Directorate of Intelligence

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USSR Monthly Review

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June 1983

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June 1983

The *USSR Monthly Review* is published by the Office of Soviet Analysis. Comments and queries regarding the articles are welcome. They may be directed to the authors, whose names are listed in the table of contents.

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The Soviet Space Program for the 1980s

Perspective

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The Soviet space program is enjoying a period of rapid growth similar to that observed during the 1960s. Today, however, the emphasis is on practical applications of technology to support intelligence and military operations and provide economic benefits—rather than, as in the early years, on programs designed primarily to enhance national prestige. The Soviets view space as another theater for military operations and as a workshop for developing and manufacturing new materials and hardware, as well as a showcase for Soviet capabilities.

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During the 1960s and into the early 1970s, the space program grew rapidly, initially to demonstrate to the Soviet people and the world the technological capability and potential strength of the Soviet Union. Many missions were launched primarily to provide a series of space "firsts" and to upstage US programs or were timed to support celebrations of international Communist solidarity. In spite of Soviet statements concerning the peaceful uses of space, the military quickly recognized the benefits of using spacecraft for strategic reconnaissance, global communications, and naval support. As early as 1962, a Vostok spacecraft, developed for the first manned flights, had been converted to a photographic reconnaissance satellite. The number of new military satellites increased steadily, and by 1975 more than 75 percent of the launches (and two-thirds of the cost) were for military or military-related missions.

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By the mid-1970s increasing economic problems and cancellation of the SL-X-15 booster development program, coupled with a series of highly publicized failures in the expensive lunar and Mars programs, resulted in a decline of projects involving only pure research and prestige. Emphasis shifted from the lunar program to the expanded development of manned space stations. Military spacecraft were launched in increasingly large

numbers, but most of this effort was devoted to maintaining the established networks, and few new spacecraft were introduced. In general, dependence on these vehicles to support day-to-day military operations remained low as the Soviets continued to rely heavily on ground-based navigation, communications, and intelligence collection systems. 25X1

In the 1980s Soviet interest in space has increased—a record 107 satellites were launched in 1982—with an emphasis on military and economic benefits. During the decade we expect to see as many as 15 new satellites which incorporate advanced technology to a greater degree than before in an effort to improve satellite lifetimes, data transmission rates, and onboard processing capacity. 25X1

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The main goal of the manned space program in the 1980s is to establish permanent manned complexes in space through a series of evolutionary steps. The current phase is likely to involve docking multiple Cosmos stations with a larger Salyut core to form a modular station for up to 12 cosmonauts. We believe that by 1990 the Soviets will launch a larger permanent space station, with a habitable volume similar to the US Skylab, followed in the 1990s by additional segments and modules which would allow the station to accommodate over 20 cosmonauts. This complex or space base would be serviced by the Soviet equivalent of the US space shuttle. 25X1

All of the space stations to date have been used at least partly for tests of military hardware, and some have served almost exclusively as military test beds and reconnaissance platforms. The military roles of the new, larger stations are expected to include reconnaissance, ocean surveillance, and

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possibly military space system research, development, testing, and evaluation (RDT&E). These stations will also be used as workshops and laboratories for materials processing and manufacturing to upgrade key industries such as pharmaceuticals, electronics, and metallurgy; for relaying Earth-resources and weather data; and as engineering bases for servicing other satellites, constructing even larger structures, or assembling spacecraft for eventual travel to other planets.

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In contrast to the US manned program, which currently is based on one vehicle—the space shuttle—the Soviet manned program appears to be planned around a variety of new vehicles now under development, including a shuttle (apparently similar to the US system), a reusable space plane similar to the planned but never flown US Dyna Soar, a series of space stations of increasing size, a broad range of crew ferry and resupply vehicles, and probably a space tug. Two new launch vehicles—the first to use high-energy, liquid hydrogen propellents—also are expected to be used to support this ambitious development program.

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In addition to developing new spacecraft and launch vehicles, the Soviets are expanding the design bureaus, production facilities, assembly and checkout buildings, and launch complexes associated with the space program. At least two and possibly three new space support ships and other tracking stations are being constructed to support future programs. This more carefully planned, systematic progression contrasts sharply with the crash programs of the early years, which resulted in a series of highly publicized failures, and is indicative of high-level, long-range commitment to the space program.

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The profusion of spacecraft and launch vehicles necessary to support the manned effort is one of the major factors in the rapid cost growth projected for the 1980s, as noted in the lead article. Another factor is the large number of new navigation and communications satellites to increase the effectiveness of conventional and strategic forces. A series of advanced lunar and planetary probes will be used, in addition to the manned program, to enhance prestige abroad through a series of spectacular "firsts." Improved Earth-resources, oceanographic, and weather satellites are expected to provide increased economic benefits by locating promising areas for mineral and gas exploration, pinpointing fish concentrations, and producing accurate crop condition reports and harvest forecasts. Moreover, Moscow has clearly indicated its intention to compete for a share of the growing international market for space services. Although current marketing efforts are focused on satellite launch and communications services,

materials processing in space may ultimately prove the area where the USSR enjoys an advantage over Western competitors (see the article on the prospects for Soviet commercial exploitation of space systems and related services). [redacted] 25X1

Estimated overall Soviet space program costs (for RDT&E, procurement, and operations) are expected to rise from $13 billion in 1981 to almost twice that amount by 1986. However, several of the new programs—especially the new photographic satellite, shuttle, large space station, and large planetary probes—are heavily dependent on the successful development of the two new launch vehicles employing liquid hydrogen. Much of the current renewed emphasis and resource commitment may again be diminished if the Soviets fail to successfully develop these more advanced launch vehicles. [redacted] 25X1

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Trends in Soviet Space Programs

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The Soviets have an ambitious and costly space program designed to support intelligence and military operations and provide economic benefits. Objectives include a permanent manned presence in space, improved photoreconnaissance, data retrieval, missile launch detection, ocean surveillance, and antiship targeting, and expansion and replacement of existing satellite networks.

Prospectus for the 1980s

In the first half of the 1980s the Soviets will develop and launch more costly and more advanced space systems than they have since they began to devote resources to space exploration. The cost of research and development (R&D), hardware procurement, and associated support is projected to rise from $13 billion in 1981 (roughly the same as the US total) to almost twice that amount by 1986.[1] The Soviets are devoting substantial resources to several comprehensive programs to:

- *Expand considerably their man-in-space effort.* This program to create in space a workplace for military and economic purposes will include a space transportation system, a permanent space station, and possibly a space tug to support the space station and to transfer satellites from one orbit to another.

- *Ensure rapid communications.* Several new communications payloads—sharing a common spacecraft platform—will provide faster, more reliable command and control over civil aircraft, ships, and military units.

- *Explore the frontiers of space.* The Soviets intend to launch a Venus radar mapping mission in 1983 and two spacecraft in 1984 to deploy landers on Venus en route to a rendezvous with Halley's Comet in 1986. They also intend to launch a lunar polar orbiter and a lunar soil sampler for analysis of soil from the dark side of the Moon. A manned flight to Mars is under consideration.

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Soviet Space Costs

During the period 1965-75 the Soviet space program emphasized the maintenance of multisatellite communications and intelligence networks and the development of the large SL-X-15,[2] the Saturn V–class space launch vehicle (SLV) designed to place a man on the Moon. Estimated total costs rose at an average annual rate of about 9 percent—from $7.5 billion in 1965 to $12 billion in 1970. After 1971 annual space costs declined somewhat but remained at about $10 billion until 1974, when the manned lunar program was canceled because of the failure of the SL-X-15 space booster. The resulting abrupt decline in R&D costs brought a reduction in overall costs despite an increase in procurement costs, mainly for military satellites.

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Since 1978 Soviet space costs have shown renewed growth as the emphasis has been redirected to manned space stations. A variety of new programs, including a follow-on to the SL-X-15, development work on a large space station, and new intelligence, communications, and scientific satellites, have pushed costs to new highs. Estimated total costs have doubled from $10 billion in 1978 to a projected $20 billion in

[1] Dollar estimates represent what it would cost to replicate Soviet development and procurement of space systems in the United States and then launch and operate the systems as the Soviets would. Data are in constant 1981 US dollars. Because our cost estimates cover only those existing or planned programs for which we have evidence, they may understate overall program costs.

[2] Commonly called the TT-05.

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1983 for an average annual increase of 15 percent. After 1983 growth is expected to be less rapid, perhaps averaging about 6 percent a year through 1986.

Space R&D Costs

The largest part of the current growth in the Soviet space effort is in the area of research and development. Estimated R&D costs will rise from $4 billion in 1981 to about $9 billion in 1984. They are expected to increase less rapidly over the next several years before declining slightly with the completion or near completion of several programs.

Space Launch Vehicles. About 60 percent of projected Soviet space R&D costs in the 1981-86 period are associated with the development of new medium- and heavy-lift launch vehicles. The heavy-lift vehicle, expected to be operational in 1986 or 1987, will be capable of placing in orbit the Soviet version of the US space shuttle orbiter, a Skylab-sized space station, and planetary probes. The medium-lift vehicle, projected to be operational by early 1984, probably will be used for the space plane now under development and possibly for advanced reconnaissance satellites and R&D flights of a space-based laser. Successful development of the heavy-lift launcher is critical to the pace of the Soviet space effort because existing SLVs cannot lift the large spacecraft under development.

Manned Systems. The other major cause of cost growth in Soviet space R&D is the increased emphasis on the development of manned systems. The Soviets have under way a long-term program to establish a permanent manned presence in space.

The permanent manned space station that will succeed the modular station is expected to accommodate 12 to 20 crewmen. A new resupply vehicle based on technology of the Cosmos 929 vehicle is also being developed for use with the permanent space station. The station may eventually be expanded to form a space base for more than 20 cosmonauts.

Unmanned Systems. R&D costs devoted to unmanned space systems are expected to remain relatively level and represent a small percentage of total R&D costs. For example, we estimate that in the 1981-86 period they will represent only 14 percent of total R&D costs, whereas R&D for manned systems will account for 25 percent and SLVs for 60 percent of the total. Nevertheless, the $1.2-1.5 billion annual costs in this area will enable the Soviets to develop a greater variety of unmanned satellites to aid in communications, intelligence, and oceanographic and Earth-resources research as well as in military missions such as radar calibration, command and control, timely reconnaissance, and precise navigation.

Space Hardware Costs

We estimate that Soviet space hardware procurement costs, after remaining relatively constant throughout the 1970s at $5-6 billion per year, will almost double by 1986.

Manned Missions. The renewed emphasis on manned programs will raise the hardware costs of these programs from about 9 percent of space procurement in

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1965-68 to almost 20 percent in 1983-86. As an example of the magnitude of these programs, the cost to procure, launch, and operate the small modular manned station is estimated to be about $1 billion with an additional $300-500 million required annually to man and resupply the station.

Communications. The proliferation of Soviet communications networks for both civil communications and military command and control will generate steadily increasing costs, which by the 1983-86 period could amount to about one-fifth of space hardware costs. By the mid-1980s, these satellites will provide global military communications to aircraft, ships, and ground forces as well as increased television and common-carrier communications capability.

Scientific, Lunar, and Planetary Missions. Soviet emphasis on scientific, lunar, and planetary missions declined in the late 1970s as a result of the aborted lunar programs. According to Soviet announcements and other sources, the USSR plans a resurgence in this area that will include the unmanned Venus and lunar missions mentioned earlier in this article and space-based telescopes. The total program probably will account for about 13 percent of hardware costs in the 1983-86 period.

Other Military Support. Costs for military support satellites that provide navigation support, collect weather data, and calibrate large ABM radars have remained small over time, accounting for about 10 percent of growing space hardware costs.

Antisatellite Systems. We estimate the cost and the share of antisatellite systems in total space hardware costs will be less than 5 percent in the 1983-86 period.

Implications

The Soviet space program preempts a growing share of the nation's most modern production and R&D facilities and many of its finest scientific, engineering, and managerial talents. In light of current economic difficulties, we believe this program is subject to intensive review. But Soviet leaders evidently believe that the economic, military, and prestige payoffs from the civilian and military space programs justify the substantial costs. Nowhere is this more clear than in the efforts to establish a permanent, continuously manned, orbiting space station. For example, the Soviets intend to manufacture pharmaceuticals, electronic devices, optical equipment, and metal alloys aboard the space station. Manufacture of these items in the absence of gravity, in some cases, results in enhanced physical properties. These manufacturing experiments have been publicized as having economic value, but they probably will have direct military applications as well. Although we are uncertain as to the military experiments to be undertaken on the space station, the Soviets are likely to pursue research in submarine, aircraft, and missile launch detection, space-based weapons, and other important defensive and offensive missions.

The investment in space in the 1980s will have a significant impact in the coming decades on Soviet scientific and technological advancement. The Soviets appear determined to gain an edge over their competitors in space and appear to be willing to devote considerable resources toward that end.

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Prospects for Soviet Space-Based Weapons

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The early successes of Soviet and US space programs demonstrated the potential for developing and deploying a variety of offensive and defensive weapons that could alter the strategic balance. As a consequence, the Soviets over the past two decades have incorporated space-based weapons into their doctrine and planning for strategic operations. A nonnuclear antisatellite (ASAT) system with a limited intercept capability has been their only success to date. At the same time, Moscow has proffered a series of initiatives on arms control in space [1] and since 1977 has consistently criticized US "militarization" of space.

Recent Soviet statements reflect Moscow's concern over prospective changes in the military balance in space. Increased US spending for military space programs, the recent creation of a US space command, the proclamation of a US space doctrine, and the success of the space shuttle, in particular, have heightened Soviet awareness of US advances that have potential application to space weaponry. We expect the Soviets to continue their efforts to perfect technology for advanced-concept, space-based weapons while at the same time pressing for a ban on space-based weapons of all types to halt or slow down US weapons development.

Current ASAT Capability

To date, the only weapon deployed in space has been the Soviet orbital ASAT system.[2]

ASAT development was probably prompted, in part, by Moscow's perception of the US potential to develop orbital conventional and nuclear weapons. The Soviet ASAT program during the 1960s had its own sponsor-induced momentum but was also spurred by US military-oriented programs such as reconnaissance satellites and by means for satellite inspection such as the manned orbiting laboratory.

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Future Directions in Space Weapons Technology

For at least the past 15 years, the Soviet military has funded basic and applied research in directed-energy weapons concepts such as high-energy lasers, particle beams, and electromagnetic pulse (EMP) generating devices. Of the three, the high-energy laser (HEL) approach appears most feasible for a space-based weapon. In a strategic context, HEL weapons would be best suited for defensive roles (ASAT and air and ballistic missile defense), and we believe that the ASAT role is the most likely near-term objective of Soviet HEL efforts. Because of their fragility and orbital predictability, satellites are more vulnerable to laser radiation than targets such as bombers and ICBM or SLBM boosters. Moreover, if based in

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[1] The United States and the Soviet Union were able to agree on the 1967 Outer Space Treaty, which banned nuclear and other weapons of mass destruction in space. In 1978-79 the two countries engaged in negotiations to limit ASAT weapons. In 1981 and 1982, at the UN, the Soviets proposed a treaty to ban all weapons in space and a resumption of the ASAT talks.

[2] In this context, *weapon* will be defined to include only those space-based systems assessed as having the ability to degrade, damage, or destroy a space-based, airborne, or ground-based target.

space, a laser would not be hampered by the adverse propagation conditions that exist in the atmosphere. It would have several potential advantages over the existing Soviet orbital interceptor:

- It would not be limited to a single target and would have a longer range.
- Attack warning time would be reduced to near zero.
- It would have a better capability against maneuvering target satellites.

An ASAT weapon might be only the first of a number of applications for Soviet space-based lasers. The Soviets may attempt to use the experience and technology gained from development of the ASAT system to develop an HEL system for ballistic missile defense (BMD). However, the requirements for continuous coverage by launch-detection systems and the large numbers of satellites and launchers required to ensure the rapid destruction of missiles make BMD the most difficult and costly of potential space-based HEL applications.[3]

Status of HEL Development

The Soviet military has been sponsoring HEL research since at least 1969. The 24th Communist Party Congress issued directives for continued growth of the HEL program and designated it as a high national priority for the 1971-75 plan.

We believe that the USSR's HEL efforts remain in a stage the Soviets call scientific research work (NIR)[4] and that no funding has yet been committed to a weapon development program. The length of NIR, coupled with the observable resources dedicated to it, reflects the technical complexity of the effort and underscores Soviet determination to demonstrate feasibility and proceed toward an operating HEL weapon.

In addition to perfecting an HEL or a particle-beam device, the Soviets must demonstrate their mastery of acquisition, tracking, and pointing (ATP) technology before they can begin developing a weapon. We have little information on Soviet ATP capabilities, particularly for space-based systems. However, on the basis of our assessment of their ATP-related technologies, we estimate that the Soviets could now have the capability to track a target precisely enough for some ASAT applications and may achieve the necessary accuracies for development of a space-based HEL BMD weapon by 1990.

The Soviets probably have the capability to build an acquisition system based on existing radar, optical, or infrared technologies, but the extreme target tracking accuracy demanded by a laser weapon in any strategic defensive role will require the use of an electro-optical precision tracker. We believe that the Soviets are continuing acquisition, tracking, and pointing NIR aimed at overcoming design or technological deficiencies.

[4] Scientific research work or NIR *(nauchno-issledovatelskaya rabota)* is basic and applied research conducted preparatory to the funding of a weapon development program. NIR includes: (a) investigating new concepts, (b) developing and testing experimental devices to verify technology, (c) completing a preliminary system design, and (d) transferring technological expertise to a system design organization if a weapon development program is authorized. The funded development program, known as experimental design work or OKR *(opytno-konstruktorskaya rabota)*, involves the complete, detailed design of a weapon system, including all of its subsystems and—after the approval of the design—full-scale engineering, fabrication of prototypes, and prototype testing.

Outlook

Prospects for Continued Development of ASAT Capabilities. The longstanding Soviet commitment to orbital ASAT development and directed-energy research indicates a strong desire to develop and deploy space-based ASAT weapons. We expect the USSR to continue efforts to improve its orbital interceptor not only for potential operational use, but also as a hedge against development and deployment of technologically superior US systems. It is possible that an improved orbital interceptor will be operationally maintained well beyond the availability of a space-based HEL weapon to ensure a reliable, redundant ASAT capability. This would be especially important as both the US and USSR increase their reliance on space systems for intelligence gathering, navigation, and command, control, and communications.

Future Space Systems Availability. Prospects for the deployment of advanced-concept, space-based weapons such as HELs and particle beams are uncertain. Historically, weapon availability has been difficult to predict when viewed solely in terms of technological capabilities or advancements. Efforts to assess the status and measure the progress of Soviet HEL projects have been complicated because of the difficulty of distinguishing devices built solely to demonstrate technological feasibility from those developed as weapon prototypes.

Development of HEL weapons will begin once appropriate technologies have been demonstrated and verified. Typically, it takes 10 to 12 years to bring a Soviet space system from initial design through prototype construction and flight-testing and into series production

we estimate that a Soviet space-based HEL ASAT could be in development for 15 or more years. We would expect more ambitious applications of space-based HELs or the development of a particle beam weapon to take even longer.

Moreover, we would expect production rates to be very low because of the labor-intensive method of assembly, competition with other systems in development, and hardware complexity. A low production rate would preclude the timely deployment of an effective space-based laser or particle beam ballistic missile defense requiring tens or hundreds of satellites.

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By the mid-to-late 1980s, a new generation of Soviet space launch vehicles, including a space shuttle, will probably be available to support the development and deployment of a space-based laser ASAT. The shuttle will probably be used to test individual components and subsystems prior to their integration. New heavy-lift launch vehicles will allow the Soviets to incorporate heavier but more reliable off-the-shelf technology in the system design. Hence, the use of mid-1980s technology probably will provide the basis for deployment of an operational system before the year 2000.

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Prospects for Deployment of Future Systems. We expect that a Soviet space-based laser ASAT prototype probably could be launched by the mid-1990s. We expect this first system to be a modest effort that, once launched, will undergo several years of flight-testing before becoming operational. Even after the system is declared operational, the Soviets will probably continue testing modified or upgraded versions as incremental improvements to their overall capability.

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Soviet progress toward more ambitious applications of directed energy will also be achieved incrementally. An operational space-based HEL weapon for air or ballistic missile defense roles probably will not be available before the year 2000. Lengthy flight-testing will be required to ensure a high degree of system reliability. Once declared operational, the pace of deployment will depend on the USSR's ability to produce a relatively large number of satellites and on the availability of launch vehicles and support systems.

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Prospects for Soviet Commercial Exploitation of Space Systems and Related Services

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Moscow has clearly indicated its intention to compete for a share of the growing international market for space systems and related services and products. Its current marketing efforts are focused primarily on satellite launch and communications services, where its capabilities are expected to increase steadily in the next 10 years and where it already is attempting to underprice Western competitors. Because the USSR is the world's leader in experiments on materials processing in space, the manufacture of pharmaceuticals, electronic devices, optical equipment, and other products in space may ultimately prove the area where it enjoys the greatest advantage over Western competitors.

Soviet Incentives and Disincentives To Compete

Moscow has both financial and political incentives to make commercial use of its space systems and capabilities. Although there is great uncertainty as to the eventual size of the market for space-related services and products, Western space and industry analysts estimate that the launching and manufacturing of communications satellites alone will yield billions of dollars of revenues a year by the late 1980s. Capturing a share of this market would provide the USSR with an important supplement to its other hard currency earnings. Moscow also would probably perceive activity in space-related trade as a means of getting a foot in the door for other Soviet high-technology products. The Soviets would value the access to Western space technology that might result from Western use of Soviet launch services and almost certainly would view commercial exploitation of space as a means of increasing their national prestige and influence.

Entry into the commercial market, however, will require some changes in Soviet operating procedures. Customers will need to know satellite capabilities, obtain reliability data for launch vehicles, and require access to satellite construction, launch, and support facilities. Even when involved in joint space ventures, the Soviets have often refused to provide information requested by the other participating country. They have never released data on the reliability of their launch vehicles, do not maintain separate civilian and military space facilities, and have generally denied foreign access to military areas.

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Soviet Intentions and Capabilities

Notwithstanding these drawbacks, the Soviets have indicated their intentions to market space-based services and are apparently increasing their capabilities to do so. Moscow's marketing efforts and its prospects for success vary greatly with the type of space-related service or product.

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Launch Services. To date commercial firms, international organizations, and governments have looked to the US Atlas-Centaur and Delta expendable launch vehicles and the shuttle to launch satellites into orbit. The Atlas-Centaur and the Delta, however, are scheduled to be phased out by 1985, and US space and industry analysts estimate that the shuttle will not be able to provide all the launches that will be demanded by non-Communist countries during the period 1986-94. A recent US decision will allow US private firms to buy US expendable launch vehicles and rent US launching pads. The firms will, however, need to prove their capability before large segments of the commercial market will be willing to book launches with them. Commercial customers of the shuttle also will have the lowest priority, behind the military and other US Government agencies, and could be bumped from scheduled launches, causing even those firms that already have booked a shuttle flight to consider alternate launch vehicles.

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The shuttle's main Western competitor is the French Ariane booster to be used by the European Space Agency (ESA). It has not yet, however, flown a successful operational mission. The Japanese also are

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LICENSINTORG Panorama

No. 5 • 1982

A quarterly publication
of V/O LICENSINTORG, Moscow, USSR.

Appears in English, Russian, Finnish, French, German and Spanish.

Cover Picture: **The achievements of Soviet scientists and designers in space research are universally known. Licenstransmash is ready to assist foreign firms in launching their artificial earth satellites by Soviet carrier rockets.**

From a Soviet foreign trade magazine disseminated in Western Europe and the United States

developing expendable boosters based on US technology, but an agreement between Japan and the United States stipulates that they will not be used for third-party launches without US permission.

The Soviets also have been trying to market satellite launch services:

- In 1981 and again in 1983, according to an official with the International Maritime Satellite Organization (INMARSAT), the Soviets offered to supply launch vehicles for INMARSAT satellites during the period 1988-89.

- In mid-1982 Vladimir D. Shibaev, director of the Soviet export-import firm for transport machine building, reported in a journal article that his firm had a new capability to provide satellite launch services, indicated that the firm was "talking" with ESA with hopes for positive results, and stated that contacts had been made with other companies.

- Shibaev subsequently reported a Soviet commercial agreement for launching an Indian remote sensing satellite in 1986 and an "arrangement" to launch the ESA MAREC-C satellite. He expressed the USSR's interest in a large number of orders for launch services now and for the next 10 years.

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The Soviets have said they will enter the market with the SL 12/13 Proton booster. It has maintained about a 90-percent reliability rate over the past 10 years and has a payload capacity only about 10 percent less than that of the US shuttle.

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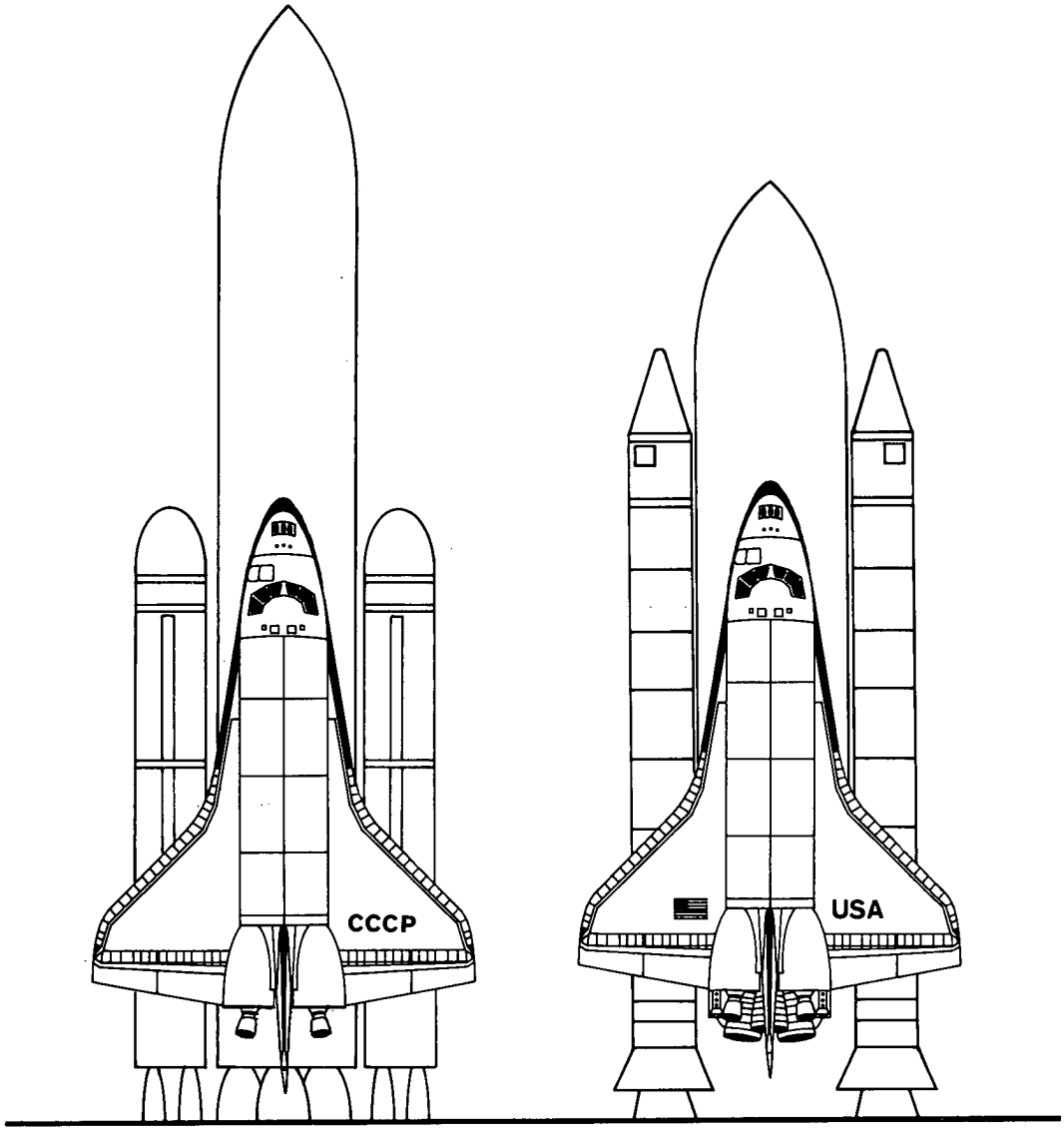
Soviet and US Space Transportation Systems



68	Height (m)	56
1,699,000	Lift-off Weight (kg)	2,026,000
26,450	Lift-off Thrust (kN)	30,500
75,400	In-Orbit Weight (kg)	97,700

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Leasing International and Domestic Communication Services. Since about 1980 the Soviet-sponsored INTERSPUTNIK organization has begun to compete with the US-sponsored International Communications Satellite Organization (INTELSAT) in marketing international communications services in the Third World. INTERSPUTNIK, which has primarily served the needs of nine Soviet Bloc members, is smaller than INTELSAT, which currently provides services to more than 120 countries. It is willing, however, to undercut INTELSAT's prices. A satellite voice circuit like that INTELSAT offers for $20,000 a year, for example, may be leased from INTERSPUTNIK for $12,000.

In 1983 INTERSPUTNIK concluded an agreement to lease domestic communications services to India, the first country not associated with INTERSPUTNIK to be offered such services.

Manufacture of Satellites. Excluding Japanese and Soviet Bloc requirements, US space analysts estimate the total world demand for commercial communications satellites, including replacements, will be more than 200 during the period 1983-95. Many of the countries that will be contracting for communications satellites are from the Third World and are not capable of manufacturing satellites. Others are industrialized nations that do not have space industries. In addition to US firms, companies in at least six Western countries can manufacture communications satellites or the associated ground stations.

While there is no evidence of Soviet intentions to manufacture satellites for foreign countries or firms, the USSR is apparently capable of doing so

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Many Third World nations will not have communications demands that require expensive, sophisticated satellites. Although Soviet communications satellites would have the cost edge initially, the life-cycle costs would probably be higher. To date the lifetime of Soviet communications satellites, however, has been about two years as compared with an average of approximately 10 years for Western satellites. Soviet prices would need to be relatively much lower to offset the increased costs incurred from frequent replacements and the accompanying launch fees.

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Remote Sensing. Both industrial and developing countries are looking to data derived from remote sensing satellites to locate mineral and energy resources, to identify potential problems in such areas as agriculture, for land-use studies, and for cartographic work. Users can buy data in the form of a picture or a tape, or own a receiving station for access to primary data and pay a fee to the country that owns the satellite. Countries concerned about national autonomy and industrial espionage are leaning more toward national ownership of ground receiving stations.

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Thus far the US Landsat program has provided most of the data to consumers. Although the records of the EROS Data Center and the NASA Goddard Distribution Center indicate a relatively small primary market—approximately $5.7 million per year in direct sales—US industry and government analysts estimate that there is a secondary market, which could be as much as 50 percent greater. (Some users obtain data from other users at a portion of the original cost, or gratis.) The US commitment to provide the data to both domestic and foreign users,

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however, does not extend beyond the mid-1980s. Moreover, competition is expected in the later 1980s from the French Spot program and from a Japanese system.

In 1977 at the UN the Soviet Union publicly offered to provide photographic services and data from outer space to other countries and claimed that photographs taken with up-to-date equipment onboard Soviet spacecraft would satisfy the most exacting customers. While this public offer has not been repeated, Moscow may be delaying its marketing effort until it has an operational system competitive with the US Landsat or the soon-to-be-operational French Spot system. We believe Moscow's competitiveness will be helped considerably when its multispectral scanning system becomes operational in the mid-1980s. The Soviets' massive mapping capabilities and competence to assist developing countries in using the data, as well as their policy of keeping the data from third countries[1] will aid in marketing their remote sensing products.

There are indications that the development of remote sensing equipment and techniques will be a Soviet-led CEMA venture. For example, a March 1983 *Economic Gazette* article describes CEMA efforts to develop the technical equipment for the space segment of a remote sensing system and for the processing, copying, and use of the data. The East Germans are already marketing image processing equipment and probably could not have made the decision to do so without Soviet agreement.

Materials Processing. Experiments show that the zero gravity of the space environment facilitates the manufacture of products that are difficult or impossible to produce on Earth. The products most likely to be produced in space are pharmaceuticals, electronic devices, optical equipment, and metal alloys. Many of these products will have important military as well as commercial applications. Until permanent manufacturing facilities are established in space that can produce materials of sufficient quantity, the potential market cannot be estimated with confidence.

Nations looking at the feasibility of space manufacturing include the Soviet Union, the United States, France, West Germany, and Japan. The Europeans and Japanese are committing considerable resources to their projects, and, in the case of Japan, space manufacturing has been made a national priority. Although some Western materials processing experiments have been conducted, extensive experimenting will not begin until the ESA-built Spacelab is orbited for a week in late September 1983. There are plans for private firms to begin manufacturing pharmaceuticals onboard the shuttle by 1985, but the US Government has no current plans for a permanent space processing facility for the remainder of the decade. The Japanese have no current capabilities for permanent facilities, and a European facility is not scheduled for launch until about 1986.

Soviet experiments in space manufacturing could give the USSR an advantage over potential competitors should it decide to commercialize its space-processed products. The USSR has conducted the most extensive experiments in this area onboard the Salyut 6 and 7 space stations. The Soviet press has claimed that such experiments will lead to the creation of space-based manufacturing facilities to produce pharmaceuticals, semiconductors, alloys, and special glasses.

[1]The Soviet Union is a strong supporter of regulating the dissemination of remote sensing data largely because of its concern over the military significance of the data for those countries that do not have a photoreconnaissance capability.

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Moscow and the Church in Eastern Europe [redacted] 25X1

The papal visit to Poland this month dramatizes a problem that is likely to become increasingly troublesome to the Soviets over the next few years: how to limit the role of the churches in Eastern Europe as rivals to Communist ideology and potential seedbeds for political opposition while having to depend increasingly on them to moderate discontent arising from frustrated consumer expectations and growing pacifist sentiment. [redacted]

Accommodation Despite Distrust

The Roman Catholic Church in Poland, Hungary, and Czechoslovakia and the Lutheran Church in East Germany are the only broadly based institutions in Eastern Europe that have preserved a significant degree of independence under Communist rule. Throughout the post-War period, the Soviets have viewed the Catholic Church with antagonism and barely concealed apprehension. They see the Church not only as an ideological foe but as a focal point for anti-Soviet and anti-Communist nationalism in several states of the region, and potentially in the Baltic, Belorussian, and Ukrainian republics of the USSR. The Soviets have also expressed concern that the Church nurtures political opposition and is subject to manipulation by forces in the West. These feelings have crystallized most recently in Soviet charges that the Church in Poland provided much of the impetus for the independent trade union movement, Solidarity, and for the opposition activity that has continued under martial law. [redacted]

Despite these misgivings, the Soviets have accepted the modus vivendi that the East European regimes have developed with the Church over the past three decades, replacing the relentless oppression of the Stalinist era. Moscow's acceptance has resulted largely from its having recognized the difficulty and costs of attempting to eliminate Church influence, but experience has also shown, particularly in Poland, the stabilizing role the Church can play in moderating public demonstrations of opposition. [redacted]

Moreover, Soviet acceptance of the varied patterns of church-state relations among the respective East European countries amounts to de facto acknowledgement that policy toward the Church must be adapted to local conditions. By the late 1970s, church-state relations ranged from the strict control practiced in Czechoslovakia to the near autonomy of the Polish Church under Cardinal Wyszynski. The Vatican, under Pope Paul VI, was pursuing a policy of *Ostpolitik* designed to improve the lot of Soviet and East European Catholics by seeking improved relations with the Warsaw Pact regimes. [redacted] 25X1 25X1

The Papal Succession and the Polish Crisis

The accession of John Paul II in October 1978 added a new dimension to church-state relations in Eastern Europe and provided abundant cause for heightened Soviet anxiety. The new Pope's Slavic origins threatened to arouse nationalist emotions and to intensify interest in the Church, not only among his Polish countrymen but in many other East European countries. Moreover, the political skills acquired during his long tutelage under Cardinal Wyszynski and the vigor with which he asserted his views suggested that he would be a formidable adversary. [redacted] 25X1

Despite misgivings hinted at privately by Soviet officials, Moscow nonetheless professed initially to see positive aspects in the Pope's election. A Soviet weekly suggested that it represented a defeat for conservatives in the College of Cardinals and that the Pope's early statements indicated an intention to continue the effort of his predecessors to "normalize" church-state relations in the "socialist" countries. Moscow underscored its interest in the views of the new pontiff by requesting a papal audience during Foreign Minister Gromyko's visit to Italy in January 1979. [redacted] 25X1 25X1

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The new Pope quickly demonstrated his intention to pursue an aggressive policy toward the Eastern regimes. Meanwhile, a papal letter addressed to the Hungarian primate, Cardinal Lekai, and read in Catholic churches throughout Hungary, appealed directly to Hungarian nationalism and implied that the Hungarian Church should pursue a more confrontational policy toward the government.

Of the Pope's early initiatives, the one which caused Moscow the greatest concern was his triumphant visit to Poland in June 1979. A Soviet commentary on the visit spoke of the "duality" in Vatican policy toward the East: while abandoning in some measure its former anti-Communism, the Church was seeking to extend its influence among the masses, and some Polish clerics wanted to use the visit for "antistate" goals. the Foreign Ministry in Moscow subsequently concluded that, although the Pope's calls for relaxation of internal tension were constructive, the visit had a generally negative effect on the political situation

The crisis that began in Poland a year after the papal visit was perhaps the most frustrating problem the Soviets have confronted in Eastern Europe, not least because it resulted in a new level of dependence upon the Church to prevent a breakdown of order that could have required Soviet military intervention. When the Polish regime appeared unable in the late summer of 1980 to suppress the growing opposition movement, the Soviets took the unprecedented step of appealing directly to the Vatican. After initiating contact in September 1980, the Soviets kept the Pope apprised of their concern and repeatedly sought his intercession with the leaders of Solidarity on behalf of moderation. Cooperation was particularly close during the critical period of March-April 1981. During this time, Soviet propaganda avoided direct criticism of the Church.

Since the imposition of martial law in December 1981, the Soviets have been more willing to criticize the Polish Church publicly, particularly the alleged support by some clerics of continued opposition activity. Nonetheless, the Soviets consented, at least tacitly, to the papal visit. the regime in Warsaw had succeeded by early March in convincing Moscow that the Pope's visit would contribute to internal stability. The Soviets probably hope too that it will bring about an easing of Western economic sanctions.

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The Challenge Elsewhere

While the activity and influence of the Polish Catholic Church will remain of greatest concern to the Soviets, there is growing potential for a clash of interests between church and state elsewhere in Eastern Europe.

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In East Germany, the Lutheran and Catholic Churches are the only religious institutions enjoying widespread legitimacy. The Lutheran Church, which comprises up to 60 percent of the population, has criticized the regime publicly on several issues in recent years. The most sensitive of these issues, from the Soviet perspective, are those relating to pacifist themes. The Church's efforts to persuade the authorities to moderate their policies on mandatory military training for East German youth and on possible alternative service for conscientious objectors have grown into a widespread though limited sponsorship of East Germany's large, unofficial peace movement.

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Although the Soviets have not commented publicly on the Church's role, their concern is probably tempered with some positive feelings. The Church, anxious to preserve the working dialogue developed with the authorities over the years, has frequently acted as a moderating influence on the unofficial peace movement and thereby spared the regime from having to resort to more forceful suppression. The latter would be particularly embarrassing for the Soviets while they are attempting to cultivate West European pacifists in an effort to block NATO's deployment of additional intermediate-range nuclear missiles.

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At the same time, both the Soviets and the East German authorities must be deeply concerned that the Lutheran Church has now emerged as a spokesman on a politically sensitive issue with such broad appeal. East German leader Honecker reportedly warned a Lutheran bishop recently that the Church should refrain from pursuing an independent path on disarmament questions. Church leaders have since backed off somewhat from their support of peace activists, but they will remain under intense pressure from Church members, particularly youth, to maintain an independent stance. The potential for church-state tension remains high, more so as a dwindling supply of draft-eligible young men will limit the government's ability to accommodate conscientious objectors in the years ahead.

Until recently, the Catholic Church in East Germany, which comprises less than 10 percent of the population, had not involved itself in political controversies. In January, however, Catholic priests read their congregations a pastoral letter denouncing the militarization of East German society and supporting conscientious objection. The head of the East German Catholic Church, Cardinal Meisner, recently told the US Ambassador that the Church would continue to avoid direct political activity, but he added that it viewed its basic relationship with the state as "antagonistic."

In Hungary, as in East Germany, the Catholic hierarchy has avoided controversy while seeking the gradual expansion of official tolerance for religious activity, and the primate, Cardinal Lekai, has condemned the pacifist activity of some dissident priests. Nonetheless, church-state relations have been troubled by the regime's refusal to allow construction of new churches, and there are reports that the Pope remains critical of Lekai for not pressing the state harder. At the end of March, the Hungarian bishops departed from previous practice by appealing to Church members to "mobilize" on behalf of peace and disarmament. The wording was cautiously neutral, but a Hungarian official issued a public warning shortly afterward against "irresponsible actions," such as advocating conscientious objection, that could disturb church-state relations.

In Czechoslovakia, where church-state relations are already the worst in Eastern Europe, the regime continues to suppress Catholic dissidents and members of the unauthorized "underground church." Relations with the Vatican have been strained further by the Pope's refusal to allow Czechoslovak priests to participate in the regime-sponsored organization Pacem in Terris and by his consecration in January of two Czechoslovak bishops, whom the authorities in Prague accuse of anti-Socialist activity, to administer to the exile community. The dialogue between the Vatican and the regime is stalemated, and a rupture of relations is possible. Czechoslovak leader Husak charged in May that some circles in the West were trying to "politicize" the Church and use it to incite citizens against the regime. 25X1

Outlook: Continuing Dilemma for Moscow

While the possibility of heightened conflict between church and state in Eastern Europe over the next few years appears high, there will also be a greater probability of situations in which the regimes would feel the need for church support. East European economic difficulties—compounded by reduced access to Western loans, difficulty in selling to hard currency markets, and restrictions on Soviet deliveries of energy and raw materials—are unlikely to improve and could worsen. Increased consumer frustration is likely, and it could lead in turn to more open expressions of political opposition. Although Poland is the most likely setting, all East European countries are vulnerable. Moreover, the problem could be compounded by succession problems, in view of the advanced ages of the East European leaders. Under these circumstances, the moderating influence of the churches will probably become even more important. 25X1

The need to balance ideological concerns against pragmatic considerations, and to prevent the churches from becoming a base for political opposition while using their influence as a force for moderation, will require constant tactical adjustments. The Soviets will have to accord the East European regimes more flexibility to develop constructive working relations with the churches but will be concerned at the same time to limit any concessions allowing the churches to propagate their views more actively. 25X1

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Because of the complexity and sensitivity of church-state issues, situations are likely to arise that will exacerbate differences of view between ideologists and pragmatists within the Soviet leadership. The Soviets are also likely on occasion to disagree with their allies on whether to employ coercion or accommodation, and this will impose additional strains on Moscow's relations with East European leaders. The response of the West to such situations will help determine whether the approaching period of particularly delicate church-state relations in Eastern Europe results in greater pluralism or greater repression.

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The Modernization of Older Warsaw Pact Tanks

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The USSR and its Warsaw Pact allies are in the early stages of a modernization program to improve the combat capabilities of their older tanks over the next 10 years. We estimate the dollar cost of the program to be $11.5 billion—roughly one-third of what it would cost to replace these tanks with the latest Soviet models.[1] Growing economic problems in the USSR and Eastern Europe probably make the modernization program an attractive alternative to a significant increase in new tank procurement. The program also offers the East Europeans an avenue to satisfy the strong Soviet pressure for force modernization at a much reduced cost to the national economies.

The Soviet modernization program may include a rebuilding of as many as 22,000 T-54, T-55, and T-62 tanks, which were introduced beginning in 1949, 1958, and 1961, respectively, as well as improvements to the fire control systems of about 3,000 early model T-72s.[2] Information on non-Soviet Warsaw Pact (NSWP) participation is more limited.

We assume that the NSWP effort will include the same improvements as the Soviet program. We expect both programs to be completed by the early 1990s.

[1] The procurement costs expressed in this article are estimated in 1981 dollars and do not represent actual Soviet expenditures. When measured in rubles, the relative cost of the modernization program versus new tank procurement could be different. However, we believe that the dollar cost estimates presented in this article reflect a fair approximation of the relative magnitude of the program. Dollar cost estimates are intended to represent what it would cost the United States to produce the Soviet design using US production technology, input prices, and profit margins. Dollar cost estimates cannot be used in isolation to draw inferences about the relative military effectiveness of Soviet equipment.

[2] These figures are derived from the Warsaw Pact ground forces projection that is contained in the Land Armaments and Manpower Model (LAMM), a data base recently developed by CIA, DIA, NPIC, and the US Army to facilitate the study of Warsaw Pact ground forces.

A Cost-Effective Response to a Perceived Threat

The Soviet modernization program apparently was prompted by the recent improvements in NATO forces and the prospect of a substantial upgrading of Chinese military capabilities in the wake of better Sino-Western relations. Growing economic problems apparently have persuaded Moscow to reduce the cost of responding to this perceived threat in part by modernizing older tanks rather than procuring the newest main battle tanks to station opposite China and Iran. These modernized tanks, while not matching the capabilities of new Soviet production models, will be capable of engaging the tanks that are likely to be in service in these countries during the rest of the century.

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This strategy will result in substantial savings. We estimate that the dollar equivalent cost of modernizing the T-54s, T-55s, and T-62s will be around $350,000 per tank.[4] In contrast, a new T-64B or T-80—the latest Soviet tank models currently in production—would cost an estimated $1 million. If the Soviets fully modernize the roughly 25,000 T-54s, T-55s, T-62s, and early model T-72s that we believe will be in the active inventory in the early 1990s, the cost could average an estimated $800 million annually for the next 10 years. If a like number of new tank models were purchased instead over the same period, the average annual figure would be on the order of $2.5 billion.

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These savings will be small relative to the overall dollar costs of Soviet defense activities, and the advantages of the program are further tempered by the fact that new tanks would have a longer expected

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[4] The T-54, T-55, and T-62 tanks are very similiar in design. For estimating the cost of the modernization program, we treat the modifications as being virtually identical.

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service life than the modernized older model tanks. The difference in expected service life would somewhat diminish the economic advantage of the modernization program if considered over a period of 20 or 30 years instead of the next 10 years. Within the ground forces, however, where an estimated 55 to 60 percent of the cost in dollar terms for land arms procurement is for tanks, the difference in costs over the next 10 years will be substantial. Moreover, the modernized tanks will be more attractive to Third World customers, generating hard currency for the Soviets.

Economic considerations probably were also pivotal in the development of the NSWP tank modernization programs. The service lives of the improved T-54s and T-55s will be extended; consequently, the need to purchase new tanks during the next 10 years or so will be reduced significantly. We estimate that modernizing these older tanks instead of replacing them with the latest version of the T-72 will reduce the dollar cost to the NSWP countries by more than $5 billion over the next 10 years.[5]

These modernized NSWP tanks will be assigned to units opposite NATO forces. They will not be able to engage the latest NATO tanks on an equal footing, but they probably could hold their own against many older tanks, including the M-60 series and the Leopard 1, both of which will remain in the NATO inventory in substantial numbers for the remainder of this century.

Planned Improvements

The Soviets began developing components for this modernization effort as early as 1974.

The modernization program is broad in scope and will apparently include upgrading fire control, ammunition, protection, and mobility.

Fire Control. The Pact countries will replace the fire control system on the T-54, T-55, and T-62—which in recent years has become a weak point—with a modern, fully integrated system

[5] The future forces projection contained in the LAMM data base indicates that, by the early 1990s, when we believe the Pact modernization program will be complete, the NSWP countries will nevertheless have procured about 5,000 T-72s in addition to improving 10,000 T-54s and T-55s.

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The recent US embargo on providing advanced microelectronics to Warsaw Pact countries reportedly has had an adverse effect on Polish efforts to replace the fire control systems in the T-55, and presumably on other Pact fire control modernization efforts. Western microchips are no longer available for use in fire control components, and the Soviet and East European substitutes are prone to failure as a result of heat buildup.

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Ammunition. the Soviets have begun fielding an improved 115-mm armor-piercing round for the T-62 and may have an improved 125-mm armor-piercing round for the T-72 and T-64 under development. These rounds apparently incorporate a tungsten-alloy core, long-rod penetrator that probably can penetrate at least 20 percent more armor than the steel-alloy projectile it replaces.[6] The T-54 and T-55 tanks have had improved tungsten-carbide armor-piercing ammunition since the late 1960s. the Soviets may be developing a follow-on 125-mm solid tungsten-alloy, long-rod penetrator round that could improve penetration by 40 percent over the original 125-mm steel-alloy projectile. A similiar 115-mm round may also be under development.

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Access to Western manufacturing technology and equipment has enhanced the Soviet capability to produce advanced kinetic energy ammunition.

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Previously, the Soviets had little success in mastering these manufacturing methods.[7] Recent evidence indicates that they have now overcome these problems, presumably through the acquisition of the US technology

Protection. The Soviets apparently will attach external armor plates to the glacis of the T-62, and presumably to the T-54 and T-55 as well.

Improved radiation protective liners will probably be installed to increase crew survivability.

Mobility. The Soviets are developing new engines, believed to be in the 650- to 700-horsepower range, to replace the existing diesel engine in the T-55 and, presumably, the T-54 and T-62. The additional weight of the extra armor necessitates an increase in engine power if the modernized tanks are to maintain or improve their previous mobility.

Additional Items. The modernized tanks probably will also be equipped with side skirts, smoke dischargers, and better communications gear. Side skirts have already been observed on T-62s in Eastern Europe and Afghanistan.

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Program Management

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The Soviet modernization program probably is just getting under way and will not reach its maximum programed refitting level until at least 1985.

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Poland was the first of the NSWP countries to initiate the tank modernization program by beginning to upgrade its T-55s in 1977.

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Although details of the tank modernization programs in the other NSWP countries are not available, we assume that they parallel the Soviet, Polish, and Czechoslovak programs. The modernization is probably being done at tank rebuilding facilities with supervision being provided by experienced armored vehicle production personnel.

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Problems in Integrating Automated Control Systems Into the Soviet Economy 25X1

Since the early 1970s the political leadership in the USSR has placed a high priority on the development of automated control systems (ASUs) as a means of facilitating planning and reducing the cost of processing the enormous volume of economic data generated by the economy. ASU is a generic term used by the Soviets to designate a wide variety of computerized data processing systems from simple automated bookkeeping to complex systems for the collection, processing, and distribution of economic data throughout the economy.[1]

Automation has taken on added significance in recent years because of the slowdown in Soviet economic growth, which has forced Moscow to make increasingly difficult choices concerning the allocation of resources. The Soviets regard automation of planning and management as a means of alleviating economic difficulties by making the economy operate more efficiently. This point was made by Brezhnev himself as early as 1972:

> *Only by raising the economy's efficiency is it possible to find assets and resources sufficient to ensure simultaneously significant growth in the worker's well-being, resources for the economy's rapid future development, and the requirements for maintaining at the necessary level the country's defense capability. . . . We must use these methods [of econometric modeling and systems analysis] to establish a nationwide automated system of information collection and processing.*[2]

Brezhnev's exhortation was made possible by the enhanced capabilities of the Ryad third-generation computers which were coming on line in the early 1970s. These computer systems were the result of a mid-1960s decision by the State Committee for Science and Technology (GKNT) to forgo the further development of indigenous, general purpose computers and to concentrate on copying the IBM-360 series and making use of the extensive library of IBM software already available for use with the IBM-360 systems.[3] Soviet efforts in the field of automated management have been frustrated, however, by shortages of quality software and hardware and bureaucratic resistance to change. 25X1

Problems

Soviet advocates of a comprehensive, nationwide ASU have failed to realize the complexity of such an undertaking, and progress has been much slower than originally expected. The three main problem areas that have prevented integration of ASUs into the economy are (1) deficiencies in computer software development; (2) supply bottlenecks, particularly in peripherals; and (3) the resistance of plant managers, who feel comfortable in their preautomation environment. (This resistance is not generally true of ministry-level officials, who are mainly concerned with the number of ASUs installed, and not with the efficiency of the systems. These officials generally overlook the resistance of plant managers toward ASUs as long as production plans are being fulfilled.) 25X1 25X1

Shortage of Computer Software. A major stumbling-block in the Soviet drive to automate the economy has been the lack of qualified programers in the USSR. The academic orientation of Soviet software development has resulted in a bias toward theoretical programing (that is, too many systems analysts and not enough programers). 25X1 25X1 programing backgrounds have been found to be poorly suited for practical work. They are essentially mathematicians more comfortable with concepts than with utilitarian programing tasks. Of the 2,500 programers at the Institute for Software Development in

[1] ASUs are also used by the military for troop and weapon systems control, logistics and supply management, and administration.

[2] Speech commemorating 50th anniversary of the USSR.

[3] The latest models of the Ryad family are based on the technology used in the IBM-370 series, but availability of these models is still limited. The Soviets are thus dependent, at least for the time being, on computers which incorporate 1960s (IBM-360) technology. 25X1 25X1 25X1

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Kazan' in 1977, there were, only 10 to 20 who were very good.

The Soviets have also been notably unsuccessful in their attempts to adapt IBM software to operate on Soviet copies of IBM hardware. Despite the availability of original IBM documentation, Soviet programers have had difficulty in designing workable systems, largely because the instructions contained in the IBM documentation are inadequate and require IBM personnel to aid users. IBM has been understandably reluctant to assist the Soviets in adapting software for use on Soviet copies of IBM hardware.

In 1980, after the Soviet invasion of Afghanistan, the US imposed an embargo on the export of high-technology items (including all computer-related equipment) to the Soviet Union. This destroyed any prospect for direct US-USSR commercial cooperation (at least in the short term) and forced the Soviets to seek outside assistance in acquiring and modifying original IBM software. Since imposition of the embargo, Bulgaria has become the largest supplier of IBM software to the Soviet Union. In addition, India, in 1980, agreed to modify IBM software for the Soviets in return for Soviet-made Ryad-series computers. These countries are not affected by the embargo and thus have maintained their access to most US software technology.

Soviet software development also suffers from a lack of cooperation between the software institutes and the end users. This point was made by the chief designer at the Nizhniy Tagil Department of the Sverdlovsk ASU Design and Planning Bureau, V. Morozov, who reported that at one point in 1978 the bureau was working on projects for plants from the Caspian Sea area to installations near Moscow. The standard procedure followed by the department designing an ASU involved one short-term (one or two weeks) trip to the plant of the potential user, a "cursory investigation," followed by "rapidly formulated agreements and protocols." Morozov believes that this lack of designer-user interface is the primary reason for the large number of ASUs being rejected by the user plants. He suggested that by decentralizing the design process (assigning ASU projects to local designers who are more familiar with the particular needs of the plant) ASU development would be more successful and designers more productive.

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Management Resistance. A serious problem retarding progress in Soviet ASU development is the resistance by senior management toward automated systems.

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Thus, automated systems threaten the familiar Soviet practice of stockpiling resources for future use as a defense against the unreliable material supply system.

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Shop foremen are hostile toward automated systems because they impose time restrictions. Normally a foreman can make up his production norm a day late under the fudging allowed in the nonautomated system. ASUs automatically take away this time cushion and force plant directors to monitor daily production figures more closely. To get around this, shop foremen provide incorrect or incomplete data in their daily reports, thus undermining the effectiveness of the ASU.

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Supply Bottlenecks. A major impediment to automation has been shortages of peripherals, including memory units and input-output devices such as displays, printers, and terminals. The Deputy Chairman of GKNT, Dmitriy Zhimerin, has stated that increasing the output of peripheral devices is an urgent task and that the shortfall in their production is holding up widespread introduction of ASUs.

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the primary obstacles preventing industrial users from putting their new SM-1 and SM-2 minicomputers to good use were the lack of good software and the

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absence of adequate input-output devices and other peripherals. Peripherals were not always provided by the plant which produced the computer, and, even when they were, the producer assumed no responsibility for service or repair—either for peripherals or for the computers themselves

The problem can be at least partly attributed to the Soviet system of success indicators, which has hindered progress both in the design of ASUs and in the production of computer hardware on which they are based. Soviet producers are driven by gross output targets, often designed in physical units (number of computers). When this is the case, the production of peripherals does not contribute toward fulfillment of the plan, and a computer producer will concentrate on increasing the output of central processing units rather than of peripherals. Because of this practice and inadequacies in the overall supply system, incomplete shipments of peripherals continue to act as a drag on the effectiveness of computers in the economy.

Search for Solutions

Soviet leaders recognize the urgent need for enhanced computing capability. They have gone on record saying that the deficiencies in the supply and quality of software and peripherals have resulted in a serious underuse of already-installed computer systems. The Soviets have attempted to overcome these deficiencies in large part by intensifying their efforts to acquire technology from abroad. The acquisition effort has taken three different forms:

- Clandestine acquisition by Soviet agents of Western technology or equipment.
- Acquisition of technology or equipment through third-country sources (Bulgaria, Yugoslavia, and India have been most active in this role in recent years).
- Direct negotiations with Western firms or governments to gain access to technology through legal means.

The following examples illustrate the breadth of the Soviet acquisition effort in recent years:

- The West German authorities' recent arrest of Gennadiy Batashev, reportedly a high-ranking KGB operative, revealed that IBM software was high on the KGB's "wish list" of wanted information.

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- Soviet Union has had a contractual arrangement for the past three or four years with an Indian computer firm to design and produce IBM-360 compatible applications software for use on the Soviet Ryad-series computers.

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- the Institute for Software Development in Kazan' has been specifically tasked with modifying original IBM software for use on Soviet copies of the IBM S/360 computer in both the administrative and manufacturing sectors of the Soviet Union. Its primary source for the original software in recent years has been Bulgaria. Programers at the institute have worked closely with the Bulgarians in developing joint software packages.

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[4] None of these items are directly available to the Soviets from US firms since imposition of the 1980 embargo on high-technology items. Moreover, the United States is attempting to persuade other COCOM countries to refrain from exporting this type of technology to the Soviet Union.

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Outlook

ASU has been accorded a consistently high priority by leaders in both the political and economic communities, but progress has been slow as the program has shown important weaknesses in providing software and hardware and in overcoming bureaucratic inertia. These problems are likely to persist, although some progress is being made in solving them. The Soviet leadership has evidently decided to augment its present computer-related capabilities by actively pursuing Western technology (hardware and software) using both legal and illegal means. Given the current system of incentives and bureaucratic inertia, this dependence on external sources for certain types of computer-related technology is likely to continue for some time.

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ecomonic officials at most levels are not yet ready to accept ASU at the rate being imposed. The lack of understanding on the part of management, the overall distrust of the system by all users, and the shortage of skilled personnel at the enterprise level to run the system cannot be overcome in the short run.

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Briefs

Outlook for Soviet Grain Crop

Soviet grain prospects have deteriorated somewhat in recent weeks because of crop damage caused by *sukhovey* conditions (hot, dry winds) in the southern European USSR and a likely shortfall in the planned sown area. Nevertheless, an above-average crop of 205-210 million tons is still possible if excellent weather prevails throughout the remainder of the season. A crop of this size would fall far short of the official target of 238 million tons, but would be well above the estimated annual average of 185 million tons for the 1978-82 period.

During late May and early June the southern portion of the Ukraine, the lower Volga Valley, and the northern half of the North Caucasus were hit intermittently with *sukhovey* conditions. Meteorological data indicated that soil moisture reserves in these areas became critically low. Moreover, the thin, uneven stands of grain fields seen on satellite imagery provided evidence that potential yields of both winter and spring grains were cut. We estimate that overall crop losses caused by the *sukhovey* conditions totaled approximately 10 million tons.

An additional 2-3 million tons of potential grain production have been lost because of an estimated shortfall in plantings. On the basis of statistics released by the USSR's Central Statistical Administration on 6 June, we believe that the area sown to grain this year will fall some 2-3 million hectares short of the 124-million-hectare target.

Third Soviet Aircraft Carrier Operational

The Novorossiysk, the third Kiev-class aircraft carrier,

The new ship has just completed a normal four-year period of fitting out and sea trials. Its complement of aircraft include at least 12 vertical-takeoff YAK-38 Forgers and some 15 to 20 ASW helicopters.

The Kiev, the Northern Fleet's other carrier, currently is being overhauled at Nikolayev on the Black Sea. Its sister ship, the Minsk, is in service with the Pacific Fleet. A fourth Kiev-class carrier, the last of the line, is being fitted out at Nikolayev.

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Soviet-Mexican Technical Cooperation

The US Embassy in Mexico City reports that in early May a Soviet delegation led by a deputy minister of petroleum toured the facilities of the Mexican state oil company, Pemex, and signed a memorandum calling for technical cooperation. The memorandum proposes scientific and technical exchanges in oil-related areas such as drilling, production, and transportation. Details of future cooperative projects reportedly are to be worked out by specialists. One Mexican official played down the memorandum by telling a US diplomat that it is only an offshoot of the Soviet-Mexican scientific and technical cooperation agreement of 1975. The Soviets reportedly are also negotiating a purchase of $190 million worth of oil drilling equipment from a Mexican firm

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The USSR may hope to use any new cooperative arrangements to acquire advanced US oil-related technology from Mexico, which is not a member of COCOM and which imports substantial oil equipment and technology from the United States. Mexico's efforts to avoid violating US export controls, however, could limit Soviet opportunities to obtain such technology. 25X1

Soviets Seek Larger Presence in Spain

The USSR considers Spain the most promising country in which to enlarge its representation, following the expulsions of Soviet personnel from other West European countries. 25X1 25X1

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Spain wants to expand relations with the USSR as part of a general effort to increase trade. Madrid wants to regulate commercial relations with Moscow, however, in order to bring the activities of Soviet representatives under control. The expulsion from Spain in February of a Soviet official accused of espionage demonstrates that the Socialists will respond vigorously to illegal Soviet activities. 25X1 25X1

Dos Santos's Visit to Moscow

There were no open signs of disagreement during Angolan President dos Santos's visit to Moscow in May, but the Soviets seem concerned about maintaining their influence in Luanda. A party-to-party cooperation accord and a cultural and scientific agreement were signed. Although the Soviets have not made an explicit public pledge of increased military or economic support, Andropov did promise "further support" to defending Angolan independence. 25X1 25X1

The Soviets have warned the Angolans against developing ties with the United States and other Western countries or taking part in the US-sponsored diplomatic initiative on Namibia. Dos Santos praised Soviet military and economic assistanc 25X1 to Angola and criticized US efforts to link Cuban troop withdrawals to a settlement on Namibia. Moscow, however, almost certainly will seek to link new aid to Luanda's firmness on Namibia and the Cuban withdrawal issue.

Skilled Manpower Shortage in Siberia

Because Siberian higher educational institutions (VUZy) do not provide sufficient training in the specialities required by local industries, many positions in Siberia requiring specialists with higher educations are being filled by technicians with less training and workers without any formal training. Shortages of skilled manpower are particularly acute in the energy resources and forest products industries. Siberian VUZy train only about 20 percent of the country's graduates in these specialities, even though work in these fields is concentrated in Siberia. 25X1

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To compensate, the authorities annually assign about 20,000 engineers from the European USSR to Siberia, but few stay permanently. Turnover rates for VUZ graduates run as high as 30 to 50 percent during the first three years. Moreover, there is a high rate of permanent outmigration among Siberian young people sent for training to other parts of the USSR. Recognizing the problem, Soviet planners have called for expansion of existing VUZ training programs in Siberia. However, chronic construction lags and difficulties in attracting teaching personnel to these remote areas present formidable obstacles to fulfilling the plans.

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Efforts To Improve Mobilization Capabilities

The Soviet General Staff has taken steps to integrate civil defense and military commissariat functions at republic and oblast levels in order to improve mobilization in wartime. Although we do not believe the consolidation has been implemented nationwide, it may be in effect in some areas and at echelons below oblast level. Since 1978 there have been indications of increased coordination between the civil defense staffs and the military commissariats, which handle mobilization. In

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The consolidation effort demonstrates the General Staff's concern with its ability to mobilize human and material resources effectively in the event of war.

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this has been a major shortcoming of the civil defense program. Workers at many installations who were to report for military duty during mobilization were also assigned civil defense functions, and transportation assets were similarly assigned both mobilization and civil defense duties. Other efforts to link civil defense more closely to the military,

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have probably improved the ability of the civil defense program to function in wartime.

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