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Directorate of Intelligence

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Soviet Capabilities and Intentions for Permanently Manned Space Stations

An Intelligence Assessment

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November 1983
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Soviet Capabilities and Intentions for Permanently Manned Space Stations

An Intelligence Assessment

This paper was prepared by

Scientific and Weapons Research. Comments and queries are welcome and may be directed to the

, OSWR

This paper has been coordinated with the National Intelligence Council.

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November 1982

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Soviet Capabilities and Intentions for Permanently Manned Space Stations

Key Judgments

Information available as of 1 October 1982 was used in this report.

The Soviets are committed to permanently orbiting, continuously manned, multipurpose space stations. In addition to Soviet public statements verifying this, [redacted] information [redacted] shows:

- A continuously improving Salyut space station program.
- The introduction of a new space station module in 1981.
- The introduction of a new resupply vehicle in 1978 and an improved cosmonaut ferry spacecraft in 1979.
- Expanded cosmonaut training facilities.
- Continuously expanded and improved command and control capabilities, including the operational use of two upgraded flight control centers.
- The development of a reusable spacecraft that could make servicing space stations more economical.

The Soviets have also demonstrated the ability to exchange space crews, to resupply all necessary expendables, and the ability of cosmonauts to endure long missions in space. Cosmonauts have increasingly improved their ability to service space station equipment to keep it operational. In short, the Soviets have demonstrated the technical capability to maintain man in space on a permanent basis.

We believe that in the mid-1980s the Soviets will form modular space complexes by docking three modules to a central core vehicle. The complex probably will compare in volume to the US Skylab. Although it could accommodate up to nine cosmonauts, initial manning for extended periods may be only four; crews probably will be rotated periodically. In the late 1980s, the Soviets probably will be able to orbit individual, large space stations, each about 50 percent larger than the US Skylab and about five times the volume of their current Salyut. Such a station could accommodate a crew of up to 15. Using the modular approach, the Soviets probably will begin interconnecting such stations to form very large space bases in the 1990s for use well into the next century. Such a base could accommodate a crew of up to 100.

We estimate Soviet space program hardware costs will reach the equivalent of $12 billion by 1986—almost double the current outlays. Soviet manned space systems—the space plane, space stations, and space transports—are

expected to account for about 25 percent of the costs through 1985 and increase to 27 percent in 1986. We do not know the total cost of the program. In an attempt to define Soviet goals for this program, we have categorized their activities to date and our projections for the future into four areas: military, political, economic, and scientific. Program justification probably rests on all these goals, but we believe that military and political goals are the driving forces.

We judge that a long-term military goal is to achieve a strategic advantage in space. To this end, the Soviets are striving toward military crews aboard permanent space bases equipped with an array of reconnaissance sensors and possibly some weapon systems. Reconnaissance sensors, with preliminary interpretation of data by cosmonauts, are expected to be aboard modular complexes of the 1980s. It is possible that large space bases of the 1990s will carry laser weapon systems

The political goal is clearly to achieve worldwide recognition as a technological superpower. In this context, the Soviets heavily publicize the unclassified activities of their manned space stations. They have repeatedly demonstrated that the achievement of space "firsts" is a major objective.

We believe that the major economic goals of this program are: (1) to achieve a space-based manufacturing facility for pharmaceuticals, semiconductors, alloys, glasses, and other materials, and (2) to photograph Earth resources for subsequent exploitation. Scientific experiments in materials processing aboard Salyut-6 have laid some of the groundwork for this goal, perhaps aboard a module of the modular complex of the 1980s. We do not believe that maintaining men in space for the sole purpose of operating a manufacturing facility is cost effective. The Soviets, however, may view this goal as practical because they will have men in space for other reasons. The Soviets have stated that they will have a module dedicated to manufacturing.

We believe Soviet scientific goals are, for the most part, closely related to their other goals. Scientific experiments in materials processing are heavily publicized for political reasons and are needed as a base for manufacturing

objectives. The Soviets also have used many scientific sensors on the Salyuts (for example, the KRT-10 radiotelescope, various cameras, and an infrared spectrometer) to test military applications. We expect this trend in applied science research to continue

Finally, the Soviets probably will continue to use man in their space systems to compensate for quality control problems and state-of-the-art deficiencies.

The Soviets may believe cosmonaut interaction with complex, developmental subsystems is useful to ensure successful testing and evaluation, whether or not the equipment is intended for deployment on manned spacecraft.

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Introduction

Senior Soviet officials, including Leonid Brezhnev, and scientists repeatedly have stated a national goal of having permanently functioning, continuously manned, orbiting space stations. Recently, the Soviets have referred to "orbital complexes" to be built by docking multiple modules in space. Soviet scientists also have talked about the development of reusable spacecraft and even reusable boosters, but not all of the statements about these programs are consistent.

This paper reviews available all-source information on the Soviet military and scientific manned space programs to deduce the scope of the programs, future developments (both near and far term), and Soviet capabilities and intentions. The relative sizes and configurations of US and Soviet manned spacecraft discussed in this paper are shown in figure 1.

Soviet Space Stations: Past and Present

Official Soviet interest in manned space flight dates back to at least 1949, when the Soviets were launching animals in nonorbiting rockets, presumably for biomedical investigations. Soviet interest in such investigations was reinforced at the beginning of the space program in 1957 when Sputnik-2 carried a dog. Only four years later, Yuri Gagarin made man's first orbital flight. The Soviets' highest priority goal circa 1959 almost certainly was to be the first to land man on the moon. When it was clear they had lost the race to the United States, the Soviets changed their priority to establishing near-Earth-orbiting space stations. Figure 2 shows the history of this program.

Salyuts 1 Through 5, 1971-77. These space stations are considered the first phase of the Soviet manned space station program. Each had a habitable volume of about 100 cubic meters (about one-third that of the US Skylab) and one docking port. Each could support two men for 95 days or three men for 65 days. The Salyuts were serviced by the Soyuz cosmonaut ferry spacecraft, which was originally designed to carry three cosmonauts without space suits, but was redesigned to carry two cosmonauts in space suits following the deaths of three cosmonauts in Soyuz-11 in 1971.

Although all Salyuts were publicized as scientific research spacecraft by the Soviets, Salyuts 2, 3, and 5 were part of the military space station program.

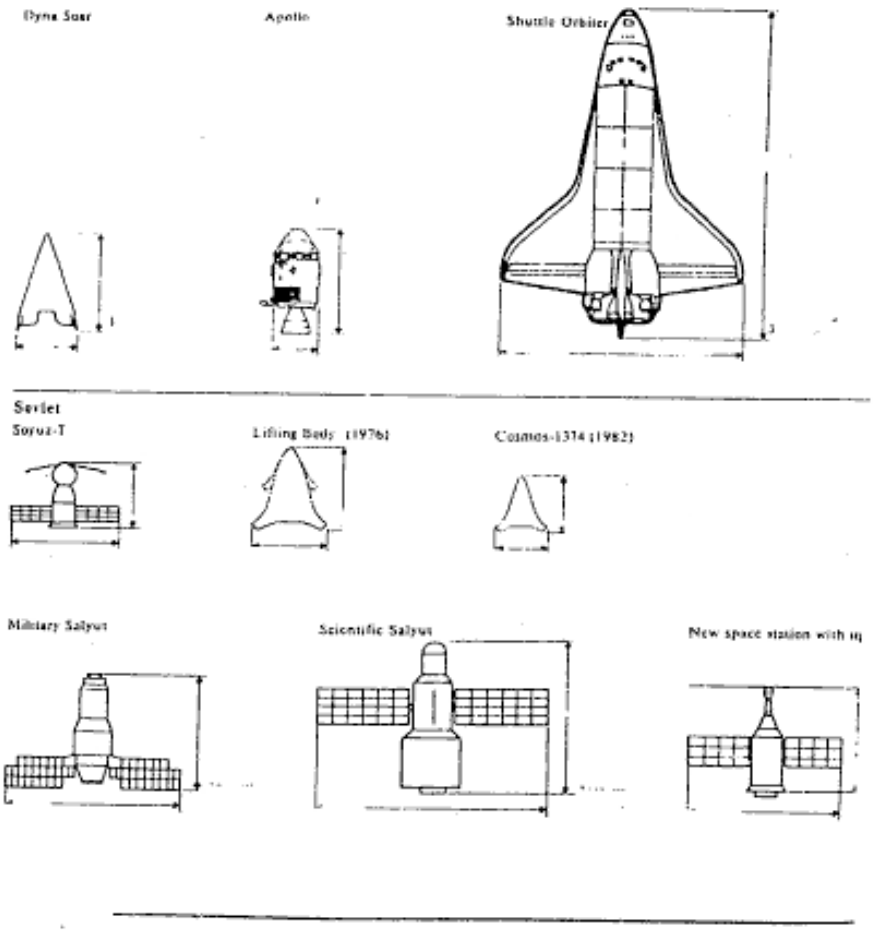
Salyut-6. Launched in September 1977 and intentionally deorbited in July 1982, Salyut-6 represented a significant new phase in the Soviet space station program. Salyut-6 was equipped with a second docking port to accommodate a new nonrecoverable resupply spacecraft that the Soviets call Progress. This spacecraft is used to replenish all consumables (including oxygen, food, and fuel) and to deliver replacement parts and scientific equipment. The two docking ports also allow the simultaneous docking of two Soyuz ferry spacecraft. The ability to resupply consumables, combined with the ability of the cosmonauts to repair most onboard equipment, enabled Salyut-6 to remain in orbit almost five years and to be

manned approximately 38 percent of the time. Crews aboard Salyut-6 logged more man-days—1,534—than have been logged in the entire US space program. (

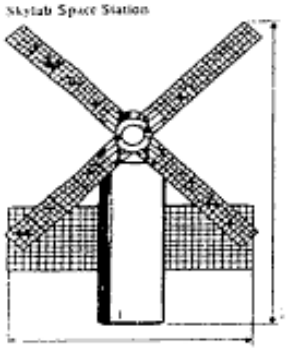
An upgraded cosmonaut ferry vehicle—the Soyuz-T—was put into operation during the Salyut-6 mission. The Soyuz-T can carry a crew of three in space suits and has many other improvements over the Soyuz.

The second launch of a Cosmos-929-type space station occurred in April 1981. This spacecraft, designated Cosmos-1267, also deorbited its recoverable segment after 30 days in space. In June the main body docked with Salyut-6 to conduct unmanned engineering tests of large vehicles docked together, clearly another step toward building a multimodule space station

Figure 1
Sizes and Configurations of US and Soviet Manned Spacecraft



Skylab Space Station

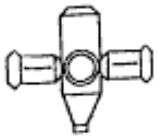


Projected Systems

Soviet Shuttle
(late 1980s)

Space Plane
(1983)

Modular Space Station
(mid-1980s)



Large Space Station
(late 1980s)

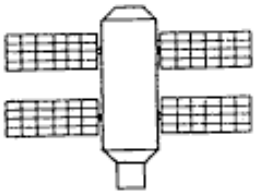


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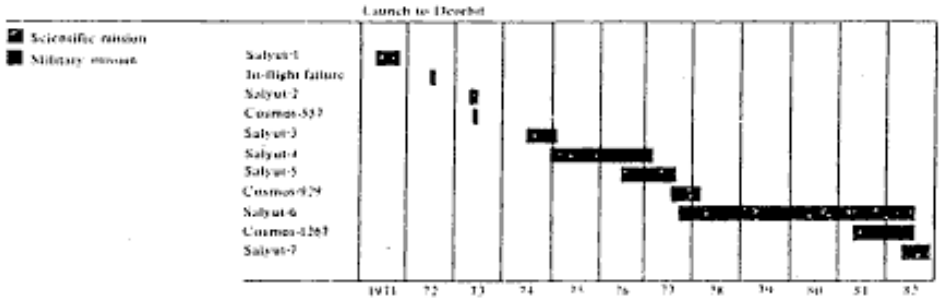
Figure 2
Salyut Space Station Program



Salyut-7. The Soviets launched Salyut-7 in April 1982 and manned it with two cosmonauts in May

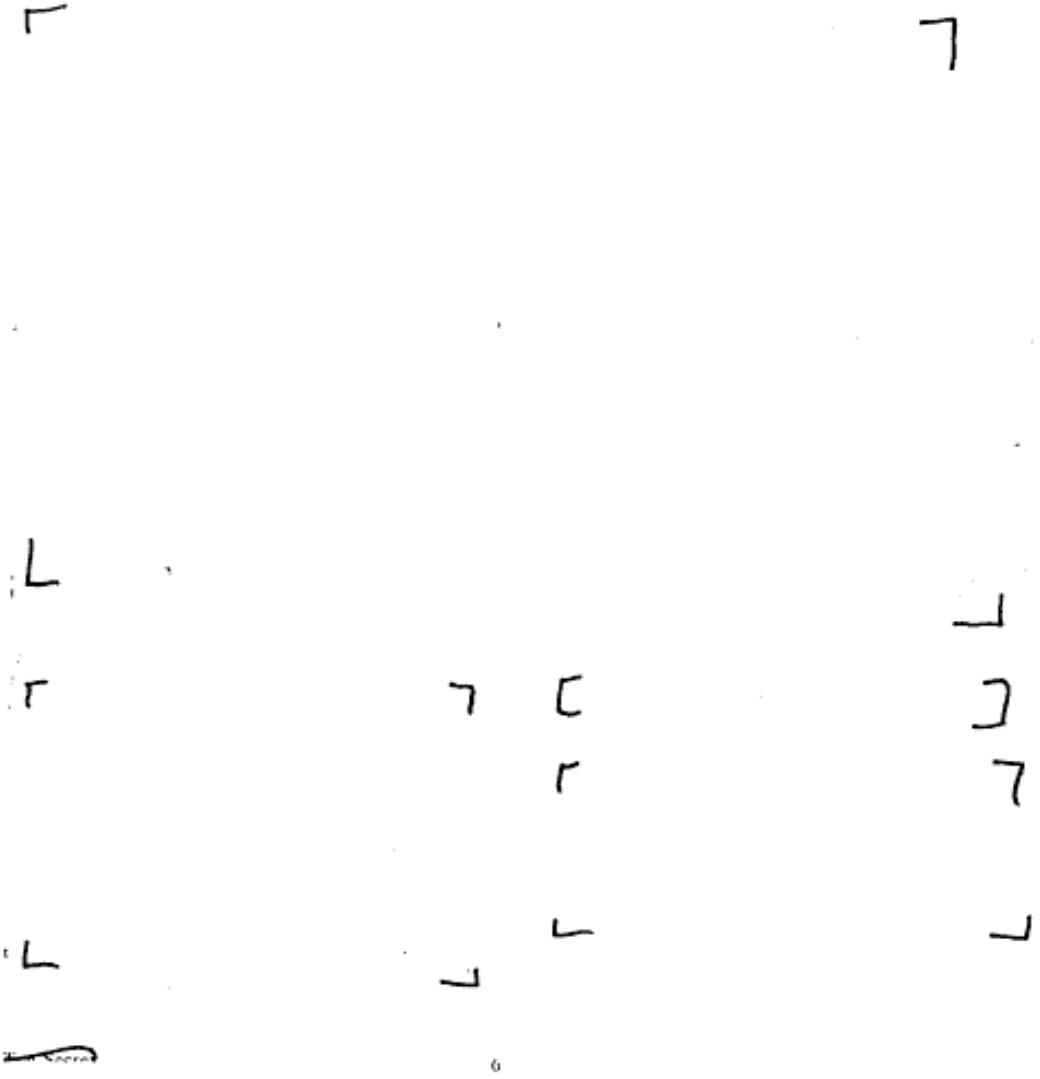
[redacted] through 10 June. This [redacted] during the visit of the French international crew from 24 June through 2 July, when all activity aboard the station was purely scientific in nature. The cosmonauts resumed visual reconnaissance on 6 July.

Cosmonaut Training Facilities

[redacted] We estimate that about 100 cosmonauts currently are in training, compared with 60 in 1967 and 80 in 1977 at the start of the Salyut-6 mission. The Soviets have enough trained cosmonauts to undertake permanent manning of a modular space complex and, if they so choose, to undertake a parallel program of manning the Salyut-7.

Among new facilities constructed at the cosmonaut training facilities is a large, neutral buoyancy facility in which cosmonauts practice activities under simulated conditions of weightlessness in space. The Soviets may have designed this facility for use with modular space complexes.

Figure 3



In 1981 the Soviets filed with the International Frequency Registration Board of the International Telecommunications Union for a satellite data relay system (SDRS). The system is to consist of three satellites in geostationary orbit and two ground sites in the USSR. The Soviets stated that one objective is to improve communications with manned space stations. The stated placement of the satellites and ground sites would allow communications with space stations anywhere in their orbits at any time. The Soviets have stated that the first of these satellites will commence operations in December 1983. Nonetheless, they are currently from one to six years behind schedule in completing networks of geostationary satellites filed for in previous years, so it is doubtful that their first data relay satellite will be on schedule. When operational, however, the SDRS will significantly upgrade Soviet communications, command, and control of space stations.

Space Launch Facilities

the Soviets are refurbishing two launch sites at complex 2 at the Tyuratam missile and space test center that previously were used by their largest developmental space launch vehicle (SLV), the SL-X-15.* In addition, a new launch site, designated complex W, is under construction near complex 1.

* The SL-X-15 was to be the Soviet launch vehicle in the race to land men on the Moon. After losing the race and experiencing disaster in their launch attempts, the Soviets canceled the SL-X-15 program circa 1974.

The new launch sites will be complete by about late 1984. They will be serviced by the same vehicle assembly building, probably will use the same transporter-erector system, and will be used for a new family of SLVs with the capability to deliver payloads weighing up to 150,000 kilograms (kg) to near-Earth orbit. After extensive handling and mating checks, the new SLVs could be tested in 1986-87 and be ready to launch payloads by the late 1980s.

One is near the new launch sites at Tyuratam and the other is in the Soviet Far East near Vladivostok. Both runways will be about 4,500 by 90 meters (comparable to the US Shuttle landing strip at the Kennedy Space Center), and both lie along the same ground trace of the 51.6-degree inclined orbit of Soviet manned space flights to date.

We believe the runway at Tyuratam is for the recovery of reusable space systems and the one near Vladivostok is an alternate and/or emergency (abort) landing site. In the far term, the Soviets may attempt to develop a booster for horizontal takeoff and recovery as an economic way to orbit payloads. Such vehicles would be extremely heavy and would require runways like those the Soviets are constructing.

Projected Capability for the 1980s

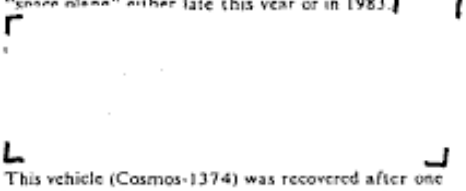
Modular Space Complex. Soviet statements of intentions to build modular space complexes are clearly borne out by early experiments on Salyut-6 and the docking of Salyut-6 with Cosmos-1267 in June 1981. Logically, the next step in this direction will be the docking of multiple Salyut-class modules to a central core vehicle. The Soviets have stated that Cosmos-1267-type spacecraft will serve as the modules, and

we have no reason to doubt them. The core vehicle may be a modified Salyut (perhaps Salyut-8) or a new vehicle. It probably will be equipped with multiple docking ports—three or four lateral ports for docking of modules and two end ports for docking of the Soyuz and Progress. A high degree of symmetry probably will be maintained for the overall structure so that the orbit can be raised periodically to compensate for atmospheric drag. That is, the thrust of the orbital maneuvering engines probably will be along the main axis of one of the modules and should pass through the center of mass of the complex to avoid imparting undesired rotational motion.

A four-module complex could support a crew of up to 12 cosmonauts. Two possible configurations for a modular complex are shown in figure 4. On the basis of statements by the Soviets, a three-module complex is the most likely configuration for the 1980s. Although it could support up to nine cosmonauts, initial manning for extended periods may be only four, thus reducing the amount of resupply required.

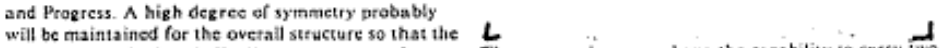
At an international conference in June 1982, Soviet cosmonaut Oleg Makarov stated that the Soviets would be working with Salyut-7 for the next two years. He also stated that construction of a modular station could begin with Salyut-8, which he implied would not be launched before the end of 1983.

New Ferry and Resupply Spacecraft. During the expected four- or five-year lifetime of the modular complex, the Soviets may introduce both new cosmonaut ferry vehicles and new resupply spacecraft. The Soyuz-T probably will remain the cosmonaut ferry vehicle through the mid-1980s. However, we expect initial orbital flights of a small, winged, reusable "space plane" either late this year or in 1983.



This vehicle (Cosmos-1374) was recovered after one revolution and probably was part of the developmental program for a manned space plane

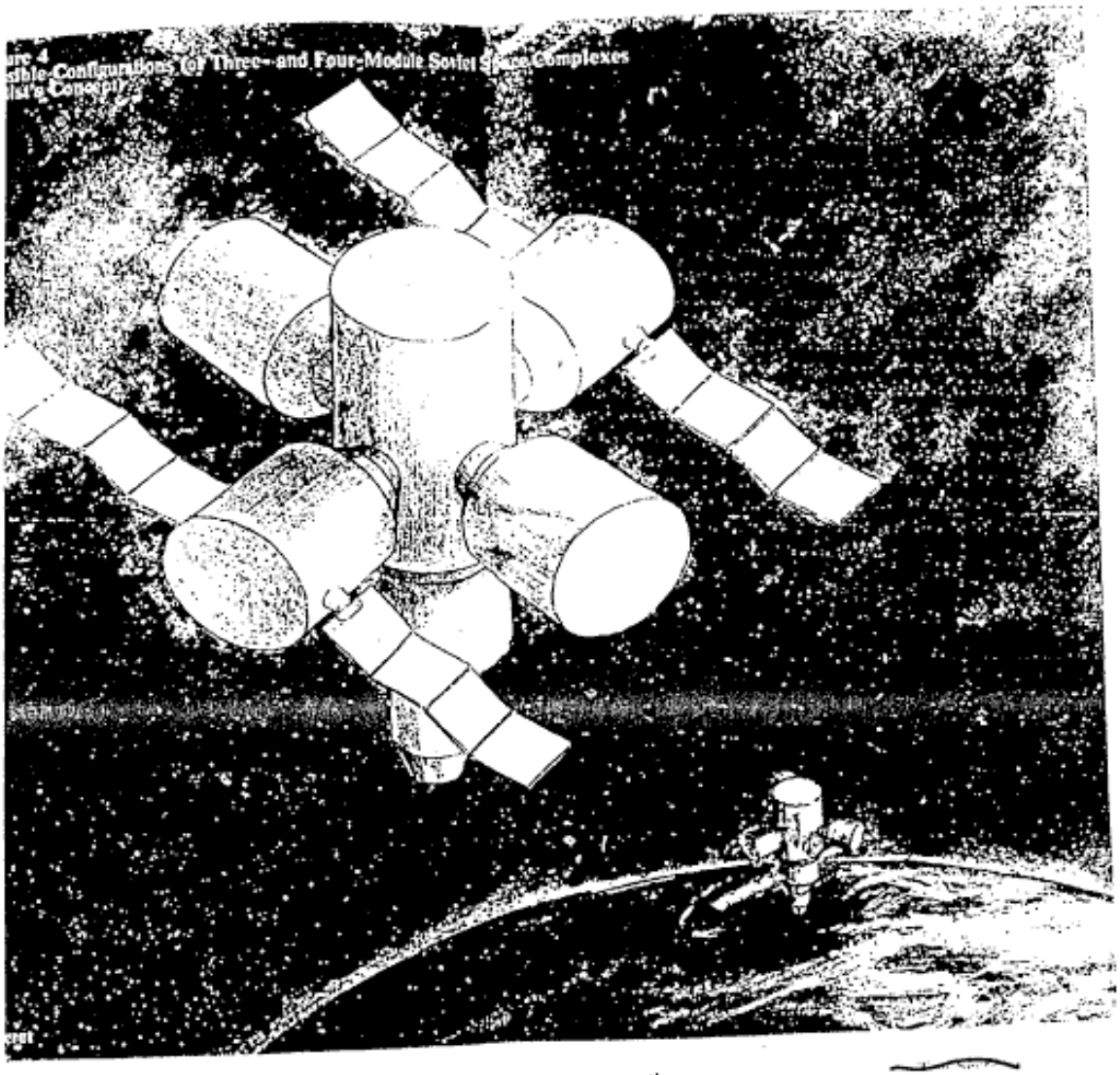
We believe the space plane is part of a Soviet Air Force program modeled after the US Dyna Soar vehicle.



The space plane may have the capability to carry two to six cosmonauts and/or a small amount of cargo. It probably will land on the recently completed runway at Tyuratam

The space plane could be used as a cosmonaut ferry vehicle in the mid-1980s, reducing or eliminating the need for nonreusable Soyuz-T spacecraft. It is not clear, however, that the Soviets intend to use the space plane for this purpose. We estimate that other missions such as reconnaissance or satellite inspection are possible, or the space plane might serve as a space weapons platform. The last mission postulated is the least likely because of the estimated limited payload capability of the space plane

Support of a permanently manned modular space complex probably will require a resupply spacecraft with a much greater capacity than Progress. The Soviets have stated that a Cosmos-1267-type module will be adapted for resupply missions. If the recoverable segment is not used, such a module could carry up to 8,000 kg of cargo versus about 2,300 kg for Progress. About 28,000 kg of expendables would be needed to support six cosmonauts for a year. To meet this requirement, 13 Progress resupply spacecraft would be needed, whereas only four Cosmos-1267-type resupply vehicles would be needed. This is particularly significant because the SL-4 SLV used to orbit Progress spacecraft also is used to orbit Soyuz-T spacecraft. Because Soyuz-T spacecraft are never allowed to exceed 90 days in space, a six-man crew would require two Soyuz-Ts every 90 days, a total of eight per year. The Soviets also launch about 35 photoreconnaissance satellites annually. To launch 13 Progress spacecraft in addition to Soyuz-T and photoreconnaissance spacecraft, the Soviets would need about 60 SL-4s, which is an unrealistic increase of about 15 per year.



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On the other hand, the production and handling facilities for the SL-12/13 SLV used to orbit the Cosmos-1267-type spacecraft have been greatly expanded. The production rate has been increased from about six to 16 annually. Although the SL-12/13 also is used to launch geostationary communications satellites, space stations, and lunar and planetary probes, we believe the increase in production of these SLVs will allow a few to be used to launch resupply spacecraft.

Reusable Space Transportation System. [redacted] The runway will be used by the Soviets to recover a large, reusable space transportation system (RSTS) comparable to the US Shuttle in size and weight. The RSTS probably will be launched vertically by one of the new, large Soviet SLVs and, at mission's end, will be recovered on the runway and refurbished at colocated facilities. The large SLVs probably will begin flight-testing in 1986 or 1987, with tests of the RSTS in 1987 or 1988.

New Large Space Station. Another payload of the new large SLVs may be a large space station. A 150,000-kg-class space station would be about 50 percent larger than the US Skylab and have about five times the volume of a Salyut-size station. It could easily support up to 15 long-term cosmonauts if the Soviets allowed the same volume per cosmonaut as they did on the Salyut. The large SLVs could be used to launch a large station in the late 1980s.

Projected Capability for the 1990s and Beyond

Space Bases. The experience gained with modular space stations of the 1980s probably will enable the Soviets to begin docking large space stations together in the 1990s, forming space bases (see figure 5). Such space bases could accommodate the maximum number (100) of cosmonauts the Soviets have discussed having and probably would be used into the next century . . .

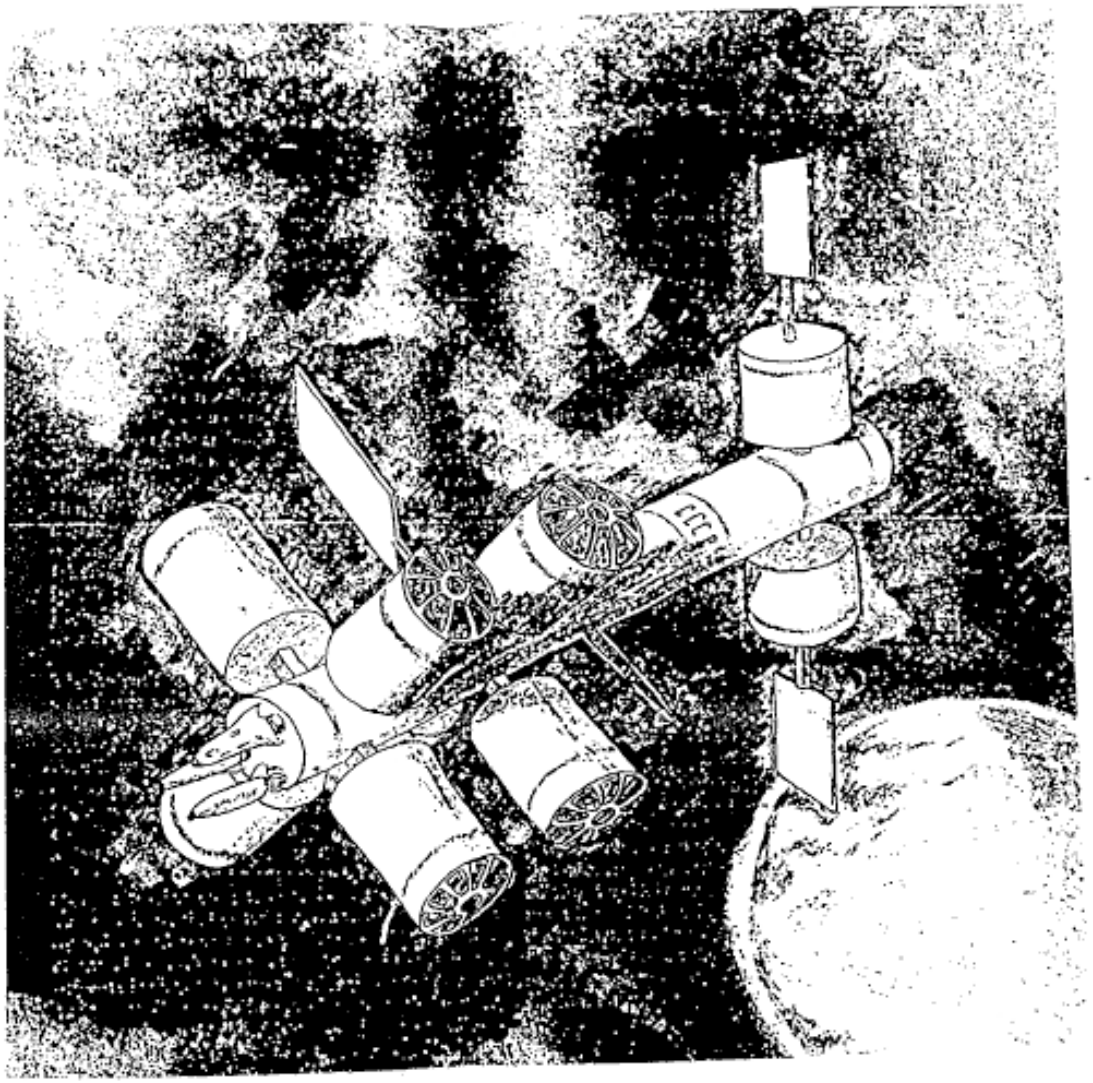
Horizontally Launched Boosters. [redacted] The Soviets [redacted] for the far term they may attempt to develop a booster for horizontal takeoff and recovery. They have stated that they consider such a system to be the most economical way to orbit payloads.

Soviet Intentions

Statements by the Soviets and intelligence information on their space program point to a clear Soviet intention to have permanent, continuously manned orbiting space complexes. As already discussed, the Soviets have demonstrated man's ability to endure long missions in space, the ability to exchange crews, and the ability to resupply all necessary expendables. In addition, the cosmonauts have demonstrated an increasingly improved ability to service space station equipment to keep it operational. In short, the Soviets have demonstrated the technical capability to maintain man in space on a permanent basis.

The Soviets are pursuing some space-related goals that extend into the next century. We have no information that clearly delineates these goals, but Soviet activities performed aboard space stations to date provide clues as to Soviet intentions. It is clear that activities aboard manned Soviet space stations have been multipurpose in nature and probably will continue to be so. We have categorized these activities as military, economic, scientific, and/or political (see the table).

Soviet leaders, as attested by their writings and statements, do not view space as an isolated area but rather as an integral part of overall military, economic, and political policy. Outlays for space hardware will require the equivalent of some $12 billion in 1986 compared to $6 billion in 1981. Based on current projections, expenditures for space hardware could increase from about 0.6 percent of GNP in 1981 to 0.9 percent by 1986. The Soviets probably perceive that the military, economic, and political returns of a ruble invested in civilian and military space are greater than could be expected from other investments. Nowhere is this more clear than in Soviet efforts to establish a permanent, continously manned orbiting space station. The manned orbiting space station probably has somewhat the same stature in



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Soviet eyes as did our national goal of placing a man on the moon. Approximately one-half of the increase in total expenditures on space hardware between 1981 and 1986 will go for this purpose.[2]

Military. We believe that in the 1980s Soviet military activities aboard modular space stations, individual military space stations, or both, will include reconnaissance by a variety of sensors [redacted]. Some of the sensors probably will be treated as operational elements of the overall Soviet military reconnaissance program; others probably will carry forth experiments in ASW research in an effort to achieve a major breakthrough in submarine detection. Cosmonauts may perform preliminary evaluation of the data collected by operational sensors over high-interest areas of immediate concern. Further, some developmental sensors may be carried and tested on manned spacecraft to verify their capabilities prior to deploying them on unmanned systems.

In the 1980s the Soviets also might test satellite-to-satellite missile systems [redacted] indicates that the Soviets have done research on missiles for manned space stations. V. N. Chelomey, the Soviet designer of the military Salyut, worked on a "fighter satellite" in the 1960s that would carry projectiles, each about 1 meter long, to fire at other satellites. As of 1968 Chelomey was still seeking government support, and we do not know if the project was ever funded. Nonetheless, we have enough information concerning such Soviet projects to warrant concern. The Soviets have frequently expressed their concerns regarding [redacted]. Previously, they had similar concerns about the US Dyna Soar and Manned Orbiting Laboratory. It is conceivable, therefore, that the Soviets would elect to afford some means of protection to their manned space stations engaged in military activities.

The Soviets are developing laser weapons, probably for antisatellite (ASAT) use in space [redacted]

[redacted]

Political. Many of the activities performed aboard manned Soviet space stations have been extensively publicized, and we expect this trend to continue. The Soviet program of having international crews visit Salyuts 6 and 7 and perform indigenously designed experiments was clearly a political ploy. More recently, the deployment of a small satellite—Iskra-2—from Salyut-7 almost certainly was designed to capture world attention. Although the feat was no more difficult than dumping waste through an airlock, some newspapers equated it to beating the US Shuttle by some six months in the delivery of a payload to orbi

Similarly, the Soviets have heavily publicized such activities as: beating the US man-in-space endurance record and then beating their own records, developing and using the world's first automatic resupply spacecraft, being the first to refuel a spacecraft, being the

[2] For a more detailed discussion of the cost of Soviet space programs, see the forthcoming DDI Intelligence Assessment entitled *Rapid Expansion of Soviet Space Programs Through 1986: Resource Implications*.

first to dock space station modules, and performing numerous biomedical and materials-processing experiments. In the future, the Soviets are expected to continue publicizing space station feats to enhance their prestige throughout the world.

Economic. Earth-resources photography is perhaps one of the best examples of Soviet space station activity with an economic application. In this case, however, the cameras aboard the space stations have been used to augment the coverage of unmanned satellites used for the same purpose. A more exotic but economically less certain use of Soviet space stations involves the numerous materials-processing experiments that the Soviets tout as leading to a space-based manufacturing facility that will produce pharmaceuticals, semiconductors, alloys, glasses, and other materials. We do not believe maintaining men in space to operate dedicated manufacturing facilities is cost effective. The Soviets, however, may view this economic goal as practical because they will have men in space justified by military and political objectives.

Scientific. The Soviets have accomplished many activities of scientific interest, including astronomy, oceanography, materials processing, biomedical research, and Earth-resources photography. Most of these activities were heavily publicized, thus accomplishing political objectives as well. Some, such as materials-processing experiments, were touted by the Soviets as being of economic value. Most were also multipurpose with military, political, and economic objectives. This trend is expected to continue in the 1980s.

A far-term scientific objective, which could also achieve political and perhaps military objectives, could be to have a large space base serve as a way station and preparation facility for manned flights to the Moon and Mars. We expect that manned Soviet flights to the Moon will be publicized as being considerably more significant than the US Apollo flights, perhaps with a stated goal of achieving a lunar base in the next century. They also might be portrayed as preparatory to a manned flight to Mars. Soviet officials have stated a goal of a manned Mars mission in the late 1990s. While the Soviets may be technically capable of conducting such a mission in the late 1990s, we believe the additional resources required for such an effort will lead the Soviets to defer it until the next century.

Other. The Soviets may view cosmonaut interaction with complex, developmental subsystems for advanced spacecraft as a way to speed development by identifying and correcting problems early [redacted]

Thus, the Soviets may use cosmonauts to ensure successful testing and evaluation of complex, developmental subsystems, whether or not the equipment is intended for deployment on manned spacecraft.