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USSR: Military and Space Systems in Development—Improving Capabilities for the 1990s

A Research Paper

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August 1986

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USSR: Military and Space Systems in Development—Improving Capabilities for the 1990s

A Research Paper

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USSR: Military and Space Systems in Development— Improving Capabilities for the 1990s

Preface

This report provides an overview of the extensive Soviet effort to develop new and modernized military systems. It lists the systems that we have identified in development, briefly discusses their principal design organizations, projects their initial operational capability, and summarizes technology and performance trends in each major mission area. The weapons developments described in this paper, for the most part, have been addressed in relevant National Intelligence Estimates and other more weapons-specific analyses. This is an effort to bring together a comprehensive view of what the Soviets have under development in each mission area.

SW 86-10021D
SOV 86-10025D
August 1986

USSR: Military and Space Systems in Development— Improving Capabilities for the 1990s

Key Judgments

Information available as of 1 January 1986 was used in this report.

The USSR is expanding and improving its war-fighting capabilities by the continuous development of new and highly modernized weapon, support, and command and control systems. The Soviets have at least 123 military systems in development, most of which will achieve initial operational capability by the mid-1990s

Future Soviet systems, including some of those currently in development, will use greater amounts of advanced technologies. In some mission areas, this increase in technology level will lead to the development of fewer but more complex systems. Soviet systems will thus be more comparable in performance characteristics to US and NATO systems. Most of the improvements in Soviet weapons will be based on advances in computers, electronics, and materials technologies. At the same time, service life will be significantly lengthened and the technical capabilities of some older systems increased by adapting new technologies to them

Our assessments of the status of Soviet developments in strategic, theater, and tactical forces weapons and in military space applications are summarized below.

Strategic Warfare. We believe the Soviets will continue their efforts to increase the lethality of their ballistic missile systems through improved accuracy obtained by upgraded navigation subsystems and through the possible use of terminal guidance on maneuverable reentry vehicles. In addition, significant increases in throw weight could result from advances in engine design and propulsion. The survivability of the force will be enhanced by the development of road- and rail-mobile systems although at some cost to accuracy and reliability. Soviet strategic offensive systems in development also include a new long-range supersonic bomber and new long-range cruise missiles, some with terminal guidance. The Soviets will extend their strategic defensive capabilities to lower altitudes and more deeply in space. A variety of ground-based and airborne systems are being developed; these include a two-layered antiballistic missile (ABM) system, new early warning and target tracking systems, surface-to-air missiles, and interceptor aircraft

Theater Nuclear Forces. We believe the Soviets' major technological improvement in their theater nuclear forces will be in short-range ballistic missile guidance. Expected improvements in accuracy probably will reduce miss distances [redacted] using both inertial- and terminal-guidance systems. These improvements will greatly increase the lethality of Soviet systems and allow them to use smaller nuclear and improved conventional warheads against certain targets.

Tactical Land Warfare. Soviet development of new tactical weapon systems will continue to emphasize mass firepower and mobility, and the capability to discover, pinpoint, and destroy the enemy. Technical improvements in assault vehicles, helicopters, firepower systems, and air defense weapons will stress improved armor protection, missile guidance and propulsion, guided artillery munitions, radars, and lasers.

Tactical Air Warfare. We believe the Soviets will continue evolutionary improvements of their combat and support aviation elements. They probably will emphasize aircraft survivability first and weapon system efficiency second. Future fighters will be deployed with radars and missile systems that will significantly enhance the Soviets' air-to-air capability. We believe they will achieve all-aspect, lookdown/shootdown capability against small radar cross section targets in ground clutter. Soviet tactical airlift capabilities will be enhanced by the deployment of two new transports, including the Condor, a C-5–like aircraft capable of carrying a maximum payload of 150 metric tons to a distance of over 3,000 kilometers.

Tactical Naval Warfare. We believe that, although the Soviets' primary emphasis will continue to be on the improvement of the war-fighting capabilities of the Navy, by the mid-1990s there will also be substantial improvements in their capability to use naval forces to project power in distant areas. They have in development three new, fast, deep-diving attack submarines with markedly improved quieting characteristics. The first unit of a new class of large aircraft carrier was launched in 1985 and should be operational by 1990. [redacted], we are uncertain of its weaponry, aircraft, and power plant. In addition, the Soviets are developing modernized versions of their antiship and air defense weapons that have improved sensors and guidance systems.

Military Applications of Space. We expect the Soviets to operate large, permanent space stations that will support global military operations. To do this they are developing a heavy-lift launch vehicle, a reusable space transport system, and a space tug. Military missions in space will include intelligence collection using a near-real-time imagery satellite, as well as command and control using improved precision navigational and continuous-broadcast satellites. Research and development are under way on new intelligence collection and communications systems

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Contents

Strategic Nuclear Forces and Supporting C3I

USSR: Military and Space Systems in Development—Improving Capabilities for the 1990s

Introduction

As of 1 January 1986 the USSR was developing at least 112 military systems, comprising weapon, surveillance, command, control, communications, and space systems. The systems successfully developed and produced will constitute an important share of Soviet strategic and theater forces into the next century. We also have identified 11 civil and/or scientific space programs, at least some of which will support present or future military R&D initiatives. The following tabulation shows the breakdown of the systems by type of program:

Strategic forces	37
Offensive	18
Defensive	16
C3	3
Tactical forces	58
Theater nuclear	3
Ground	23
Front aviation and airlift	10
Naval	22
Space	28
Military	17
Civil and/or scientific	11
Total	123
Military	112
Civil and/or scientific space	11

We have categorized the Soviet weapon development programs according to the US Department of Defense's major mission areas and have grouped them into six overall sections. Each section consists of a discussion of the major qualitative improvements expected to result from current Soviet development efforts. This discussion is followed by a list of individual programs (shown in tables 1 through 6) that we have identified [ ]

The categories of systems are defined as follows:

- *New Systems.* These systems have technological characteristics that are, in the broadest possible context, unique, new, or otherwise significant. New systems represent overall system designs that are significantly different from previously developed systems of the same generic type. For example, the SS-X-24 ICBM and the Blackjack bomber are both new systems.
- *Modernized Systems.* These systems are based on extensive modernization of an existing system. To improve performance characteristics, the systems incorporate extensive changes in the design, materials, or manufacturing of components and subsystems. The SS-18 Mod 4, which has significant improvements over earlier SS-18 versions, is an example of a modernized system.
- *Modified Systems.* These systems are design variants of an existing system in which relatively minor changes have been made. The mobile SA-10 surface-to-air system represents a modified variant of the basic SA-10 design

Our estimates of IOC [1] and program start dates are based on the Soviet process for managing the development of military systems. This process establishes well-defined milestones to be met in the course of a development program

The estimated start date indicates when the decision was made to authorize a full-scale engineering development program. This decision establishes a detailed development schedule that the general designer of the system is expected to meet. Therefore, the general designer—and the subsystems designers—adopt only

[1] See appendix for acronym

those technologies that have matured to the point where they can be incorporated into a program with little or no prospect for program failure. In effect, the start date marks a de facto "technology freeze," making the start date a good indicator of the general level of technology available for incorporation into a system design.

We can normally estimate IOC dates for systems nearing the completion of their development cycle with moderate-to-high confidence. It is inherently more difficult to project IOC dates for systems in earlier stages of development, for "one of a kind" systems (such as civil and/or scientific spacecraft), or for particularly complex systems (such as large radars) that take many years to build. Moreover, unforeseen problems, especially in the development of complex systems, may cause delays that we are often unable to detect until several years after the fact.

The development program for a Soviet military system is managed by a general designer whose organization functions as the integrating contractor. This role is typically performed by one of the many Soviet design bureaus and research institutes. In this role, it manages the development of all subsystems via an extensive network that taps into other industrial design bureaus and research institutes. The general designers are subordinate to the specific industrial ministries that are responsible for developing and producing particular types of systems.

The general designers have established product specialties that in most cases extend back several decades. For example, the Tupolev Design Bureau under the MAP develops long-range bombers; the Antonov Design Bureau, also under the MAP, develops transport aircraft. Similarly, the networks for subsystem hardware development have been sustained with relatively minor organizational changes over the past two decades. Although these programs commonly draw upon the resources of a dozen or more separate industrial ministries, such interaction is not synonymous with competition—as practiced in the West.

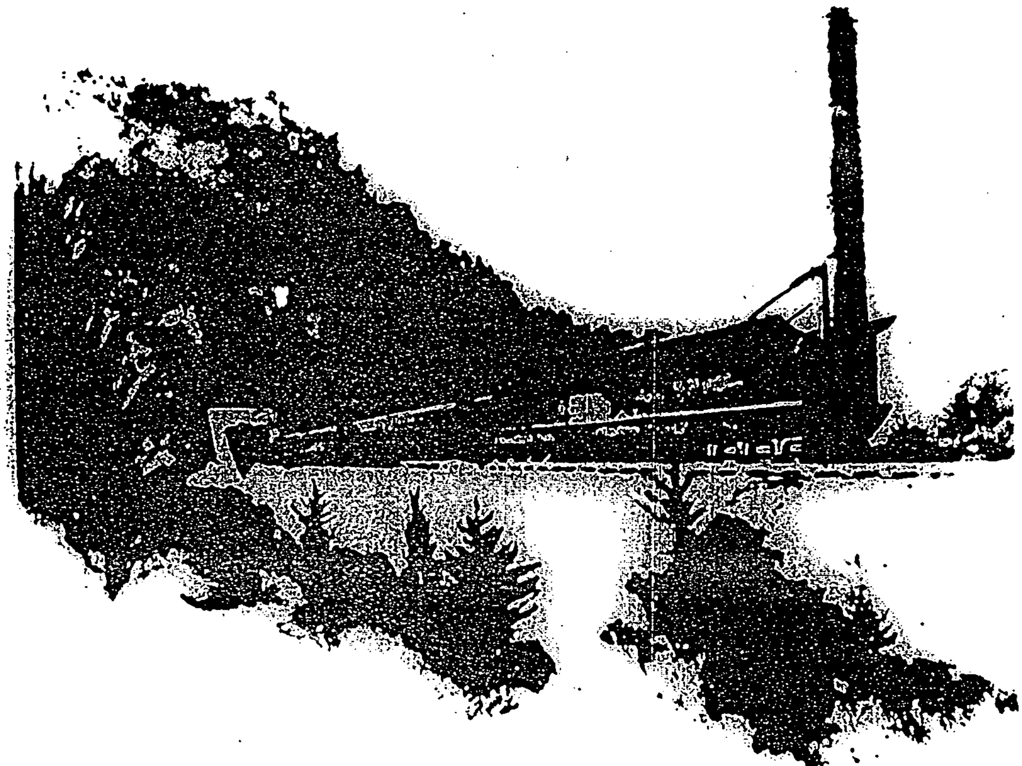
In addition to the 123 weapon and space programs, we have also identified [ ] military-related building complexes that are part of command, control, and communication systems and [ ] that could have a weapons role as well as a sensor mission.

[ ]

By the end of 1985 the Soviets would have had to decide which military programs they would begin to develop in the 12th Five-Year Plan (1986-90). Programs initiated during this five-year plan probably will include many of the Soviet military systems that will reach IOC in the mid-to-late 1990s and that will remain operational well into the next century.

Strategic Nuclear Forces and Supporting C3I

Figure 1
Artist's Conception of Soviet Rail-Mobile SS-X-24 ICBM



The Soviets continue to stress mobility in ensuring the survivability of their strategic forces. Beginning in 1987, the 10-RV SS-X-24 ICBM will be deployed on a rail-mobile launcher.

Strategic Nuclear Forces and Supporting C3I

Strategic Offensive

The strategic systems projected to begin deployment in the late 1980s and the early 1990s are largely evolutionary improvements to the new generation of systems in flight-testing. These improved systems include a modernized version of the SS-18 heavy ICBM; modernized variants of the silo- and rail-mobile-based SS-X-24 (see figure 1) and the road-mobile SS-25; a modernized solid-propellant SS-N-20-class SLBM; and a modernized variant of the liquid-propellant SS-N-23 SLBM. Additionally, the Soviets' new strategic bomber and three new long-range land-attack cruise missiles also are nearing deployment

In the 1980s survivability of land-based ICBMs has become a primary concern of the Soviets. System survivability will be enhanced by increasing rail and road mobility and by hardening critical missile subsystems against nuclear effects although at some cost to accuracy and reliability. Increasing use of solid-propellant systems facilitates mobile-basing modes and reduces maintenance requirements. The Soviets will continue their efforts to increase the lethality of their ballistic missiles by improving accuracy in several ways such as upgrading navigation subsystems, the possible use of external navigational aids—including satellites—and of terminal guidance. Missiles that will become operational in the late 1980s undoubtedly will carry improved inertial navigation systems. Advanced RV nosetip materials for MIRVs, which are being developed for nearly all Soviet strategic ballistic missile systems, can also lead to modest improvements in accuracy

Naval system development efforts since the 1970s have stressed long-range MIRVed SLBMs that will be deployed in protected bastion areas. In addition, we believe the Soviets are moving toward a hard-target capability for their SLBM force both by improving inertial navigation systems and by possibly developing a MaRV system. An improved SS-N-18-class missile—the SS-N-23—is expected to reach IOC in early 1986 aboard the new Delta-IV-class SSBN. This missile has increased throw weight and a MIRVed payload. A follow-on to the SS-N-23 is expected in the late 1980s or early 1990s. A modernized version of the SS-N-20 having improved propellant and more

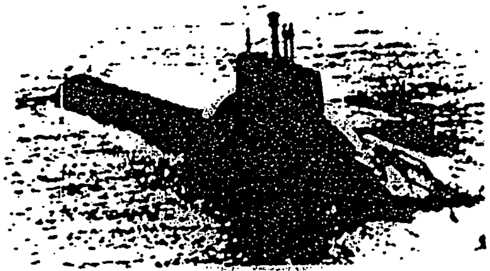


Figure 2. Typhoon-class SSBN

accurate inertial guidance probably will be deployed in the late 1980s. In addition, a MaRVed variant of this missile is projected for the early 1990s

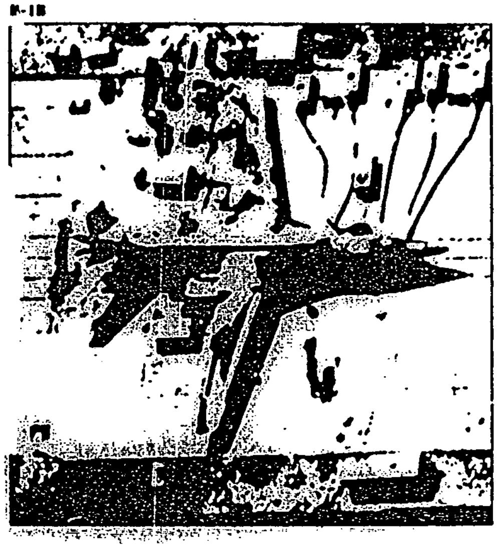
The operational life of the Delta-II-, Delta-III-, and Typhoon-class SSBNs (see figure 2) should extend through the 1990s. We are uncertain how SLBMs in development will differ from currently deployed systems or whether they will require new deployment platforms

The Soviets have one new strategic bomber—the Blackjack A—in development (see figure 3). It is similar to the US B-1B strategic bomber and probably is designed for long-range subsonic cruise with supersonic high-altitude dash and subsonic/transsonic low-level penetration. When deployed, the Blackjack A will carry both bombs and long-range ALCMs.

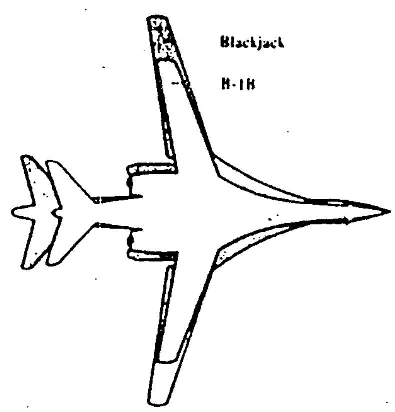
The Soviets are developing two significantly different kinds of long-range land-attack cruise missiles. One kind is a subsonic low-altitude cruise missile having an estimated maximum range of 3,000 to 3,500 kilometers (km). There are three variants of this missile—the SS-NX-21 SLCM, the AS-15 ALCM, and the SSC-X-4 GLCM. These missiles, which are similar to the US Tomahawk and ALCM systems, have some form of position update that possibly uses a system similar to the US TERCOM navigational system. The second kind is a supersonic cruise missile that has flown at an altitude of about 20,000 meters to a range of approximately 2,000 km. This missile utilizes advanced propulsion technology. The Soviets

Figure 3
Comparison of New US and Soviet Long-Range Strategic Bombers

B-1B



The new Soviet strategic bomber Blackjack A has a variable geometry wing and is similar in appearance but larger than the US B-1B. When deployed, Blackjack will carry both bombs and long-range cruise missiles.



are developing an SLCM version of this missile designated the SS-NX-24 and may be developing a GLCM as well.

Strategic Defensive

A variety of ground-based and airborne systems are being developed that will extend the coverage of Soviet strategic defenses to lower altitudes and more deeply into space. These new systems incorporate advances in established technologies such as propulsion, aerodynamics, radars, and computers.

The upgraded, two-layer ABM defense system for the Moscow area, which will become operational in the late 1980s, will form the basis of the ABM system through the year 2000 However, the Soviets are pursuing a number of missile defense efforts, including the testing of an advanced tactical SAM that we believe will have some capabilities against TBMs and a potential against some strategic missile RVs.

The Soviets are developing and deploying new air defense systems designed to improve their early warning and detection, tracking, command and control and intercept capabilities against low-altitude bombers. Some of these new weapons have the capability to intercept low-altitude cruise missiles.

Soviet interceptor aircraft, such as the SU-27, probably will have lookdown/shootdown capabilities, high maneuverability, and improved rear-hemisphere detection.

Antisatellite Weapons

The Soviets have an ASAT interceptor and several other means of conducting ASAT operations, including the Galosh ABM interceptor and the ground-based high-energy lasers at Saryshagan. These systems provide the Soviets with a limited ASAT capability. It is particularly limited against high-altitude targets. We fully expect the Soviets to continue attempts to strengthen their ASAT capabilities. They are engaged in a number of technology development programs, some of which, if successful, will provide the Soviets with the technological basis for initiating ASAT weapon development programs before the end of this century. These technology development programs include work applicable to high-energy lasers, particle beam, radiofrequency, and kinetic-energy weapons.

Supporting C3I

Future improvements in operational command and control capabilities will assure national command authorities more rapid and direct control of forces and weapons. By the 1990s the Soviets will have an improved technical warning capability that will enable them to execute ICBM strikes more rapidly, perhaps even preemptively. Real-time crisis management may become possible with the use of integrated intelligence displays and automated decisionmaking; information will be provided by networks of sensors and weapons-status monitors in strategic forces. Communications and signal-processing terminals will become more survivable through increased use of hardened antennas, satellite communications, and probably optical fiber cabling

Table 1
Soviet Strategic Warfare Programs

Program	Mission Area	Program Start/Type	Estimated IOC [a]	Significant Improvements
Strategic offensive				
SS-X-24 ICBM; silo/rail mobile	Countervalue land-based strike	Mid-1970s/new	1986-87	Mobility for increased survivability Improved inertial guidance Transition to solid-propellant MIRVed ICBMs
SS-X-24-class ICBM	Countervalue land-based strike	Early 1980s/modernization	1989-90	Improved solid propellant for increased range/throw weight
SS-25-class ICBM; road mobile	Countervalue land-based strike	Early 1980s/modernization	1989-90	
SS-18-class ICBM	Counterforce land-based strike	Early 1980s/modernization	1988-89	Improved inertial guidance for high accuracy Improved liquid propellant for increased throw weight
SS-20-class IRBM	Countervalue land-based strike	Late 1970s/modernization	1986	Improved throw weight Spin-stabilized RVs for improved accuracy
SS-NX-23 SLBM	Countervalue sea-based strike	Mid-1970s/new	1986	Increased range and throw weight for bastion deployment
SS-N-20-class SLBM	Countervalue sea-based strike	Early 1980s/modernization	1988-89	
SS-NX-23-class SLBM [b]	Countervalue sea-based strike	Early 1980s/modernization	1990-91	
Delta-IV-class SSBN	Sea-based strike	Mid-1970s/modernization	1986	
Typhoon-class SSBN upgrade [c]	Sea-based strike	Early 1980s/modernization	1991-93	
SS-NX-21 SLCM	Sea-based strike	Early 1970s/new	1986-87	TERCOM-like guidance for accuracy; torpedo size allows deployment on a number of SSNs and possibly surface ships
SSC-X-4 GLCM	Land-based strike	Early 1970s/new	1986-87	TERCOM-like guidance; mobility for survivability

Table 1
Soviet Strategic Warfare Programs (continued)

Program	Mission Area	Program Start/Type	Estimated IOC [a]	Significant Improvements
Yankee-class possible SSGN conversion (possibly for SS-NX-21)	Sea-based strike	Mid-1970s/ modernization	1986-87	
SS-NX-24 SLCM	Sea-based strike	Mid-1970s/new	1987	Supersonic, high-altitude, long-range cruise missile
SSC-X-5 GLCM	Land-based strike	Mid-1970s/new	1987	GLCM version of SS-NX-24
Yankee-class SSGN conversion (SS-NX-24)	Sea-based strike	Mid-1970s/ modernization	1986-87	
Blackjack	Airborne strategic attack	Early 1970s/new	1987-88	Variable geometry Long range Low-altitude penetration Supersonic dash
SRAM-type missile (VA-7)	Air defense suppression	Mid-1970s/new	1986-87	Improved solid propellants for supersonic velocity
Strategic defensive				
Galosh ABM interceptor upgrade; silo based	BMD	Mid-1970s/ modernization	1986-87	
Pushkino ABM radar	BMD	Early 1970s/new	1986-88	360-degree EW and battle management
Pechora BMEW radar at Krasnoyarsk, Mishelevka, Sary-shagan	BMD	Mid-1970s/ moderniza-tion	1988	
High-acceleration interceptor system; silo based	BMD	Early 1970s/new	1986-87	Improved propellant for high-speed endoatmospheric intercept
GER-EL-05 EW radar	Strategic air defense	Mid-1970s/new	1986	
KY-EL-08 EW/GCI radar	Strategic air defense	Mid-1970s/new	1986	
King Set EW/GCI radar	Strategic air defense	Mid-1970s/new	1986	
Tall Rack EW radar upgrade	Strategic air defense	Mid-1970s/ modernization	1986	

Table 1
(continued)

Program	Mission Area	Program Start/Type	Estimated IOC [a]	Significant Improvements
Saryshagan zigzag log periodic antenna	Strategic air defense	Mid-1970s/new	1986-88	
Transportable air defense radar	Strategic air defense	Early 1980s/new	Early 1990s	Mobility
Ground-based air defense laser weapon	Strategic air defense	Mid-1970s/new	1990	SAM dead zone reduced
IL-76 airborne laser	ASAT and air defense	Mid-1970s/new	1990-95	
Ground-based BMD laser weapon	Space defense/BMD	Mid-1970s/new	1990-95	
SU-27 fighter	Strategic air defense	Early 1970s/new	1986	Lookdown/shootdown radar Improved rear hemisphere detection
IL-76 AWACS	Strategic air defense	Early 1970s/new	1986	Improved low-altitude detection and tracking
IL-76 tanker	Strategic airborne strike	Early 1970s/new	1986	
SS-17 ICBM rocket communication system; silo based	Strategic communication and control	Mid-to-late 1970s/new (payload)	1986	Phased-array antenna for downlink signal
SS-20 IRBM rocket communication system; road mobile	Strategic communications	Mid-to-late 1970s/new (payload)	1986	Phased-array antenna for downlink system
Airborne VLF system on Bear-F	Strategic communications and control	Mid-1970s/new (payload)	1986-87	

[a] See appendix for acronyms.
[b] We have not identified a program for the submarine to carry this missile.
[c] While there is no direct evidence for this program, a scheduled upgrade, accompanying the modernized SS-N-20-type missile is possible.

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Theater Nuclear Capability

Theater Nuclear Capability

Table 2
Soviet Theater Nuclear Programs

Ballistic Missile Program	Mission Area	Program Start/Type	Estimated IOC [a]	Significant Improvements
SS-21 SRBM	Battlefield theater nuclear	Late 1970s/ modernization	Late 1980s	Improved inertial guidance for high accuracy
SS-23 SRBM	Theaterwide nuclear warfare	Late 1970s/ modernization	Late 1980s	MaRV Optical/radar area correlator Computer storage
SS-12 SRBM	Theaterwide nuclear warfare	Late 1970s/ new	1990	Improved propulsion system MaRV

[a] See appendix for acronyms.

Theater Nuclear Capability

Soviet theater-level nuclear assets include SRBMs, artillery systems, and fighter aircraft. All of these systems are capable of firing nuclear and conventional munitions, making it virtually impossible to determine the fire mission for any particular unit. For purposes of this report, only the SRBMs are considered to be theater nuclear assets. The other weapon systems are discussed in the appropriate tactical warfare sections.

The SRBM systems projected to be deployed by the early 1990s include a modified version of the SS-21, a modernized SS-23, and a new SS-12-class missile. The major technological improvement will be in missile guidance. Expected improvements in accuracy are likely to reduce the miss distance [redacted] using inertial systems in the case of the SS-21-class missiles and maneuvering systems for the SS-23- and SS-12-class missiles

The Soviets could use some form of an area correlator—optical or radar—for their terminally guided SRBMs. Radar correlators would give the Soviets the ability to launch at night or in adverse weather. Radar reference images are complex, however, and would require considerably more computer storage than optical reference images

One principal advantage of improved SRBM accuracy is the ability to use less powerful warheads without reducing lethality and thus expand the option of using nonnuclear warheads against certain targets. Highly accurate SRBMs [redacted] could be available in the early-to-middle 1990s. Such an SRBM would be very effective against soft targets using nonnuclear warheads such as fuel air explosives

Deployment of terminally guided SRBMs could begin in the late 1980s. The Soviets may intend to retrofit terminal guidance packages to existing missile systems as well; the SS-12 and SS-23 are prime candidates. The retrofit of modular terminal guidance systems to boosters currently in production would be the most cost-effective way of fielding high-accuracy SRBMs. Such a decision would allow the Soviets to begin widespread deployment of terminally guided SRBMs by the late 1980s

Although Soviet SRBMs will be designed for different fire-support missions—at division, army, and front levels—they will have similarities in their technical characteristics. All of these missiles are likely to be lighter and more reliable. Transporter-erector-launcher systems also will be improved through the use of light, strong, corrosion-resistant materials.

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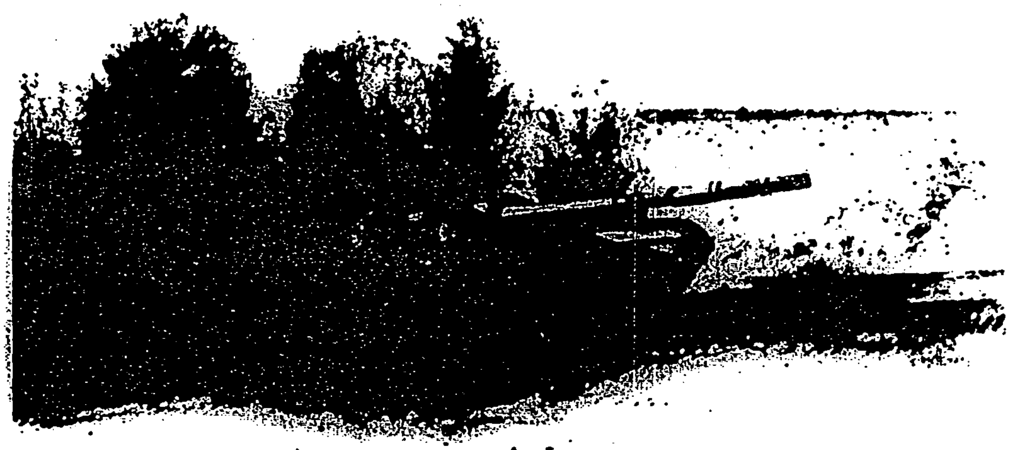
Tactical Land Warfare

Tactical Land Warfare

Figure 5
Artist's Conception of Soviet Reduced-Volume Turret Tank



The Soviets will continue to improve the mobility, survivability, and firepower of their conventional land arms. This artist's conception represents a possible configuration of a reduced-volume turret for a future Soviet tank.

Tactical Land Warfare

The primary missions of the Soviet Ground Forces are to defend Soviet territory against invasion and to destroy the military, economic, and political strengths of the enemy. The Soviets see a vigorous, highly mobile offensive as the best way to defeat the enemy. Therefore, their emphasis in the development of new tactical weapon systems is on mass firepower and mobility coupled with the capability to reconnoiter, discover, pinpoint, and destroy the enemy—particularly his nuclear assets.

We believe the Soviets will continue to stress during the late 1980s and into the 1990s the doctrine of selective attack of rear areas to support frontline operations. Technical improvements in assault vehicles, helicopters, firepower systems, and air defense weapons will contribute to greater capabilities in these areas. To support these advances, work is in progress to improve armor, missile guidance and propulsion, artillery ammunition, radars, and lasers.

[redacted]

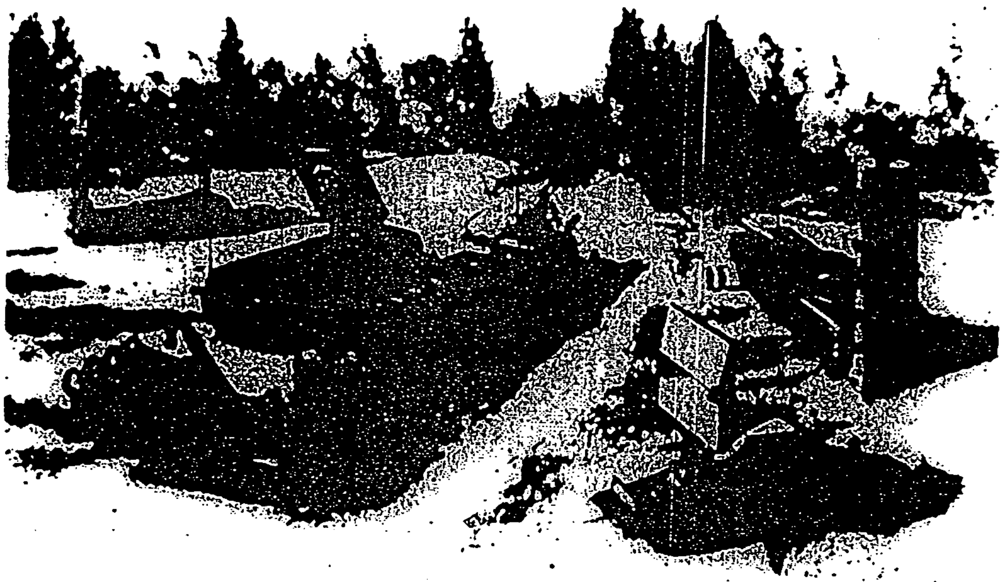
Assault Vehicles and Helicopters

The Soviets probably will field in the late 1980s or early 1990s a new main battle tank, which we call FST-II, possibly using a reduced-volume turret (see figure 5). Such a tank probably will feature a high-velocity gun that fires an improved antitank guided missile. Its fire control might incorporate a thermal imaging site for improved target acquisition capability. Armor protection over the 60-degree frontal arc probably will use laminate or composite laminate providing protection o[redacted] thickness against kinetic-energy weapons. More engine power is expected to increase the performance. The horsepower-to-ton ratio could be in the range of 20:1.

Two infantry fighting vehicles, including combat support and reconnaissance variants, of new design may be deployed in the mid-to-late 1980s. These vehicles, one wheeled (a follow-on to the BTR-70 series) and one tracked (a follow-on to the BMP 1/2 series), will have improved armor protection, mobility, and firepower. Both vehicles probably will have an improved antitank guided missile system.

Two new attack helicopters—the Havoc and the Hokum—probably will become operational by the late 1980s [redacted] Improved avionics and fire-control systems give the Havoc the capability to operate at night and in adverse weather and to employ a variety of air-to-ground weapons, including laser-guided ATGMs [redacted] Because of its high dash speed and maneuverability, [redacted] the Hokum can perform both antitank and antihelicopter missions. It has a high potential against low and slow conventional aircraft. It may also be assigned a naval mission.

Figure 7
Artist's Conception of Soviet SA-X-12 Surface-to-Air Missile System



We believe the Soviets will significantly improve the capabilities of their active and passive tactical defensive systems over the next 10 years as a number of new types of weapons are introduced. New SAM systems, such as the SA-X-12, can engage conventional aircraft, cruise missiles, and tactical ballistic missiles.

The Soviets are developing two tilt-rotor aircraft that are expected to become operational in the early 1990s. they could fill a number of roles including assault, fire support, command and control, and electronic warfare.

Firepower Support

We believe the Soviets will continue to develop and field improved rocket and artillery systems to maintain their capability to have large amounts of firepower available in all battlefield situations. A new MRL is expected by the late 1980s and an improved version for deployment at the maneuver regiment level is expected by the early 1990s. Automated on-carriage launchers, reloaders, and supply reloaders will be improved. Improved conventional munitions, terminally guided munitions, scatterable mines, and fuel air explosives have already been deployed with some weapon systems. Further improvements in these areas are expected.

Cannon-launched, terminally guided projectiles, primarily for use against targets such as ATGM positions, fire-finder type radars, and command and control sites probably will continue to be developed. Laser-guided terminally homing rounds for the Soviet 122-mm howitzer and 152-mm gun-howitzer systems already have been deployed. The rounds use high-explosive warheads. In addition, shaped-charge warheads, for use against armor, could be adapted to these terminally guided warheads. Guided projectiles for the 240-mm mortar and possibly the 203-mm gun have already been deployed, possibly equipped with laser guidance systems.

Tactical Air Defense

The Soviets are developing a modern, sophisticated, long-range tactical system—the SA-X-12 (see figure 7). This system will probably supplement or replace the SA-4 and significantly enhance front/army defense of Soviet ground operations against a number of US weapon systems. The SA-X-12 will provide capabilities against high-performance aircraft, low-altitude penetrators, and US TBMs

An improved SA-8-type SAM, the SA-X-15, probably will be deployed with Soviet Ground Forces in the late 1980s. The Soviets probably will employ all-digital processing in the radars and the missiles. They will mount this weapon on tracked vehicles to enhance battlefield mobility. The new missile will have a 15 kilogram (kg) warhead, employ RF guidance and have improved range and altitude capability. The Soviets probably will improve the Land Roll radar system to detect low RCS targets. Improvements in tracking capabilities are expected to provide the system with nighttime and all-weather capability.

We believe the Soviets will have a modified SA-11 by the late 1980s and that a major modification to this system could be deployed by the mid-1990s. Radar modifications will provide electronic scanning needed to correct the present low scan rate. Operational ranges will extend from a minimum of 3 to 4 km to 40 km, with a maximum effective altitude of 20 km.

An SA-13-type E-O homing missile is projected for the early 1990s. It will employ solid propellants and a laser-beam rider or proportional navigation guidance. Its range will be 1 to 9 km, with an altitude range of 10 meters to 9 km

Table 3
Soviet Tactical Land Warfare Programs

Program	Mission Area	Program Start/Type	Estimated IOC a	Significant Improvements
Assault vehicles/ helicopters				
Havoc attack helicopter	Indirect-fire support	Mid-1970s/ new	Late 1980s	
Hokum attack helicopter	Indirect-fire support	Mid-1970s/ new	Late 1980s	
MI-30 tilt-rotor aircraft	Land-warfare-associated mobility	Mid-1970s/ new	Early 1990s	Increased range, speed, payload
MI-32 tilt-rotor aircraft	Land-warfare-associated mobility	Mid-1970s/ new	Mid-1990s	Increased range, speed, payload
T-84 (FST-I) tank	Direct-fire combat	Mid-1970s/ new	1986	
FST-II tank	Direct-fire combat	Mid-1970s/ new	Late 1980s	Possible reduced-volume turret Improved laminate or composite armor protection
T-54/62 tank upgrade	Direct-fire combat	1984/ modernization	1988-89	
T-80 tank upgrade	Direct-fire combat	Late 1970s/ modernization	Late 1980s	
Light combat vehicle; tracked	Direct-fire combat	Early 1970s/ new	1986-90	
Light combat vehicle; wheeled	Direct-fire combat	Mid-1970s/ new	1986-90	
Firepower support				
120-mm self-propelled gun/mortar	Direct- and indirect-fire support	Mid-1970s/ new	1986-90	Capability to fire both indirect mortar rounds and indirect ammunition, including HE antitank rounds at high and low elevations
220-mm self-propelled MRL	Indirect-fire support	Mid-to-late 1970s/ modernization	1986-90	

Table 3
(continued)

Program	Mission Area	Program Start/Type	Estimated IOC [a]	Significant Improvements
122-mm wheeled MRL	Indirect-fire support	Mid-to-late 1970s/modernization	1986-90	
122-mm tracked MRL	Indirect-fire support	Mid-to-late 1970s/modernization	1986-90	Armored, tracked chassis for improved mobility and protection
Large caliber self-propelled MRL	Indirect-fire support	Mid-1970s/new	Late 1980s	Larger caliber rocket for increased firepower
125-mm antitank gun	Direct-fire combat	Mid-1970s/new	1986	Larger caliber for increased penetration; possible ATGM
85-mm antitank gun	Direct-fire combat	Mid-1970s/new	1986-90	
Tactical air defense				
Antisensor laser	Tactical air and ground defense	Early-to-mid-1970s/new	1986-88	Use of glass laser to jam E-O, navigation, target acquisition, and fire-control sensors
SA-X-15 SAM	Ground-based missile defense	Mid-1970s/modernization	1986-88	Improved target engagement radar
SA-13-class SAM	Ground-based antiair/tactical missile defense	Mid-1970s/new or modernization	1986-88	
SA-X-12 SAM/ATBM upgrade	Ground-based antiair/tactical missile defense	Early 1980s/modernization	1990-95	
SA-X-12 SAM/ATBM System	Ground-based antiair/tactical missile defense	Late 1960s/new	1986-87	Improved radar to engage small RCS targets and TBM RVs
SA-11-class SAM	Ground-based antiair/tactical missile defense	Early 1980s/modernization	1990	

[a] See appendix for acronyms.

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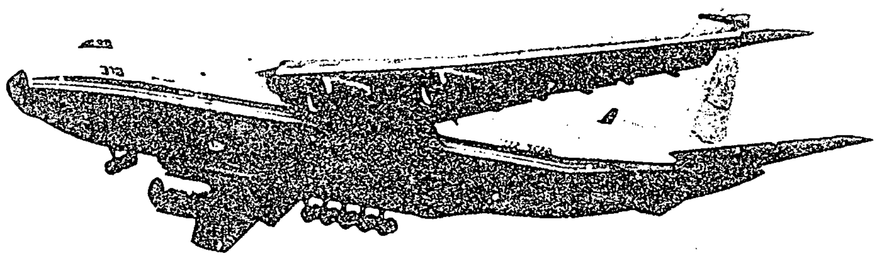
Tactical Air Warfare and Supporting C3I

Tactical Air Warfare and Supporting C3I

Figure 8. New Soviet heavy-lift aircraft AN-124 Condor



Tactical Air Warfare and Supporting C3I

We believe the Soviets will continue to modernize and upgrade their combat and support aviation elements, including airframes, propulsion, avionics, reconnaissance and communications systems, electronic warfare equipment, and ordnance. The majority of this continuing effort will come from evolutionary technological developments. Few dramatic changes are envisioned for aircraft design apart from V/STOL aircraft. Future fighters will have new missile systems that will significantly enhance their air-to-air capability. All-aspect, lookdown/shootdown capability to attack small RCS targets in ground clutter is also expected.

The tactical ground attack force will continue to develop capabilities for deep penetration into defended enemy airspace. Improved defense-suppression ASMs and cruise missiles are under development and probably will be deployed on fighters and fighter-bombers by the late 1980s. These missiles have improved sensor and propellant technology.

The principle design consideration for tactical fighters will be improved survivability through the use of high-speed evasion and energetic maneuverability aided by radar and IR warning systems as well as chaff and decoys. To enhance battlefield persistence and survivability, tactical fighters probably will need advanced onboard sensors and ordnance for night and all-weather capability.

Future Soviet light bomber and fighter-bomber designs will accommodate the growing number of sophisticated electro-optically guided air-to-surface weapons.

Tactical Airlift

Soviet airlift capabilities to support battlefield operations will continue to be renovated and advanced into the 1990s. Two new transport aircraft, including the heavy-lift AN-124 Condor (see figure 8), are expected to be deployed by the late 1980s. In addition the Soviets are developing modernized or modified versions of four existing medium-lift aircraft systems. Current technology levels are adequate for the development of these systems. It is expected that they will make increasing use of composites, improved propulsion systems, and more extensive application of automated control systems.

The AN-124 Condor, the new heavy-lift aircraft, will utilize the Soviets' new D-18T engine, a large high-bypass-ratio turbofan. Although the Soviets have been developing efficient turbojet and low-bypass-turbofan engines for many years, their high-bypass-ratio turbofans have not been large or efficient. The Soviets apparently have resolved these problems with the development of the D-18T.

Supporting C3I

Since the mid-1970s the Soviets have been developing an aircraft [redacted] that possibly is similar in mission to the US U-2/TR-1 [redacted] We expect this aircraft to be deployed in the mid-to-late 1980s.

[redacted] The AN-72 is an STOL aircraft similar in appearance to the US YC-14 aircraft. [redacted]. The STOL capabilities suggest that this system will be used in a tactical early warning role from unprepared airfields and, possibly in a carrier-based fleet air defense role

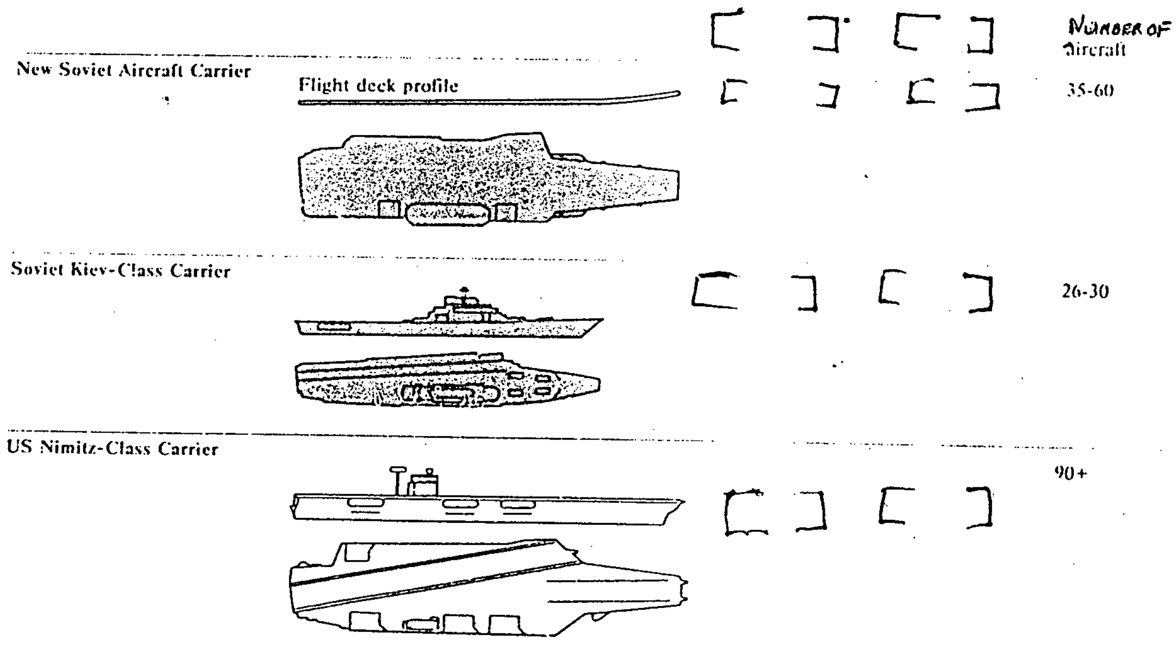
Table 4
Soviet Tactical Air Warfare Programs

Program	Mission Area	Program Start/Type	Estimated IOC [a]	Significant Improvements
Counterair/attack systems				
AS-X-13 TV-guided ASM	Defense suppression	Mid-1970s/ new	1986-87	TV guidance
New ASM	Defense suppression	Early 1980s/ new	Early-to-mid-1990s	
Reconnaissance/EW aircraft				
[redacted] Reconnaissance aircraft	Theater reconnaissance	Mid-1970s/ new	1986-88	[redacted]
AN-72 Coaler-[redacted]	Tactical EW	Late 1970s/ modification	1988-89	STOL capabilities for possible carrier basing and/or forward basing
DR X-4 drone	Battlefield reconnaissance	Mid-1970s/ new	1986-87	
Transports and helicopters				
AN-124/Condor heavy transport	Intertheater airlift	Mid-1970s/ new	1987-88	Use of large high-bypass turbofan engines Use of lightweight composite materials
TU-204 transport	Civil transport	Mid-1970s/ new	1990	
IL-96/Camber variant	Civil transport	Mid-to-late 1970s/modernization	1988-89	
YAK-42A transport	Civil transport	Early 1980s/ modification	1986-87	
AN-74; Coaler-A variant	Civil transport	Mid-to-late 1970s/modernization	1986-87	
IL-114 twin turboprop	Civil transport	Early 1980s/ new	1992-95	

[a] See appendix for acronyms.

Tactical Naval Warfare

Tactical Naval Warfare



The Soviets have embarked on a major program to upgrade their sea-based aircraft capability. The most visible evidence of this is a new nuclear-powered aircraft carrier being constructed at Nikolayev on the Black Sea.

Tactical Naval Warfare

We believe the Soviet Navy will continue efforts to improve the capability of its general purpose forces to protect its SSBNs, counter Western surface naval forces, provide support for ground operations, and disrupt enemy sea lines of communication. The primary emphasis will be to improve the war-fighting capabilities of the Navy. By the mid-1990s we believe some programs will result in substantial improvements in the Soviet capability to use naval forces to project power in distant areas.

Naval Combatants

The Soviets have launched three new classes of attack submarines, the Mike-class, the Sierra-class, and the Akula-class, all of which probably incorporate substantial improvements in war-fighting capability. (All three of these new classes are believed to incorporate great advances in acoustic quieting [ ] All probably can carry the latest Soviet ASW weapons and possibly the SS-NX-21.

The Sierra-class SSN [ ] which is probably made of titanium, is quieter and possibly deeper diving than the Victor-III class. The Akula-class is similar in size to the Sierra-class, although it probably has a steel hull. The Mike-class probably is a developmental submarine to test Soviet state-of-the-art submarine propulsion and hull technology.

In the late 1980s the Soviets will begin sea trials of the first of a new class of large attack aircraft carriers [ ] this class of carrier may be nuclear powered and capable of launching and recovering CTOL aircraft. We believe that difficulties in developing the air group for this carrier will result in a delay in initiating CTOL operations. These delays could be substantial, perhaps necessitating V/STOL operations as the primary mode for the first years after IOC

[ ]

The Soviets are building a new surface combatant, possibly a modified Sovremenny-class destroyer. This ship probably will be deployed in the late 1980s and may have improved armament. It will provide the surface strike fleet with air defense and some ASW protection

Naval Weapon Systems

We anticipate that three and possibly four new or modernized antiship cruise missiles and a new SAM will be deployed by 1990. An air defense laser weapon also is in development and probably will be operational by the late 1980s. We judge that the Soviets will be approaching the lower limits of cruise missile altitude by the early 1990s. Future developments will probably concentrate on speed, using improved liquid-rocket technology, and target tracking sensors. SAM developments are likely to concentrate on improved techniques for search, acquisition, and low-altitude discrimination and greater warhead lethality

Table 5
Soviet Tactical Naval Warfare Programs

Program	Mission Area	Program Start/Type	Estimated IOC [a]	Significant Improvements
Naval platforms				
Akula-class SSN	ASW	Mid-1970s/ new	1986	Faster, quieter, and deeper diving than V-III-class SSN
Sierra-class SSN	ASW	Mid-1970s/ new	1986	Faster and deeper diving than V-III-class SSN; titanium hull technology
Mike-class SSN	ASW	Mid-1970s/ new	1986	Possible state-of-the-art propulsion and titanium hull technology
Yankee-class SSN conversion [b]	ASW	Mid-1970s/ modernization	1986	
Uniform-class SSAN	Naval warfare support	Mid-1970s/ new	1986	
X-ray-class SSAN	Naval warfare support	Mid-1970s/ new	1986	
Possible conventional aircraft carrier [ ]	Naval warfare	Mid-1970s/ new	1990-92	First Soviet CTOL aircraft carrier
Kiev-type carrier [ ] [ ]	Naval warfare	Mid-1970s/ modernization	1986	
Surface combatant [ ] [ ]	Naval warfare	Mid-1970s/ modernization	1987-88	
Possible guided-missile patrol ship	Naval warfare	Late 1970s/ modernization	1987	
SLBM tender [ ]	Naval warfare support	Mid-1970s/ new	1987-88	
Space-event support ship [ ]	Space launch and orbital support	Mid-1970s/ new	1986-87	
Oceanographic research ship	Naval warfare support	Mid-1970s/ new	1986-87	

Table 5 (continued)

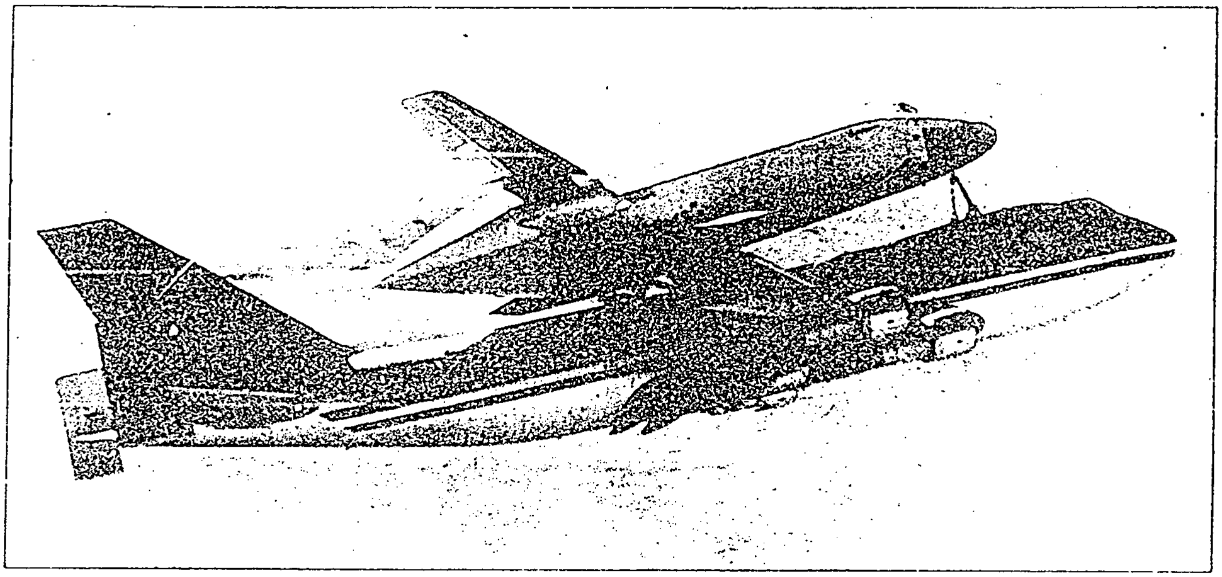
Program	Mission Area	Program Start/Type	Estimated IOC [a]	Significant Improvements
Naval weapon systems				
SS-N-19-class antiship missile	Amphibious strike and antisurface warfare	Early 1980s/ modernization	1988-90	
SS-N-12-class antiship missile	Amphibious strike and antisurface warfare	Mid-1970s/ new or modernization	1985-86	
VA-08 antiship cruise missile; air launched	Amphibious strike and antisurface warfare	Mid-1970s/ new	1987-88	Long-range antiship ASM Improved target acquisition and tracking radars
SA-NX-9 SAM	Antiair warfare	Mid-1970s/ new	1986-87	
Laser air defense weapon; shipborne	Antiair warfare	Mid-1970s/ new	1986-88	
Phased-array radar; shipborne	Antiair warfare	Mid-1970s/ new	1986	
Top Dome acquisition radar upgrade	Antiair warfare	Early 1980s/ modernization	1987-88	
Naval aircraft				
[ ] V/STOL fighter	Naval strike	Mid-1970s/ new or modernization	1986-88	
[ ] fighter	Naval strike	Mid-1970s/ new	1987-90	

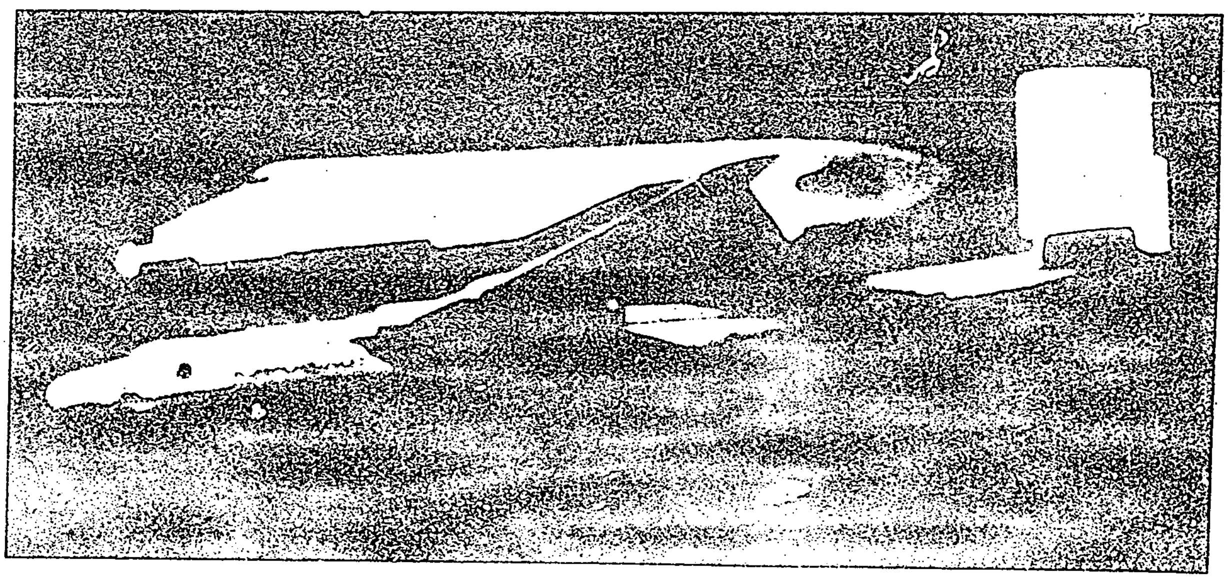
[a] See appendix for acronymns.
[b] Conversion from a ballistic missile submarine.

Military Application of Space

Military Application of Space

Figure 11
US and Soviet Shuttle Orbiters





Military Application of Space

We expect the Soviets to operate large, permanent space stations that will support global military operations. To do this, they are developing a heavy-lift launch vehicle [redacted] a reusable space transport system, and a space tug. The principal military missions for the space stations are not clearly understood, but will include intelligence collection, command and control, and research and development. Other space assets in support of Soviet military need will include advanced communications satellites and new, continuous-broadcast, precision-navigational satellite system

Space Support

The Soviets are developing two new launch vehicles: the SL-X-16 and the SL-W. [redacted] Both of these systems are expected to be operational in the next few years. A version of the SL-W is expected to be used to launch a reusable space shuttle orbiter. These launch vehicles will be the workhorses of the Soviet manned space program in the 1990s.

The Soviets are developing a reusable shuttle orbiter system that is a near copy of the US shuttle orbiter (see figure 11). Initial flights could take place in 1986 or 1987. Soviet motives for space transport development include a desire to economize on space launchers, the construction of large space stations, and a desire to compete with the United States for prestige and political influence by providing competitive space launch services for international clients

A smaller, reusable, spaceplane probably will be used for conducting reconnaissance, satellite inspection, and other military missions [redacted]. Suborbital tests of a subscale model have been conducted, and more tests are expected before a full-scale test is conducted

The Soviets probably will have a continuously manned modular space station by the late 1980s (see figure 14). They have demonstrated the capability to assemble a two-module space station and have indicated that a multimodular system would involve a station composed of several modules that could be changed or

[redacted]

added to as mission objectives changed. This program will require the successful development of the heavy-lift launch vehicle and adequate power sources. Large multimodular space stations could be deployed beginning in the early-to-middle 1990s, taking several years to accomplish:

These stations could be used as:
- Logistic bases for the repair, maintenance, modification, and assembly of spacecraft.
- Launch platforms for deep-space missions.
- Military-support platform permitting in-orbit reconnaissance operations.
- An R&D facility for space-based military systems.

The ability to work on satellites in orbit would require a space tug. Such a system could be operational in the late 1980s or early 1990s. The tug would provide access to high-orbit satellites and would complement the Soviets' space shuttle. The space shuttle and tug combination would extend satellite service life, enhance the building and servicing of orbital launch complexes, and allow the economical shipment of goods between Earth and space bases.

Military Support

Reconnaissance Satellites. An E-O imaging system is being developed to provide more timely reconnaissance. [redacted] We believe a full network of two to four imaging satellites, supported by multiple data-relay satellites, will be operational by the late 1980s. This network may increase to eight imaging satellites in the early 1990s and provide greater area coverage on a real-time basis.

[redacted]

Communications and Data Relay. Communications satellites will be used increasingly over the next 10 to 20 years to support intelligence, military, and political activities worldwide. This will result in significant improvements in the speed, flexibility, and reliability of the Soviet command and control network, while also improving the security of this network. The high-data-rate multiple-access systems, onboard multiplexing, spread spectrum, and compact mobile ground terminals now being used are among the more important developments in the Soviet communications satellite program

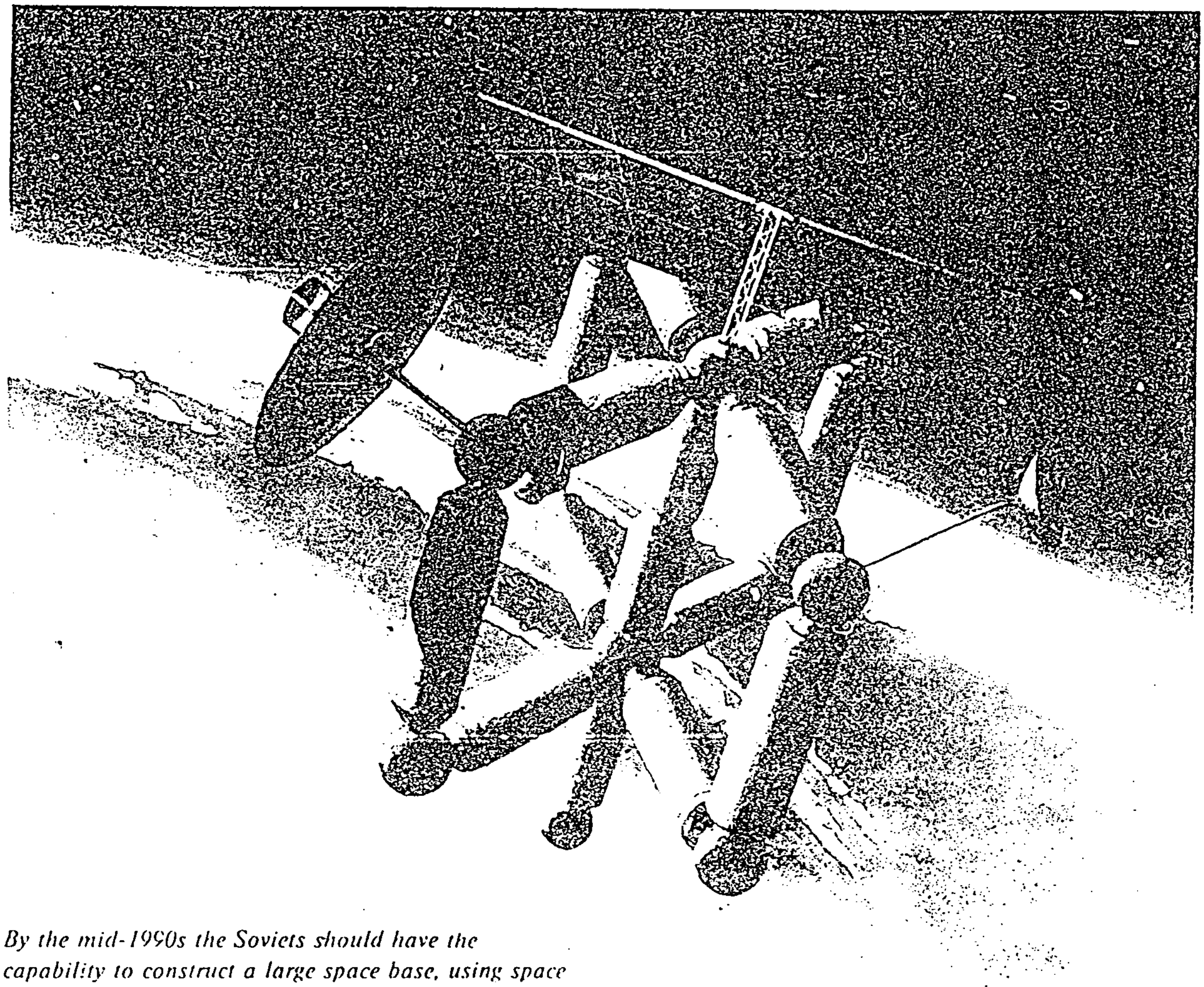
The Soviets are developing a geostationary communications system that could include satellites that serve more than one network, intersatellite cross-linking, and laser communications links. These systems include the Volna, Gals, Luch, and Luch-P. We project that this communications satellite system will be completed by the early 1990s

In addition to the communications satellite network, the Soviets also are developing a three-satellite data transmission satellite system, designated Potok, and a three-satellite data-relay system. These systems will be established in geostationary orbits by the late 1980s. The Potok system is designed to transmit digital information between central and peripheral Earth stations, and may include military missions. The data-relay system is designed to relay data from low-Earth-orbiting satellites to Earth terminals. This relay capability will greatly improve the Soviets' real-time control of low-orbiting satellites and the timely relay of data. This will allow for real-time intelligence collection, the timely redirection of that collection, and on-demand orbit adjustments of low orbiters.

Space Exploration. New planetary missions and a lunar mission are expected by the early 1990s. Some of the proposed missions could be used to test new military technology. The purely scientific missions may be delayed or canceled if Moscow decides to place more emphasis on the military space program.

Most of the identified lunar and planetary missions are already technologically feasible or soon will be. The SL-12 is the SLV for space exploration missions. However, the Soviets may utilize the heavy launch vehicle for a number of their planetary missions

Figure 14
Artist's Conception of Soviet Space Base



By the mid-1990s the Soviets should have the capability to construct a large space base, using space stations as components. Assembly of such bases will take place over several years.

Table 6
Soviet Military and Civil Space Programs

Program	Mission Area	Program Start/Type	Estimated IOC [a]	Significant Improvements
Military				
Space base	Space launch and orbital support	Early 1980s/ new	Mid-to-late 1990s	
Large modular space station; Salyut type	Space launch and orbital support	Mid-1970s/ new or modernization	Mid-to-late 1980s	
Space shuttle orbiter	Space launch and orbital support	Early 1970s/ new	1986-88	
Spaceplane [b]	Space launch and orbital support	Early 1970s/ new	1986	Lower cost and shorter turn-around time than shuttle
Cargo/resupply vehicle	Space launch and orbital support	Early 1970s/ new	1986-87	
Space tug	Space launch and orbital support	Early-to-mid-1970s/ unknown	Mid-to-late 1980s	Move satellites in orbit and/or place satellites in higher Earth orbits Construction of large modular space station
SL-W heavy-lift booster	Space launch and orbital support	Mid-1970s/ new	1986-88	Capability to launch shuttle support construction of large modular space station
SL-X-16 medium-lift booster	Space launch and orbital support	Mid-1970s/ new	Mid-1980s	Launch space shuttle and heavier photo and radar reconnaissance satellites
Electro-optical imaging satellite	Strategic surveillance and warning	Mid-1970s/ new	1986-87	Electro-optical system for near-real-time reconnaissance
Global positioning satellite	Navigation and position fixing	Early-to-mid-1970s/new	1986-87	
30-meter dish space antenna	Possibly strategic communication, surveillance VLBI	Mid-to-late 1970s/ modification	Late 1980s/ early 1990s	
Satellite data-relay system	Strategic communication	Mid-1970s/ new	1986-87	Data relay to improve real-time control of low-Earth orbiting satellites
Potok satellite data-relay system	Strategic communication	Early-to-mid-1970s/new	1986-87	

Table 6 (continued)

Program	Mission Area	Program Start/Type	Estimated IOC [a]	Significant Improvements
Luch-P COMSAT	Strategic communication	Mid-1970s/ unknown	1986	Combined with Gals and Volna for worldwide C3 coverage
Gals COMSAT	Strategic communication	Mid-1970s/ unknown	1986	Combined with Luch-P and Volna for worldwide C3 coverage
Volna COMSAT	Strategic communication	Mid-1970s/ unknown	1986	Combined with Gals and Volna for worldwide C3 coverage
Geosynchronous meterological satellite	Global military environment support	Mid-1970s/ new	1986	
Civil				
Interball/Earth's magneto tail payload		Mid-1970s/ modification	Late 1980s	
X-ray phenomena observatory		Mid-1970s/ modification	Late 1980s	
Gamma-1 gamma ray telescope		Mid-1970s/ modification	1986-87	
Sigma gamma ray telescope		Late 1970s-early 1980s/ modification	Late 1980s	
Submillimeter-wave-length telescope		Early 1980s/ unknown	1990s	
Venus asteroid mission (Vesta)		Early 1980s/ unknown	Early 1990s	
Mars manned-mission spacecraft		Mid-1980s/ new	Mid-to-late 1990s	
Mars Phobos mission		Late 1970s/ new	1988	
Lunar polar-orbiting mission		Mid-to-late 1980s/ modification	1988-91	
Active wave experiment or satellite		Early 1980s/ modification	Late 1980s	
Magnetospheric mission		Early 1980s/ modification	Late 1980s	

[a] See appendix for acronyms.
[b] Existence of a planned operational program is uncertain.

Appendix

Appendix

Appendix

Acronyms Used in This Report

ABM	Antiballistic missile
ALCM	Air-launched cruise missile
ARM	Antiradiation missile
ASAT	Antisatellite
ASM	Air-to-surface missile
ASW	Antisubmarine warfare
ATBM	Antitactical ballistic missile
ATGM	Antitank guided missile
AWACS	Airborne warning and control system
BMD	Ballistic missile defense
BMEW	Ballistic missile early warning
C3	Command, control, and communications
C3I	Command, control, communications, and intelligence
CEP	Circular error probable
COMSAT	Communications satellite
CTOL	Conventional takeoff and landing
ECM	Electronic countermeasures
EMP	Electromagnetic pulse
E-O	Electro-optical
EW	Early warning
GCI	Ground control intercept
GLCM	Ground-launched cruise missile
GLONASS	Global Navigation Satellite System
HE	High explosive
IOC	Initial operational capability
IR	Infrared
IRBM	Intermediate-range ballistic missile
MAP	Ministry of Aviation Industry
MaRV	Maneuverable reentry vehicle
MIRV	Multiple independently targetable reentry vehicles
MRL	Multiple rocket launcher
PGM	Precision-guided munitions
RCS	Radar cross section
RF	Radiofrequency
RV	Reentry vehicle
SAM	Surface-to-air missile
SATCOM	Satellite communications
SLBM	Submarine-launched ballistic missile
SLCM	Submarine-launched cruise missile
SLV	Space launch vehicle
SRAM	Short-range attack missile
SRBM	Short-range ballistic missile
SSAN	Nuclear auxiliary submarine
SSBN	Nuclear ballistic missile submarine
SSGN	Nuclear cruise missile submarine
SSN	Nuclear attack submarine
STOL	Short takeoff and landing
TBM	Tactical ballistic missile
VLBI	Very-long-baseline interferometer
VLF	Very low frequency
V/STOL	Vertical/short takeoff and landing