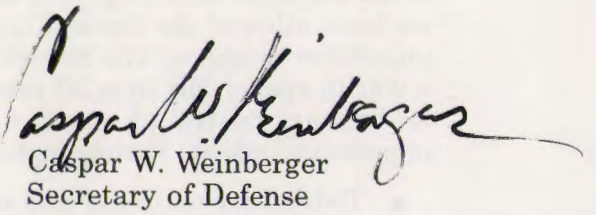
- Today they maintain and operate over twice as many classes of launch vehicles and routinely have five times as many launches as the United States.
- The Soviets are the only nation that maintains a space station that is manned almost year round where personnel can conduct military experiments.
- They are in the process of developing their heavy-lift launch vehicle, "Energiya." This system will provide them not only with a booster for their space shuttle but a booster that can lift over 100,000 kilogram payloads. By the turn of the century our conservative estimates indicate that their lift capability will be almost twice their lift requirement for an assumed expanded and ambitious space program.
- The Soviets already possess such a robust launch capability that they could, if their entire satellite network were destroyed, reconstitute it almost totally in two to three months if they had the replacement satellites.
- They are the only nation that maintains an operational ground-based orbital interceptor ASAT system that can destroy low-earth satellites.

These capabilities merely highlight what is discussed in this publication. Clearly, the Soviet program points in one direction — the methodical pursuit of a war fighting capability in space.

The United States does not have the need or the desire to mimic Soviet military space activities. Our superior technology enables us to use space more efficiently and more effectively for early warning, communications, navigation, and soon, for a stabilizing defense against ballistic missile attacks. But with these greater capabilities comes greater dependence. Today, United States military forces are critically dependent on space systems, and in the future, that dependence will be even greater. The challenge we face, if we are going to rely on space systems for our national security, is the overriding need to guarantee free access to and safe passage in space, for us, our friends, and our allies.

There is no denying that we are short of that goal. The United States needs new launch systems to provide assured access to space; we need more survivable satellite constellations to provide an assured capability to deter aggression of any kind; and we need a response to the deployed Soviet antisatellite threat. To obtain any of these, we need the support of the American public and the Congress.

That is the reason for this publication. I believe that, if presented with the facts, the American people will reject Soviet propaganda about US "militarization of space," and will recognize the need to protect our national security interests in the arena of space, just as we must on earth. It is essential that the message be clearly conveyed. We must not cede space control to the Soviet Union or to any other power that could use it to coerce our nation or restrict our liberties.



Caspar W. Weinberger
Secretary of Defense

November 1987

The Soviet Space Challenge

Introduction

On 4 October 1957, the Western world was stunned by the early morning launch of the world's first satellite, SPUTNIK. Prior to the orbiting of SPUTNIK, few US space experts questioned the West's superiority over the "backward Russians," as they were known, in any area of scientific or technological endeavor. As a consequence, the next several years involved a high priority effort to establish US superiority in the space arena.

That this monumental Soviet undertaking remained largely undetected until launch time should not be surprising, given the USSR's obsession with secrecy regarding all matters of an advanced scientific nature. As one Soviet geophysicist explained after the launch, "It is the general principle of the Soviet Union not to announce anything before it is absolutely certain."

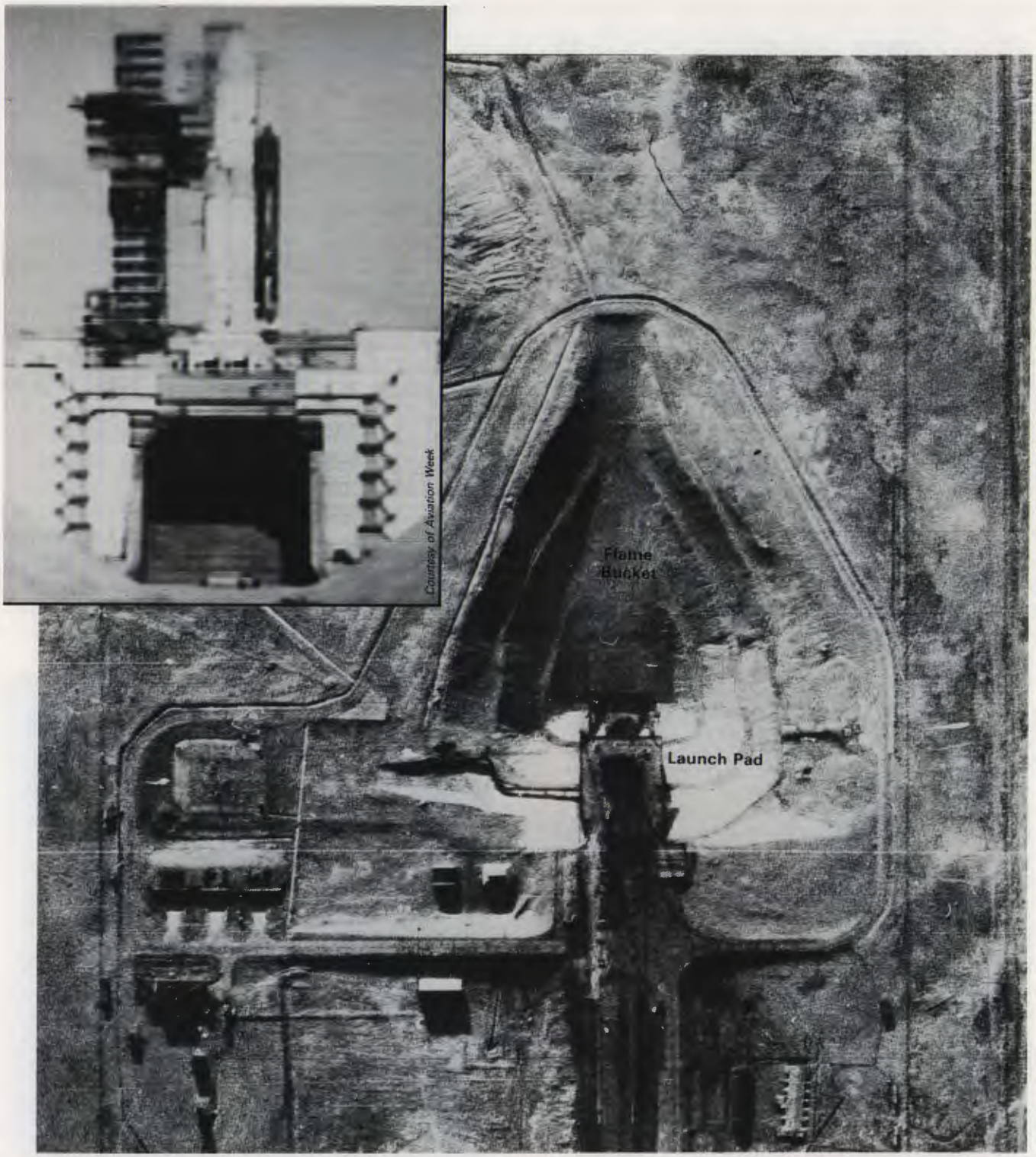
Although the Soviet space program is still largely cloaked in secrecy, the West no longer underestimates the "backward Russians." The Soviets, arguably, have the most extensive, robust, and dynamic space program in the world today. But even as Soviet space achievements deserve respect, Soviet space objectives warrant serious concern. The continuing evolution of a Soviet military space doctrine, the increasing number of military-related launches, and the high priority given to development of space-related strategic offensive and defensive systems are the visible evidence of a Soviet drive toward utilization of space, primarily for military purposes. Today, the challenge for Western scientists and strategists is to closely examine what is known of the Soviet space threat and to reveal that which remains unseen.

MILITARY SPACE DOCTRINE AND STRATEGY

Although Soviet officials maintain that no military doctrine exists for space, a close look at the evolution of the Soviet space program reveals that potential military benefits were a prime motivating factor. Following its devastating losses of life and property during World War II, the Soviet Union examined all possible means of strengthening its military. One area of exploration was the employment of rockets for both civil and military purposes. Although the immediate aim of the rocket program was to build guided intercontinental ballistic missiles, Soviet scientists also envisioned the use of these rockets to orbit earth satellites and even to carry men into space.

During the 1950s, even before the launch of the first Soviet satellite, military doctrine in the USSR recognized the potential utility of space for military purposes. Although unable to achieve such objectives at that time, Soviet strategists envisioned space as a logical

Soviet planners were already stressing the need for space support to strategic operations and future space-based offensive weapons at a time when the SL-3 was the main Soviet launch vehicle in the early 1960s.



This Tyuratam (Baikonur) launch site, shown in this early photo, provided the Soviets with their first space launch capability 30 years ago. The complex is still flourishing today and serves as one of the Soviet Union's principal space launch centers. Construction of very large launch pads to accommodate the SL-X-17 (see inset) continues at Tyuratam. The Soviets have about 20 operational space launch pads.

extension of a global war strategy. They foresaw the use of space-based systems in future wars as a decisive factor in achieving victory. Soviet planners realized that to acquire such capabilities in space would require a long-term commitment of resources. As a result, over the past 30 years, the Soviet Union has devoted considerable time, effort, and funds toward the realization of its space goals.

Insight into the formulation of Soviet space strategy can be gleaned from published military doctrine. Once SPUTNIK was launched and space exploration became a reality, the first indicators of a military space doctrine began to appear in Soviet military literature. In the early 1960s, about the time the first COSMOS satellite was launched, Marshal Vassily Sokolovsky, author of *Soviet Military Strategy*, wrote of a need for space support to strategic operations, and of a future need for space-based weapons. He said ". . . It would be a mistake to allow the imperialist camp to achieve superiority in this field. We must oppose the imperialists with more effective means and methods for the use of space for defense purposes." By 1965, the statement "mastery of space is an important prerequisite for achieving victory in war," appeared in the Soviet *Dictionary of Basic Military Terms* as well as in Soviet military texts. That same year, the US discovered the Soviet Fractional Orbit Bombardment System development program — a satellite believed to contain a nuclear weapon programmed to deorbit and land on a terrestrial target during its first orbit around the earth.

By 1972 the Soviets had successfully orbited a manned space station, SALYUT-1, and military exploitation of space was discussed in the military academies. General Anureyev, a Department Head at the Academy of the General Staff, began writing that year of combat zones in space, new technology for the

The SL-4, shown here lifting a manned SOYUZ crew ferry vehicle, has been operational for 24 years, and is still the workhorse of the Soviet space program. The first two stages of the SL-4 were derived from the SL-1, which carried the world's first SPUTNIK satellite into orbit in October 1957.

An example of how the Soviets transport a fully integrated launch vehicle is shown above. The SL-4, which is used to place cosmonauts, resupply vehicles in support of the MIR space station, and many other payloads into orbit, is transported to the pad by rail and then erected for launch.

development of lasers, heavy-lift boosters, and space-to-space weapons.

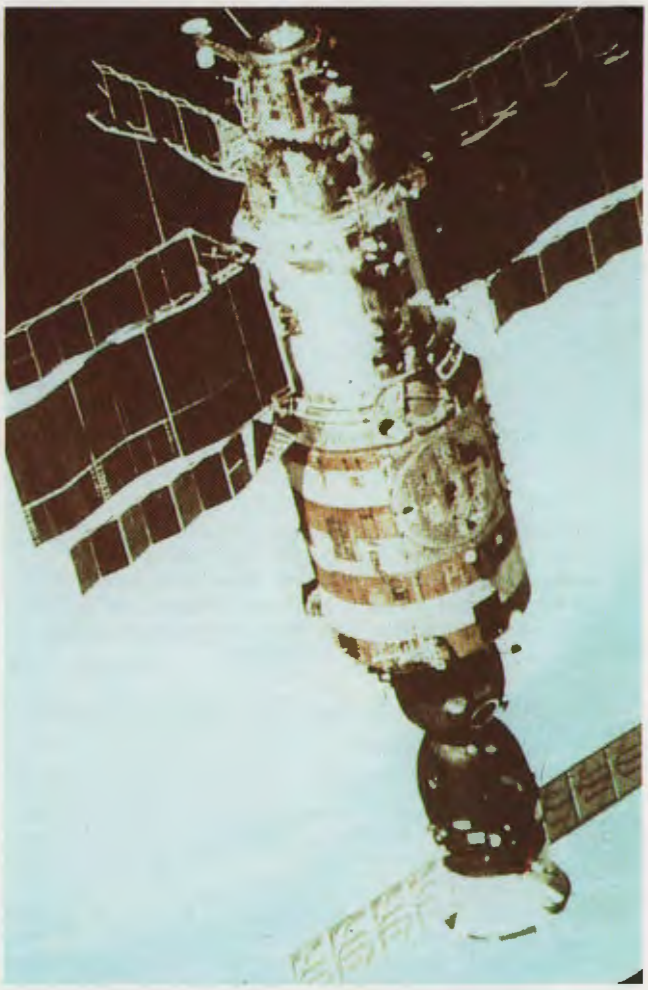
The long-term Soviet commitment to space was reaffirmed by General Secretary Gorbachev in May 1987 at the Tyuratam (Baikonur) Space Center, prior to the first test launch of the new heavy-lift SL-X-17 space booster. He stated, "We do not intend to relax our efforts and lose our vanguard positions in the conquest of space."

Such pronouncements tend to confirm that the Soviets indeed have a longstanding grand strategy for space that has been well conceived, is driven by the military, and is fully supported by the USSR's leadership. Undeniably, the USSR derives important political, economic, and scientific benefits from its civil space exploits. But the enormous Soviet investment in space clearly indicates that the military use of space is the major driving force behind the Soviet program.

While isolated statements have admitted Soviet use of satellites for military support purposes, Soviet propaganda continues to accuse the United States alone of "militarizing" outer space. A peculiarity of the Soviet media is that descriptions of purported US programs are often used as a cloak for internal discussion of their own programs. Although the Soviets have been conducting a substantial research program on advanced technologies applicable to the development of a defense against ballistic missiles since the late 1960s, they continue to insist that they have no program comparable to the US Strategic Defense Initiative (SDI). Moreover, even though the USSR has had an operational, dedicated antisatellite (ASAT) system since 1971, the Soviets continue to insist that they do not possess operational weapons for attacking satellites. Such contradictions are believed by the US to be aspects of the Soviet deception program. The Soviet media's treatment of Gorbachev's statement at Tyuratam on the conquest of space typifies Soviet efforts to play down statements possibly construed as militaristic. The printed version of his speech published in *Pravda* omitted his conquest of space statement. Such omissions, however, are not enough to obscure the existence of the largest military space program in the world today.

The key elements in Soviet military doctrine are the overwhelming offensive application of superior military force to further Soviet interests and a combined arms approach to combat operations. Both of these

The Soviets first launched the SL-12 vehicle, the "Proton" (similar to the US Titan), in 1967. This four-stage space booster is used to launch communication and navigation satellites, interplanetary probes, and, in the SL-13 three-stage version, the SALYUT and MIR space stations. The Soviets are now advertising the Proton for worldwide launch services at half the cost competitors are asking.

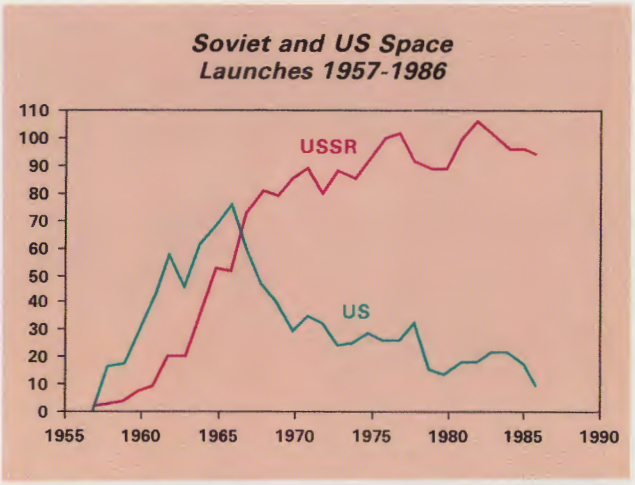


SALYUT 7 is the last of the SALYUT series of Soviet manned space stations. Since the first SALYUT was launched in 1971, the Soviets have had a space station in orbit almost continuously. Soviet cosmonauts have accumulated nearly three times as many man-days in orbit as have US astronauts.

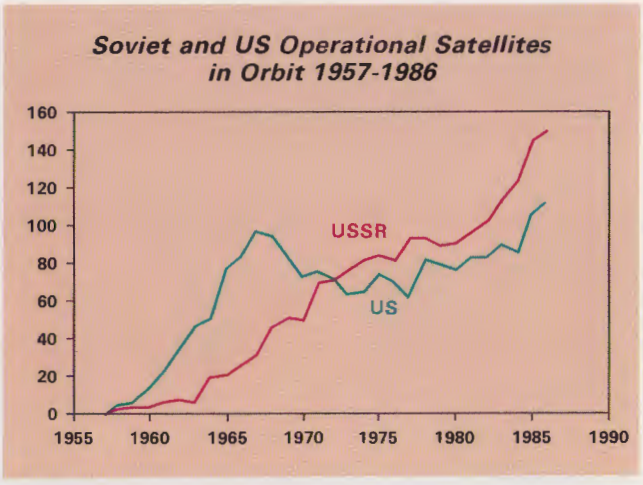
elements are equally important in Soviet military space doctrine. Based on Soviet statements about the military use of space, we conclude that Soviet space doctrine may be stated as follows:

The Soviet armed forces shall be provided with the resources necessary to attain and maintain military superiority in outer space sufficient both to deny the use of outer space to other states and to assure maximum space-based military support for Soviet offensive and defensive combat operations on land, at sea, in the air, and in outer space.

Thus, Soviet military space doctrine satisfies the dual requirement of being compatible with and subordinate to general Soviet military doctrine. It places no limits on either the scope or depth of Soviet combat operations and is unequivocal concerning the requirement for allocating resources to the military effort. The ability to provide space-based military support for terrestrial combat operations requires the freedom to operate in space as well as to deny the enemy the use of space. Soviet military



Since 1967, the Soviet launch rate has exceeded that of the US and has been maintained at approximately 100 a year for over a decade. At least 90 percent of Soviet launches are military related, although the Soviets often try to mask the true nature of their launches.



The difference between the number of US and Soviet operational satellites in orbit is much smaller than the difference in the number of annual launches. This is because the length of time a Soviet spacecraft functions in orbit (its "lifetime") is typically much shorter than that of US spacecraft. However, Soviet spacecraft lifetimes are increasing.

doctrine fully recognizes the need to disrupt, if not destroy, enemy command, control, and communications assets. With space becoming increasingly essential to military forces, the Soviet leadership is expected to pursue with vigor the capabilities for space warfare and space-based military support.

This assessment of Soviet military space doctrine parallels the actual design, development, and deployment of the USSR's military space capabilities. These capabilities illuminate Soviet objectives in outer space more effectively than do their statements. They testify to the existence of a Soviet military space doctrine and clarify its status within general Soviet military doctrine. Because the attainment of Soviet military superiority in terrestrial forces is essential to overall Soviet military doctrine, the USSR will certainly not settle for anything less in space.

SPACE PROGRAMS AND CAPABILITIES

The Soviets currently operate about 50 types of space systems for military and civilian uses including manned space stations and reconnaissance, launch-detection, navigational, meteorological, and communications satellites. Some types of satellites, such as the Soviet space station, the materials processing satellite, the radar ocean reconnaissance satellite (RORSAT), the ELINT ocean reconnaissance satellite (EORSAT), and the radar-carrying oceanographic satellite, are unique to the Soviets.

The USSR conducts approximately 100 space launches annually from three multi-pad "cosmodromes." The Tyuratam launch complex is the world's largest. The Soviets currently have eight different types of boosters to launch their payloads. In addition, the number of active satellites the Soviets maintain in orbit has increased from about 120 in 1982 to about 150 in 1987.

At least 90 percent of the launches and satellites are military related and support both offensive and defensive operations. The USSR obscures the true nature of many space missions by declaring that they are for the "exploration of outer space." Because the 1967 Outer Space Treaty requires nations to register space launches with an agency of the United Nations, the Soviets acknowledge most of their space launch activity. Few details, however, are provided. The results of and data from these missions are rarely

published or disclosed except for some aspects of the manned and interplanetary programs. Throughout, the Soviets steadfastly maintain they have no military space program.

Nevertheless, the military emphasis is expected to continue in the years ahead. Of the approximately 200 operational Soviet satellites projected to be in orbit by the mid-1990s, about 150 will most likely have purely military missions, such as ocean reconnaissance, electronic intelligence, imagery reconnaissance, and special communications. Another 40 will probably support joint military-civilian functions, such as providing communications, navigation, and weather data. The manned program will fulfill both military and civilian missions. The approximately 10 remaining satellites are expected to include interplanetary probes and other scientific missions. The lifetimes and survivability of Soviet satellites are expected to continually increase during the next 10 years because of a variety of improvements such as the incorporation of sophisticated technology and the placement of satellites at higher altitudes. These moves could also increase the satellites' fields of view and would make them less vulnerable to an ASAT attack.

Military Support From Space

Under their COSMOS designator, the Soviets continue to develop and deploy space systems designed to support military operations on Earth. The Soviets now have a fully-operational network dedicated to warning of ICBM attack. They also operate several types of space-based reconnaissance systems. Two of these, the RORSAT and EORSAT, are used to locate naval forces that could be targeted for destruction by antiship weapons. The US has no comparable capability. Moreover, the Soviets actively practice their detection and targeting techniques, routinely launching these satellites to monitor both Soviet and NATO naval exercises.

The Soviets continue to expand an already mature satellite reconnaissance program. Several enhancements, such as the incorporation of a data-relay satellite system, could improve the timeliness of their satellite reconnaissance data. Demonstrations of flexibility and versatility in launching and deploying their surveillance systems have continued, and the Soviets are capable of redirecting them for worldwide missions as situations dictate. Meanwhile, the satellite imagery reconnaissance capability has been refined, and space-based electronic-intelligence assets are being upgraded.

While the Soviets are expected to maintain their current launch-detection satellite network, they are probably working on a more capable space-based surveillance system able to detect US submarine-launched ballistic missiles (SLBMs), as well as European and Chinese missile launches. Although the USSR's land-based ballistic missile defense radar network permits detection of SLBM launches, a space-based geosynchronous launch-detection satellite system could significantly increase warning time. The Soviets probably have the technical capability to deploy such a satellite system in the next several years.

Deployment of the Soviet space-based global navigation satellite system known as GLONASS continues. This system will probably be able to provide highly accurate positioning data for military and civilian users by 1992. GLONASS is the Soviet version of the US NAVSTAR Global Positioning System (GPS). (In fact, the Soviets used digital signal processing data from GPS documents to develop GLONASS.) GLONASS is being placed in a GPS-like orbit. Based on the 9 to 12 satellites announced for the system, GLONASS would have a worldwide, two-dimensional capability. If the Soviets want GLONASS to provide worldwide, three-dimensional navigation updates, they would need to orbit 18 to 24 satellites.

The Soviets are increasing the number and variety of their communications and weather satellites. They have declared their intent by submitting over 100 filings for more than 25 positions in the geostationary orbit belt with the International Frequency Registration Board. Some of the communications satellites are expected to be used to relay data between terrestrial sites, including ships, or between satellites and ground sites. The Soviets

Shown here is the **AGI MARSHAL NEDELIN**, *lead ship of the newest class of Soviet space support ships, equipped to support spacecraft launch and recovery, and manned space activity. These ships provide additional mobile monitoring, data relay, and communications, extending the Soviets' ability to monitor their satellites beyond their homeland.*

demonstrated this capability by using a data-relay satellite to transmit television pictures from the MIR space station to the ground. By using such satellites, the Soviets will be able to communicate among ships, satellites, and ground stations that are not within line of sight of each other. This technique increases the timeliness of these communications.

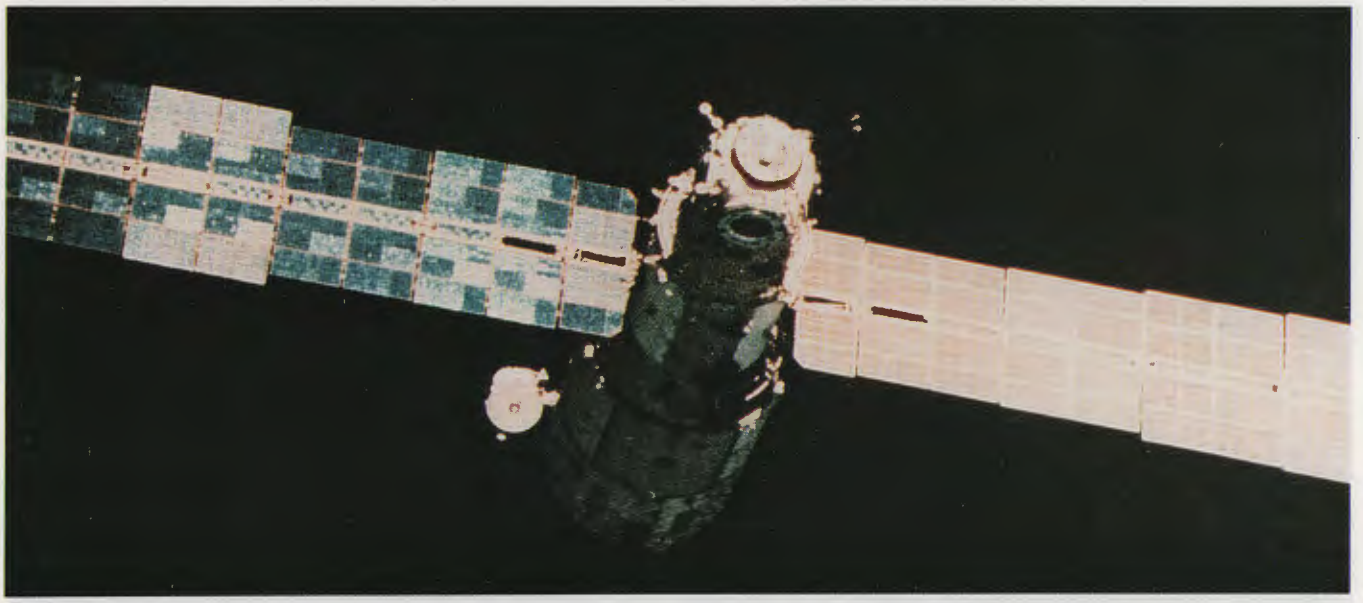
The Soviets have recently introduced a new radar-carrying satellite system. Designed for mapping ice formations in polar regions, these satellites will greatly enhance the ability of the Soviet Navy to operate in icebound areas. The system can be used to aid in the navigation of northern sea routes to assist in such activities as moving naval ships from construction yards in the western USSR to new ports in the Pacific. The Soviets have already tested the ability of their TV broadcast satellite, EKRAN, to transmit data derived from the radar satellite directly to users in the polar regions.

In late 1984, a new Soviet auxiliary ship was seen arrayed with extensive radomes and antennae. This ship, named after the first commander of the Strategic Rocket Forces, Marshal M.I. Nedelin, appears to be a new space and missile support ship able to perform a variety of missions, including support to strategic forces worldwide. On its maiden voyage the *NEDELIN* transited directly from the Baltic to the port of Vladivostok, the headquarters of the Pacific Ocean Fleet. This ship significantly upgrades the Soviet ability to test new generations of missiles as well as to support the expanding Soviet space program. The *NEDELIN* joins a growing fleet of Soviet space support ships that provide assistance to manned and unmanned space missions. An additional ship of the NEDELIN-Class is under construction.

Manned Operations

The Soviet manned space program occupies a unique position in the USSR's space efforts. It is heavily publicized to promote the perception of the peaceful nature and technological superiority of the USSR's space program. Visits to the Soviet space station by foreign cosmonauts and the long missions by Soviet cosmonauts have been reported with great fanfare in the nation's news media. Nonetheless, the Soviets have made a strong commitment to using their manned space program to accelerate their drive to achieve military superiority in space.

Soviet literature indicates that the military applications of remote sensing, oceanography, meteorology, and geodesy



In February 1986, the Soviets launched the first of their third-generation space stations. Larger and more efficient solar panels provide nearly 10 kilowatts of power, almost twice that available on the SALYUT space stations. MIR will be used to conduct military experiments. Many of these experiments will use visual observations, cameras, radars, spectrometers, and multi-spectral electro-optical sensors — devices that could support, among other things, ASAT and ballistic missile defense system development.

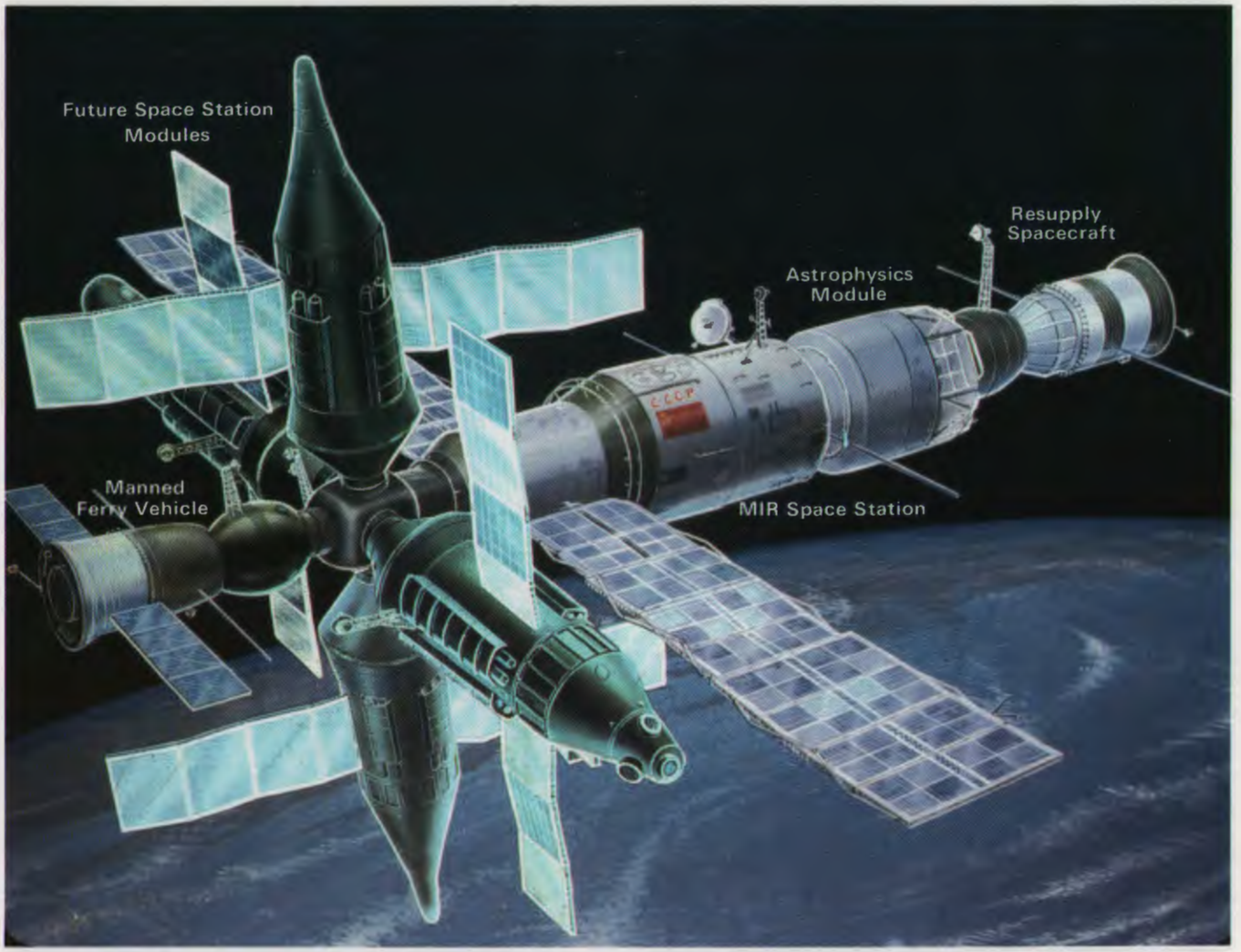
have been a focus of repeated cosmonaut investigations. Even civil investigations, such as astronomical observations, also performed by cosmonauts, have military uses. Such investigations, for example, can develop techniques useful for maintaining the orientation of certain equipment to an accuracy of a few arc-seconds, a capability needed to aim directed-energy weapons.

The ability to rendezvous and link up with uncooperative spacecraft, which Soviet cosmonauts demonstrated in 1985 and 1986, also has military applications. Cosmonauts use such equipment as a laser rangefinder, a night vision device, and an optical sight while performing this type of operation. The Soviets state that this rendezvous procedure will allow the rescue of cosmonauts stranded in orbit, but it could also be useful for repairing friendly satellites and for inspecting and disabling enemy satellites.

Conducting materials-processing experiments is an important cosmonaut function that has both civilian and military applications. Soviet efforts in this field, however, have concentrated on the production of substances with militarily significant applications in the development of semiconductor devices, infrared and optical detectors, and electro-optical systems.

Another crucial cosmonaut activity is Earth observation, which has applications for reconnaissance and targeting. The Soviets report that their cosmonauts have used visual observations, cameras, spectrometers, and multispectral electro-optical sensors in their observations from SALYUT and MIR space stations. These experiments suggest the Soviets are evaluating their ability to locate, identify, and track targets from outer space. This could be the first step toward designing a space weapons platform for use against targets in space and on Earth. Such a platform may eventually be used for ASAT and ballistic missile defense operations as well as for space station defense.

Despite some setbacks in their manned space program during the past several years, the Soviets have made considerable progress toward achieving a permanent, manned presence in near-Earth orbit. In 1984, two cosmonauts spent a total of over 20



Early SALYUT space stations had only one docking port. SALYUT-6 and -7 had two — one at each end. The new MIR space station has six. The Soviets have already docked an astrophysics module, a resupply spacecraft, and a manned ferry spacecraft to MIR. The four laterally attached space station modules shown in this artist's concept have not yet been docked to MIR.

hours in open space repairing a fuel line on SALYUT-7. In 1985, two other cosmonauts conducted a dramatic salvage mission to SALYUT-7, reactivating the space station after a malfunction in its electrical power system had left it "dead" in orbit.

In 1986, the USSR launched a new generation space station to replace the aging SALYUT-7. Ironically, the Soviets named this new space station "MIR" (Peace in Russian), though it has been, and probably will be, largely dedicated to military purposes. MIR is an impressive advancement over SALYUT-7, having enhanced solar energy and electrical power systems, greater computer capabilities, and individual "cabins" for crewmembers. Most significantly, while SALYUT-7 had only two docking ports, MIR has six — one rear axial docking port, one forward axial port, and four forward lateral ports.

The MIR core vehicle is essentially a habitation and flight control center. Most of the cosmonauts' military and scientific work will take place in specially outfitted space station modules attached at the various docking ports. These modules will provide the Soviets with greater flexibility in performing missions such as reconnaissance, targeting,

and military-related R&D, as well as research in fields such as astrophysics, biology, and materials processing.

With the launch of MIR, a space station module, and SOYUZ-TM, the Soviets are well on their way to fulfilling their goal of establishing a permanent manned presence in space. The modular space station will probably house 2 to 12 cosmonauts. In the early-to-mid 1990s, the Soviets should be able to construct a very large modular space station. They have discussed ultimately housing up to 100 cosmonauts in a large space complex.

Antisatellite Operations

In addition to space programs which could be construed as having both military and civilian applications, the Soviets have space systems which are purely military in nature. Indicative of the Soviets' military program for space is their development and maintenance of the world's only currently operational ASAT system, a ground-based orbital interceptor. Using a radar sensor and a pellet-type warhead, the interceptor can attack all current low-altitude satellites. A target engagement during the first orbit of the intercept leaves little time for a target satellite to take evasive action. The interceptor can reach targets orbiting at an altitude of more than 5,000 kilometers, but it probably is intended for high priority satellites at lower altitudes.

The antisatellite interceptor is launched from Tyuratam where two launch pads and storage space for many interceptors and launch vehicles are available. Several interceptors could be launched each day from each of the pads.

Given the complexity of launch, target tracking, and radar-guided intercept, the Soviet ASAT system is far from primitive. Soviet ASAT tests have been largely successful, providing them an operational system fully capable of performing its mission. Although the Soviets have not launched their ASAT system in several years, as part of their effort to forestall US development of an ASAT weapon, they have maintained their ASAT readiness. Over the past several years the Soviets have routinely launched the SL-11

The Soviets' operational antisatellite system attacks other satellites in orbit by maneuvering a conventional warhead within range and destroying the target with a multi-pellet blast.

ASAT booster with other payloads, thereby ensuring the reliability of this component of the system. Other components of the system can be tested on the ground without actually having to launch the ASAT system. Thus, the Soviet ASAT system continues to be a distinct threat to US low-altitude satellites.

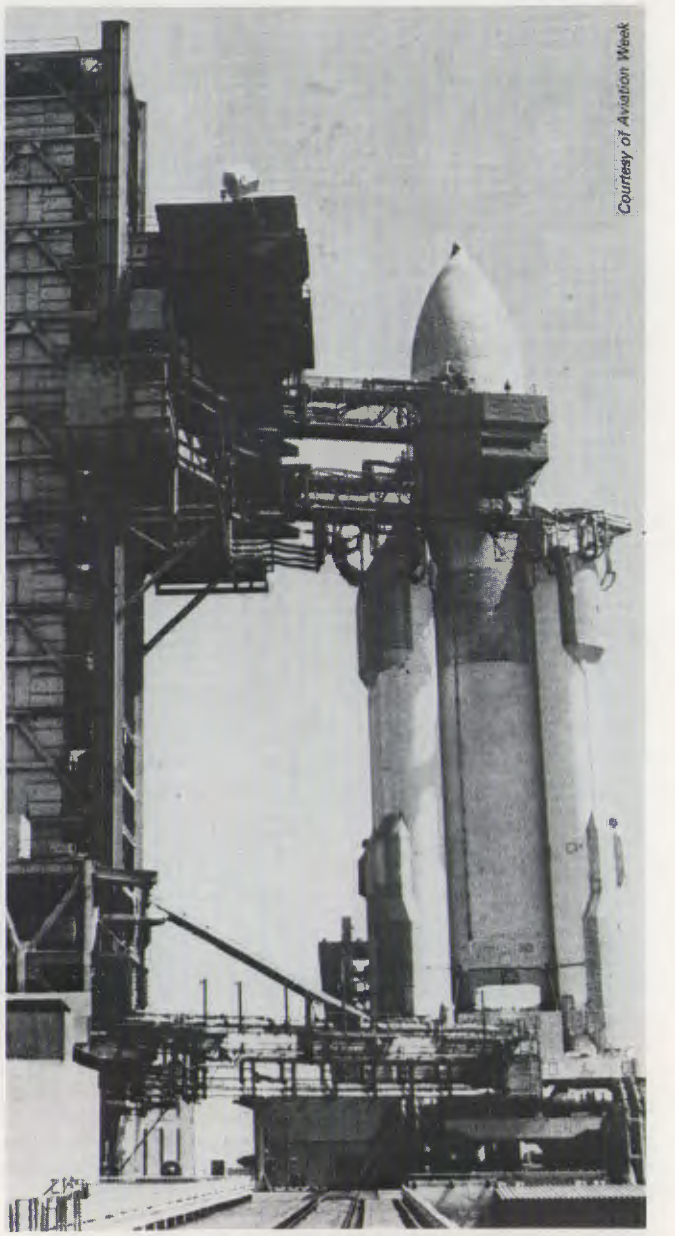
Other Soviet systems have ASAT capabilities. The nuclear-armed GALOSH ABM interceptor deployed around Moscow has an inherent ASAT capability against low-altitude satellites. Some of the lasers located at the Sary Shagan Missile Test Center may be capable of damaging sensitive components onboard satellites. Although weather and atmospheric beam dispersion may limit the use of ground-based laser ASAT weapons, such systems have the major advantage of being able to refire and therefore to attack several targets. The Soviets also have the technological capability to conduct electronic warfare against space systems.

During the next decade, the Soviets are likely to retain their current ASAT-capable systems while moving aggressively ahead in developing and deploying new ASAT systems. Their large-scale ballistic missile defense research and development efforts in laser, particle beam, radio-frequency, and kinetic energy technologies may soon provide them with additional ASAT capabilities.

The development of a space-based laser ASAT weapon that can disable several satellites is probably a high-priority Soviet objective. The Soviets may deploy space-based lasers for antisatellite purposes in the 1990s, if their technological developments prove successful. Space-based laser ASAT weapons could be launched on demand, or maintained in orbit, or both. By storing a laser weapon in orbit, the Soviets could reduce the time required to attack a target and hence decrease the warning time needed by the target to attempt countermeasures. The Soviets are also developing an airborne laser whose missions could include ASAT, with limited deployment possibly beginning in the early 1990s.

Space Program Costs

The high priority the Soviets are giving to their space program is reflected in the rapid overall growth of the program — a program that is absorbing a large share of the nation's most advanced and productive technology. During the past decade the cost of Soviet military space programs approached $80 billion. Since 1980, the estimated dollar costs of the overall Soviet space effort have increased substantially, owing largely to programs for the manned space stations, new launch vehicles, supporting facilities, and the shuttle orbiter. The projected rate of growth in the space program, driven by such things as the ambitious manned space program, future communications satellites, new reconnaissance systems, and space-based weapons is expected to outpace overall trends in both military spending and GNP well into the future.



The first flight test of the new heavy-lift vehicle, carrying a full-size and -weight satellite mock-up, occurred on 15 May 1987.

New Space Launch Systems

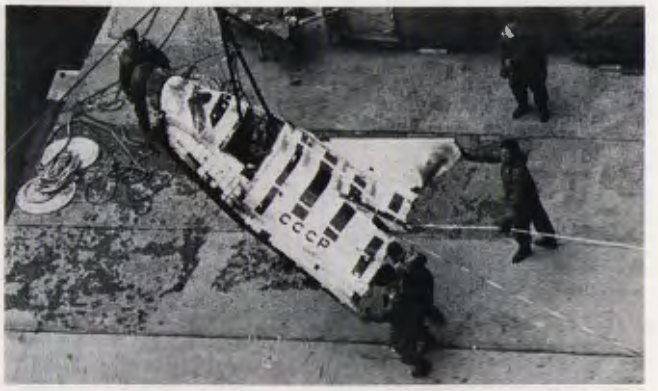
The success of the Soviet space program is due largely to its versatile and reliable inventory of space launch vehicles (SLVs) and to its space launch and support facilities. The Soviets launch a satellite every three or four days, using one of eight types of operational SLVs. The USSR's impressive ability to launch various boosters and to orbit spacecraft quickly gives the Soviets a distinct operational military advantage in any crisis. Most malfunctioning satellites could be rapidly replaced, and additional satellites could be launched to cover new or expanding crisis areas. In fact, if the entire Soviet satellite network were destroyed, it could be reconstituted almost totally in two to three months, assuming the required satellites were available.

Even with their current robust launch capability the Soviets are expanding their extensive family of SLVs with new expendable launch vehicles and reusable manned spacecraft. The deployment of the medium-lift Titan IIIC-Class SL-16 and the heavy-lift Saturn V-Class SL-X-17 will increase the number and payload weight of satellites the Soviets will be able to orbit.

On 15 May 1987, the Soviets conducted the first flight test of the SL-X-17, designated "Energiya" (Energy) by the Soviets. They openly announced that "military experts took part in creating and testing" the new launch vehicle. The Soviets reported that Energiya's first stage (the strap-on boosters) and the second stage (the core vehicle) operated as planned: "the aims and objective of the first launching have been fully met." They also stated that an attempt was made to orbit a full-size and -weight mock-up of a payload during this test. The engines on the mock-up apparently did not function properly and it splashed down in the Pacific Ocean. The failure of the payload, however, was not due to problems with the booster, which performed flawlessly. Thus, the SL-X-17's performance on its maiden flight was another dramatic achievement for the Soviet space program.

The SL-X-17 heavy-lift vehicle will be used to launch the Soviet space shuttle orbiter as one of its payloads. Launch pad compatibility testing of an orbiter attached to the SL-X-17 vehicle may already have taken place; if so, a test flight could occur soon. By using US propulsion, computer, materials, and airframe technology and designs, the Soviets were able to produce an orbiter years earlier, and at far less cost, than if they had depended solely on their own technology and engineering. Resources including money and scientific expertise could thus be diverted to other areas.

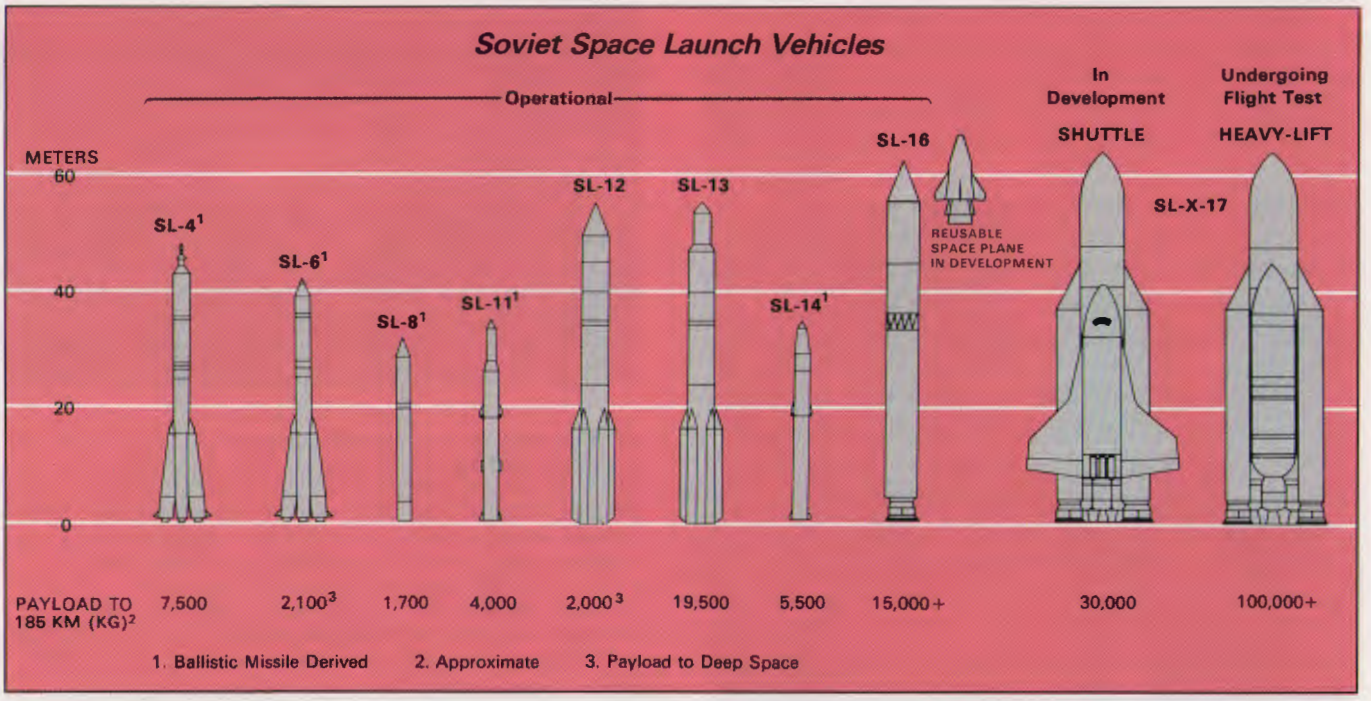
Development of a heavy-lift launch system with its main engines on the core vehicle rather than the orbiter gives it the versatility to launch either an orbiter or other very heavy payloads. The SL-X-17, for example, will be able to place payloads of over 100,000 kilograms into low Earth orbit, a figure comparable to that carried by the discontinued US Saturn V. Potential payloads include modules for a large space station, components for manned and unmanned interplanetary missions, and perhaps directed-energy ASAT and ballistic missile defense weapons.

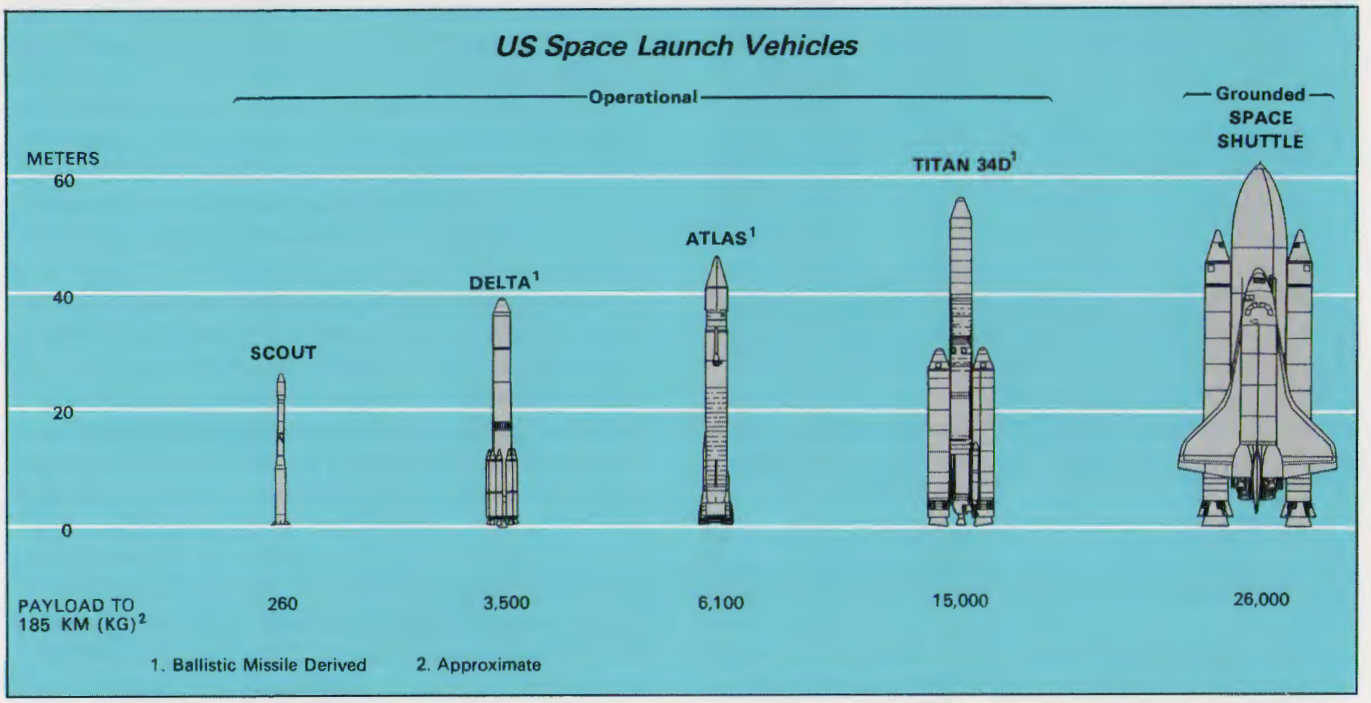


Shown above is a subscale model of a possible Soviet space plane. The Soviets have already conducted orbital test flights of this subscale model. A full-scale space plane, which could carry a crew of 2 to 4 cosmonauts, would most likely be launched on the SL-16. Space plane missions may include crew ferry, reconnaissance, satellite inspection, and satellite negation.

The SL-16 booster is capable of placing a payload of more than 15,000 kilograms into low Earth orbit. This capability fills a gap in the current SLV inventory for an economical means of launching medium-weight payloads. One candidate payload for the SL-16 could be a space plane, a different program than the space shuttle. A subscale version of this vehicle has been flight-tested in orbit and a possible full-scale version could be in production. A small, manned spacecraft could be used for quick-reaction, real-time reconnaissance missions, satellite repairs and maintenance, crew transport, space station defense, satellite inspection and, if necessary, satellite negation. Although the SL-16 has placed operational payloads into orbit and is now fully operational, the Soviets are not expected to launch a space plane until they have had sufficient experience with the SL-16. Testing of a full-scale space plane, however, could begin in the next few years.

The introduction of the SL-16 and SL-X-17 into the family of Soviet space launch vehicles, coupled with an expected greater use of the SL-12 and SL-13 launch vehicles,

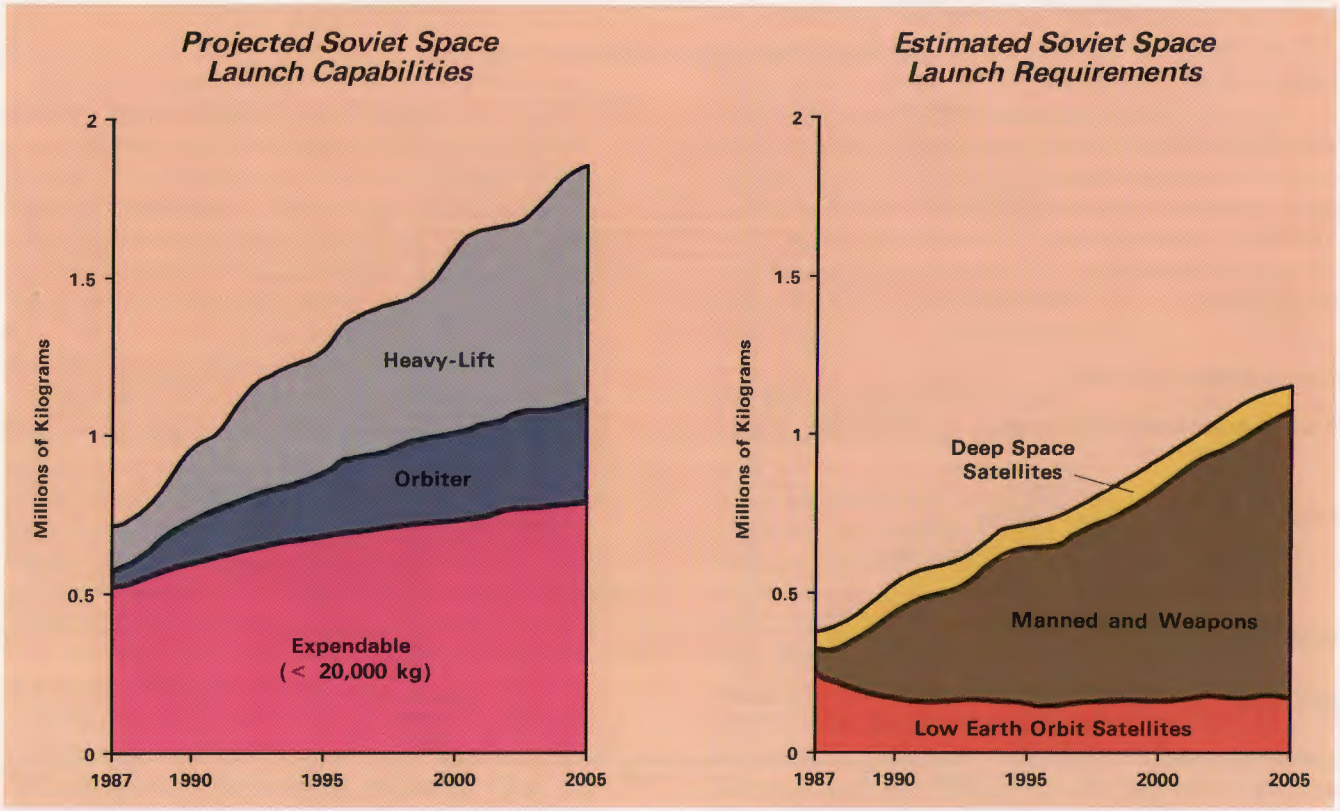




will dramatically increase the payload weight the Soviets will be capable of launching into space. In fact, during the next 5 years, we anticipate a doubling of the annual payload weight the Soviets will be launching into orbit compared with the payload weight launched in 1986, and a quadrupling of that weight within 15 years.

Advanced Technologies in Space

In the late 1960s, the USSR initiated a substantial research program into advanced



technologies applicable to ballistic missile defense systems. This effort covers many of the same technologies currently being explored for the US SDI but involves a much greater investment of plant space, capital, and manpower. The USSR will probably increase its efforts to acquire Western technologies associated with space and the SDI program to enhance its own programs.

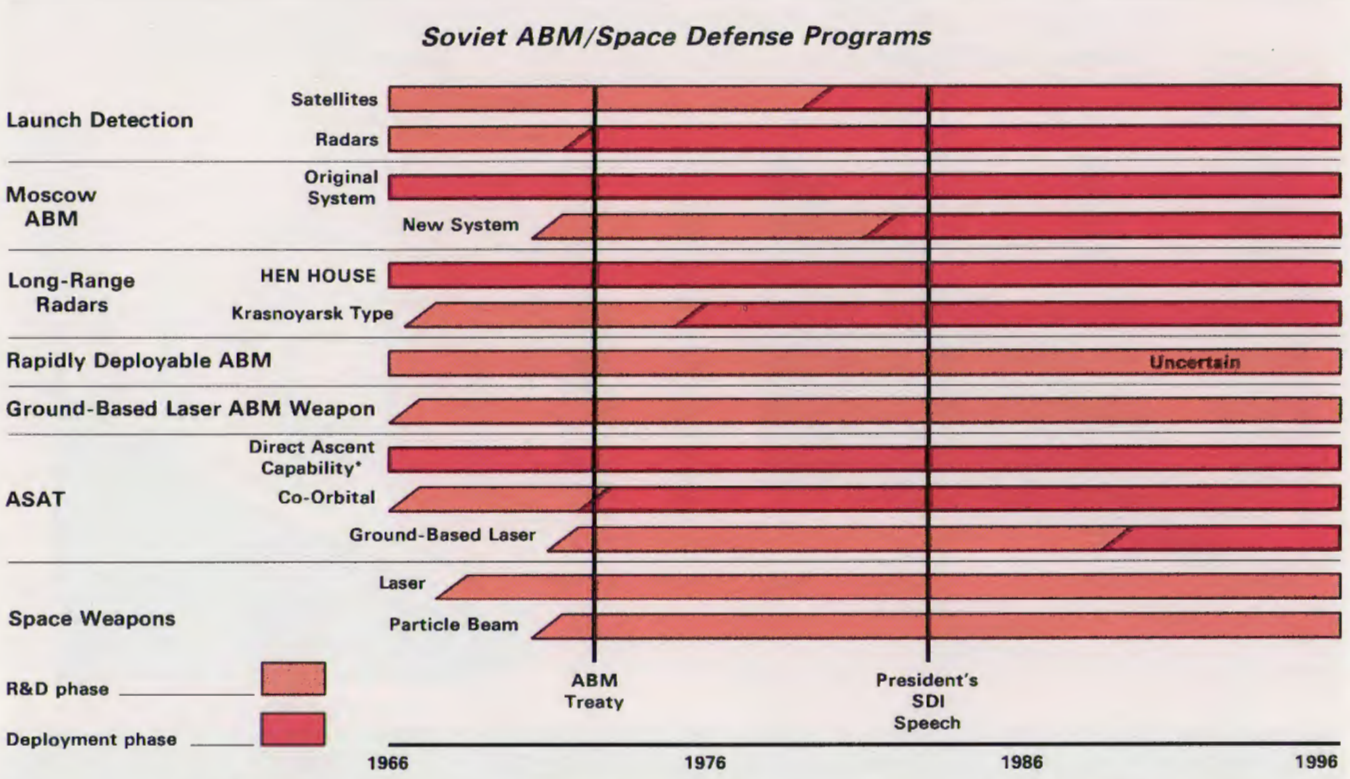
Many of the systems developed in the following programs will eventually be space based. These developments and the progress being made by the Soviets in other areas of their space program, such as their heavy-lift boosters, are a challenge for the near future.

Laser Weapons

The USSR's laser program is larger than US efforts and involves over 10,000 scientists and engineers as well as more than a half-dozen major R&D facilities and test ranges. Much of this research takes place at the Sary Shagan Missile Test Center, where ABM testing also is conducted. At Sary Shagan alone, the Soviets are estimated to have several lasers for air defense and two lasers probably capable of damaging some components of satellites in orbit, one of which could be used in feasibility testing for ballistic missile defense applications. The Soviet laser weapons program would cost roughly $1 billion a year in the US.

Scientists in the USSR have been exploring three types of lasers that may prove useful for weapons applications — the gas-dynamic, the electric discharge, and the chemical. They have achieved impressive output power levels with these lasers. The Soviets are possibly exploring the potential of visible and very-short-wave-length lasers. They are investigating the excimer, free-electron, and x-ray lasers, and have been developing argon-ion lasers.

The Soviets appear generally capable of supplying the prime power, energy storage, and auxiliary components for their laser and other directed-energy weapons programs. They have probably been developing optical systems necessary for laser weapons to track and attack their targets. They



Soviet programs for ABM and Space Defense, which include advanced technologies and space-based weapons, were in place prior to the 1972 ABM Treaty and have continued to expand in scope and size. During the same time period, US ABM/Space Defense research has been limited in scope as well as level of effort in terms of resources invested.

*Potential capability of the Moscow ABM system.

produced a 1.2-meter segmented mirror for an astrophysical telescope in 1978 and claimed that this reflector was a prototype for a 25-meter mirror. A large mirror is considered necessary for a long-range space-based laser weapon system.

The USSR has progressed in some cases beyond technology research. It has ground-based lasers that have some capability to attack US satellites and could have a prototype space-based antisatellite laser weapon by the end of the decade. Additionally, the Soviets could have prototypes of ground-based lasers for defense against ballistic missiles in the near future and could begin testing components for a large-scale deployment system in the early 1990s.

The remaining difficulties in fielding an operational laser system will require more development time. Hence, operational ground-based lasers for defense against ballistic missiles probably could not be deployed until the late 1990s or after the year 2000. If technological developments prove successful, the Soviets might be able to deploy a space-based laser system for defense against ballistic missiles after the year 2000. The Soviets' efforts to develop high-energy air defense laser weapons are likely to lead to ground-based deployments in the early 1990s and to naval deployments in the mid-1990s.

Particle Beam Weapons

Since the late 1960s, the Soviets have been exploring the feasibility of using particle beams for a space-based weapon system. They may be able to test a prototype space-based particle beam weapon intended to disrupt the electronics of satellites in the 1990s. An operational system designed to destroy satellites could follow later; however, application of a particle beam weapon capable of destroying missile boosters or warheads

may require several additional years of research and development.

Nevertheless, Soviet efforts in particle beams, particularly ion sources and radio-frequency accelerators for particle beams, are impressive. In fact, much of the US understanding of how particle beams could be made into practical weapons is based on published Soviet research conducted in the late 1960s and early 1970s.

Radio-Frequency Weapons

The USSR has conducted research in the use of strong radio-frequency (high-power microwave) signals that have the potential to interfere with or destroy critical electronic components of ballistic missile warheads or satellites. The Soviets could test a ground-based radio-frequency weapon capable of damaging satellites in the 1990s.

Kinetic Energy Weapons

The Soviets also have research programs underway on kinetic energy weapons, which use the high-speed collision of a small object with the target as the kill mechanism. In the 1960s, the USSR developed an experimental "gun" that could shoot streams of particles of a heavy metal, such as tungsten or molybdenum, at speeds of nearly 25 kilometers per second in air and more than 60 kilometers per second in a vacuum.

Long-range, space-based kinetic energy weapons for defense against ballistic missiles probably could not be developed until at least the mid-1990s. However, the Soviets could deploy in the near term a short-range, space-based system for space station defense or for close-in attack by a maneuvering satellite. Current Soviet missile guidance and control systems are probably adequate for effective kinetic energy weapons use against some objects in space, such as satellites.

Computer and Sensor Technology

Advanced technology weapons programs — including potential advanced ASATs and defenses against ballistic missiles — are dependent on remote sensor and computer technologies. These are areas in which the West currently leads the Soviet Union. The Soviets are devoting considerable resources to acquiring Western know-how and to improving their abilities and expertise in these technologies. An important part of that effort involves the increasing exploitation of open and clandestine access to Western technology. For example, the Soviets operate a well-funded program through third parties and front organizations for the illegal purchase of US high-technology computers, test and calibration equipment, and sensors.

IMPLICATIONS FOR US NATIONAL SECURITY

The Importance of Space

Since the end of World War II, our fundamental national security objective has been to safeguard the United States and our allies by deterring aggression. This fundamental objective is supported by a national military strategy which underwrites deterrence by placing US forces forward — in proximity to the immediate threat in both Europe and the Pacific — and by maintaining the ability to rapidly mobilize and reinforce those forces with reserves located in the United States. In addition, deterrence today requires highly capable, modernized theater and strategic nuclear forces.

Deterrence depends on more than the capability of our land, sea, air, and space forces. It also depends on an adversary's perceptions about those capabilities and our willingness to employ them to safeguard our interests. It is imperative that the Soviets understand that an act of aggression against the US could result in prompt, decisive, and effective military action in response.

Over the past 20 years, space assets and the medium in which they operate have taken on tremendous importance in the calculus of deterrence. US forces and the strategy they support depend heavily on access to space and space defensive systems. The Soviets also use space systems and, while they possess redundant non-space-based systems capable of performing many of the same missions, they are becoming increasingly reliant on space.

Like the oceans and the atmosphere, space is an operating medium for the military forces of the United States as well as

the Soviet Union and other nations. All countries realize that forces operating in space contribute directly to their overall military posture.

Unlike US space activities which are driven by civil, military, and commercial requirements, the primary impetus of the Soviet space effort is military programs and activities, including antisatellite systems. The diverse and complementary ASAT capable systems now in the Soviet inventory are able to destroy, damage, or interfere with US and Allied spacecraft. The USSR could deny us much of the vital support our military spacecraft provide, and make it almost impossible to freely and safely operate in space. Our response to this extant challenge will determine whether or not the United States remains able to deter the Soviets, and equally important, whether or not free passage through space during a crisis or war can be maintained.

Freedom of passage through space is a principle embodied in international treaty.[1] The vital nature of all our space systems, the Soviet intention to control space during conflict, and the existence of Soviet antisatellite systems all suggest that we should take prudent steps to ensure free passage, and defend our own and Alliance space systems.

US Military Resources in Space

There is a widely held view that space is an inviolate sanctuary which must remain free of military presence. This perception is erroneous, as space has been used for military purposes for decades.

Today, space systems are used routinely for essential military functions such as communications, navigation, and surveillance — all on a global basis and with speed, reliability, and efficiency that are superior to many terrestrial systems. For example, military satellites are the primary means by which we are able to detect immediately the launch of ballistic missiles. These satellite systems alone are absolutely vital to deterrence because they deny an adversary the element of surprise, provide our national command authority the time necessary to determine the nature and size of an attack, and allow us time to warn our land, sea, and air forces of an attack. This warning time allows our national leadership the time required to implement an effective response.

Additionally, we rely on our military communications satellites to relay vital data and instructions instantaneously to our deployed forces and diplomatic centers worldwide. About 70 percent of our worldwide military communications travel via space-based systems. In addition, a space-based navigation system has been providing US naval forces with vital positioning data over the world's oceans continuously since 1961. The US is in the process of deploying a new space-based navigational system which will improve the efficiency and combat effectiveness of all of our forces. The NAVSTAR Global Positioning System will provide precise three-dimensional data to all our forces. These data will be vastly superior to the data available from current navigational aids.

Space systems also provide support to civilian and military decisionmakers during periods of crisis or tension. This support makes it possible to employ the various instruments of national power to stabilize and defuse a crisis without committing military forces to combat. US space systems also contribute significantly to our national security by providing the means to monitor and verify Soviet compliance with arms control agreements. Without such systems compliance with agreements would be much more difficult to verify.

US military space resources also include a worldwide array of ground-based space surveillance sensors which continuously monitor the activity of most orbiting spacecraft. As in any other operational medium, it is essential to know precisely what is taking place in space, and whether or not a given activity might be threatening or hostile.

[1] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (1967 Outer Space Treaty).

The surveillance of activity in space is an essential prerequisite to being able to control operations in space in peace or in war.

Access to space and the military systems in space make a fundamental contribution to our national security. Their value might best be understood by examining the potential impact of their loss.

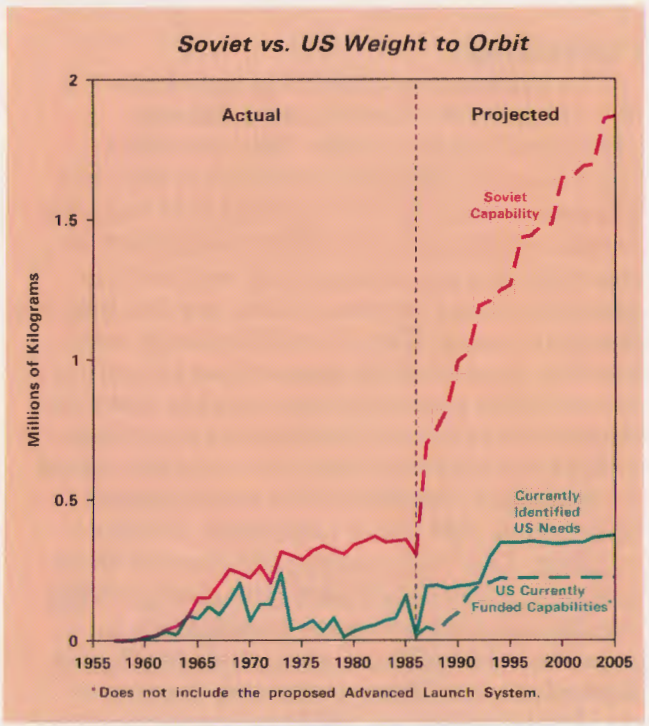
Strategic Role of Space

A critical factor in the outcome of military conflicts has always been the weather. Knowledge of environmental conditions in enemy territory would be significantly decreased without weather observation satellites in space. Lack of timely weather data could conceivably result in ill-timed or misdirected military operations.

Communications satellites also provide vital support to military intelligence operations. For example, intelligence nets which support ground, air, and fleet operations are connected via satellites. While secondary communications systems also connect the intelligence nets, they are limited in capacity and cannot satisfy current operational requirements. A degradation in satellite communications capability would also result in the loss of vital targeting data necessary to engage successfully a hostile force on land, sea, or in the air. Satellite communications are essential to the successful prosecution of combined-arms operations, and the execution of our Maritime Strategy, the AirLand Battle, and the Follow-On Forces Attack. Satellite communications also are used for battle group command nets and submarine communications, as well as ship-to-shore and shore-to-ship communications. Loss of these nets could mean less effective defensive or strike operations with the attendant risk of the loss of personnel, aircraft, and ships; and loss of the large number of space-based, long-haul communications circuits would also reduce the efficiency of logistics, command and control, warning, and other vital support operations.

Without spaceborne assets, military aircraft already committed to and depended upon by commanders engaged in other vital operations would have to be diverted to both strategic and tactical surveillance operations. Additionally, targeting for long-range air interdiction and counter-air operations would be severely restricted.

The loss of the ability to transit freely and use space would have an adverse impact on the United States not only in peacetime, but particularly in crisis or war. The Soviet antisatellite systems could curtail the use of space to the United States or our Allies, while the West is unable to respond in kind. Consequently, the Soviets would be able to continue to operate space systems which directly threaten US and Allied forces, such as the Soviet RORSAT and EORSAT satellites, two unique military spacecraft used to locate and target maritime forces. Hence, in a crisis or wartime, our inability to operate freely in space, or to deny the enemy unrestricted use of space, would have an adverse impact on all Western land, maritime, and aerospace forces.



Our assessment of the Soviet weight-to-orbit capability is based on a conservative forecast of launch rates. The forecasted launch rate clearly provides the Soviets with the capability to place in orbit many satellites, possibly including advanced weapons for ballistic missile defense.

Denial of US military support from space risks the loss of many vital land, sea, and air assets — assets essential to successful military operations. Without the ability to conduct space operations in support of defense forces, an adversary would have significant unilateral military advantages provided by the unhampered ability to use space-based surveillance, communications, and navigation systems, while simultaneously denying us similar capabilities.

An enemy would have the advantage of precise knowledge of force dispositions and environmental conditions in an area of interest. Armed with this knowledge and using space-based communications, he could more efficiently execute command and control of his forces for a more effective attack on our forces. An enemy advantage in any area — communications support, navigational aids, surveillance, or warning — would be serious enough; but an enemy advantage in all of these areas could well be disastrous.

Conclusion

The systems we operate in space are absolutely vital to our nation during peacetime, crisis, or war. We must take the necessary steps to ensure that they are protected. Just as it is unthinkable that we would relinquish freedom of navigation at sea or in the air, so too must we take the necessary steps to ensure that we can operate freely in space. The United States is more heavily dependent on space than any other nation. Our space systems provide essential support to civil and commercial activities and to our globally deployed military forces in peacetime, crisis, during contingency operations, and, most important, during conflict. Our national dependence on these systems is not only clear; it is also growing. While our military space systems are a manifestation of our national strength, our dependence on them could also become a weakness unless we take the steps necessary to protect them.

It is equally important that we develop and maintain our ability to place our satellites in space. The tragic loss of the space shuttle Challenger and the failures experienced in our other launch systems have brought to the forefront discussions on the reliability of our launch means. In response, two new series of expendable launch vehicles — the Titan IV and Delta II — are being developed. In addition, DOD is working with NASA to develop a new heavy-lift launch vehicle. These programs are essential to all our future civil, military, and commercial programs.

Clearly, the Soviets understand the long-term strategic importance of space. Their current and planned space programs and their developing capabilities are structured for maximum future exploitation of space operations. The chart on page 19 clearly illustrates that between now and the year 2005 the Soviets will deploy a tremendous weight-to-orbit capability. Their identifiable launch requirements, we estimate, will be two to three times our own, while their projected launch capacity between 1990 and 2005 is nearly double any requirement that we can presently identify. This raises the possibility that the Soviets are already considering the lift requirements necessary to expand rapidly their large-scale military presence in space.

Today we face a situation in which the Soviets can negate many critical US space assets while their space systems that would support their offensive military operations enjoy a sanctuary in space. This situation does not contribute to a stable deterrence. If this situation is allowed to persist, deterring future aggression will become ever more difficult. Recognizing the issue and the importance of space as well as undertaking the measures to redress the situation will contribute to US national security and reduce the risk of war in the future.

Without the ability to access and operate freely in space, we would relinquish the ultimate high ground to our adversaries — if only by default. Our adversaries could more effectively bring their military power to bear against us while the capability of our land, sea, air, and space forces would be sharply reduced. These are not just the future challenges of space — these are the challenges that face us now.


DEPARTMENT OF DEFENSE
UNITED STATES OF AMERICA