Salyut Space Station Characteristics

Because each new U.S. spacecraft system is designed "from scratch," American designers tend to emphasize quantum leaps in capability. By contrast, the Soviets reuse subsystems on different spacecraft whenever possible. For instance, the same propulsion, power, and thermal-control systems may be used on many vehicles. By relying on systems flight-proved in earlier space programs, * the Soviets may have been able to reduce costs and shorten the time spent in development and construction. Still, most of these elements require modification. [b]

The Soviets are believed to have begun work directly related to the development of Salyut space stations in the late 1960's. The first in this series of stations, Salyut 1, was launched in April 1971. To date, the Soviet Union has officially acknowledged that seven of these facilities have been launched, one of which (Salyut 2) broke up in orbit. Cosmos 557, which failed in orbit, is generally thought to have been a Salyut, although the Soviets have not confirmed this inference.[7]** Only one other spacecraft, Cosmos *382*, may have been a Salyut, but the evidence for this view is meager.[8] Though the Soviets experienced numerous failures early in the Salyut program, their strategy of using flight-proved subsystems in new programs to save time and costs was less at fault than was their weakness in the quality control of these subsystems.

Salyut-class space stations utilize several distinct major components:

- *Salyut.* —An orbital laboratory, 13 meters (m; one m = *3.3* ft.) in length, *4.2* m at maximum diameter and weighing approximately *19* tonnes; it provides over 100 m^3 of usable space for up to five crewmembers. The orbits of civil Salyuts *(4, 6,* and 7) lie between 362 and 338 kilometers (km; 1 km = 0.62 statute mile) above the Earth's surface; those of military Salyuts (3 and 5), between 274 and 241 km; that of Salyut 1, thought to be civil, between *277* and 251 km; all have an inclination of approximately 52 0 Two of the sections—a transfer/docking compartment and a working/living compartment—are habitable; the third is an unpressurized instrument/propulsion section. Solar arrays provide power. Salyuts 1 through 5 had one docking port; Salyuts 6 and 7, two ports. With a Soyuz transport craft docked at one end and a Progress resupply ship at the other, the total length of the complex is *29* m. Onboard laboratory equipment has included a multispectral camera, materials processing furnaces, and devices for scientific, medical, and technological tests. *
- *Soyuz.* —An early model of this class of transport that was retired from Salyut operations after Soyuz 40 in 1981. This spacecraft, flown with and without cosmonauts onboard, provided a transport link for two- or three-person crews and supplies between Earth and the Salyut vehicles, or, in the case of Soyuz 22, a solo flight.**
- Soyuz T.–Unveiled in December 1979. The successor to Soyuz,[9] and similar to it in external shape and dimensions, Soyuz T can

[b]For example, the Soyuz and Salyut (1 and 4) propulsion systems were identical. Salyut 1 also used Soyuz solar panels. The propulsion unit of Molniya spacecraft was the same as that used onearly lunar and interplanetary vehicles.

[6]K. P. Feoktistov and M. M. Markov, "Evolution of 'Salyut' Orbital Stations," *Zemlya i Vselennya,* September-October 1981, pp. 10-17,

[7]Nicholas L. Johnson, *Handbook of Soviet Manned Space Flight, vol. 48,* Science and Technology Series, American Astronautical Society, San Diego, Calif., 1980, p. 209, (Note that this book was published before the orbiting of Salyut 7.)

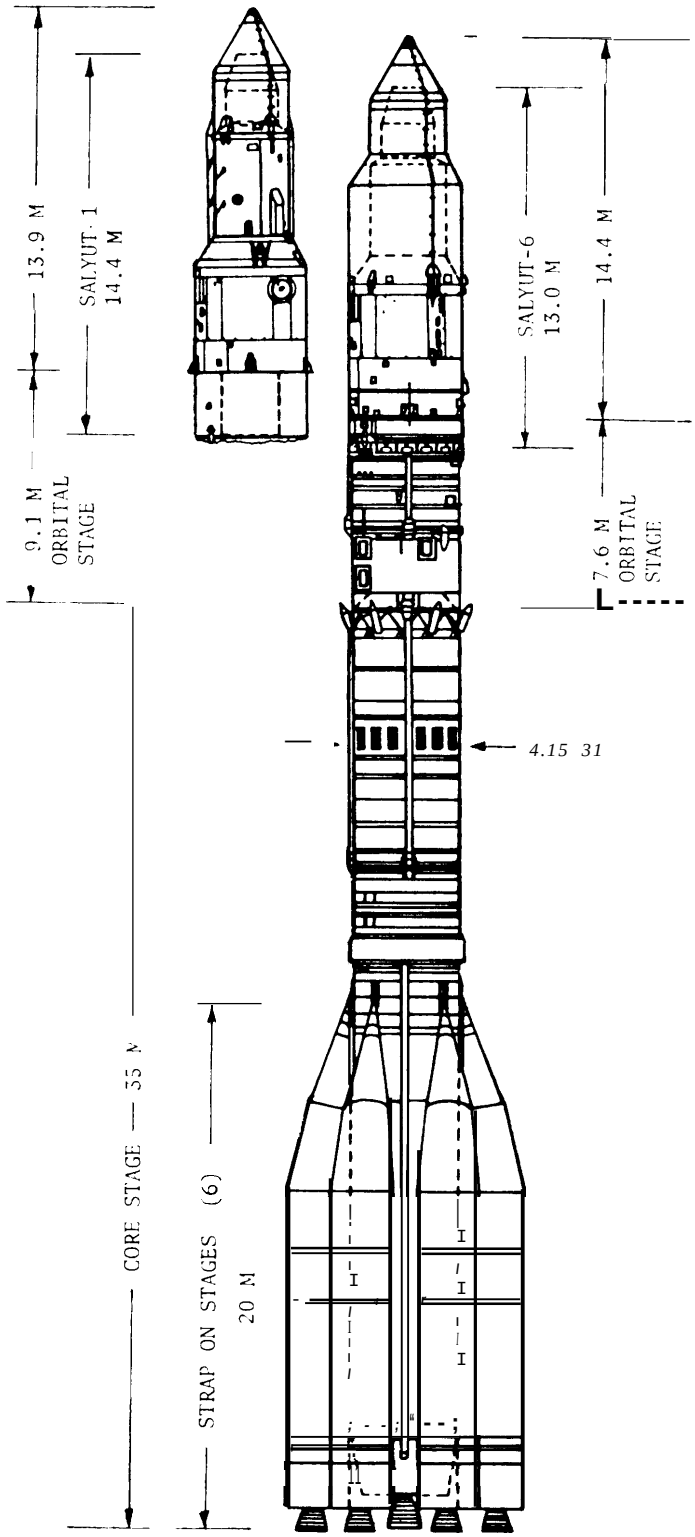
* *As a rule, Soviet practice is to give a spacecraft a name appropriate to its class only if it achieves the purpose for which it was intended; craft which miscarry or are aborted receive either no name (as was the case for two that exploded in 1966) or the general appellation Cosmos. The failed Salyut 2 is the exception to this rule.

[8]Johnson, op. cit. Cosmos 382 was probably not a Salyut; it appears to have been considerably lighter and more maneuverable. Its altitude (5, 000 km apogee), plane-change capability (51.6 to 55.9), and perigee increase (from 320 km to 2,577 km) link it more probably to Cosmos 379.

*For a more detailed description of Salyut, see *Appendix A: The Soviet Salyut Space Program.*

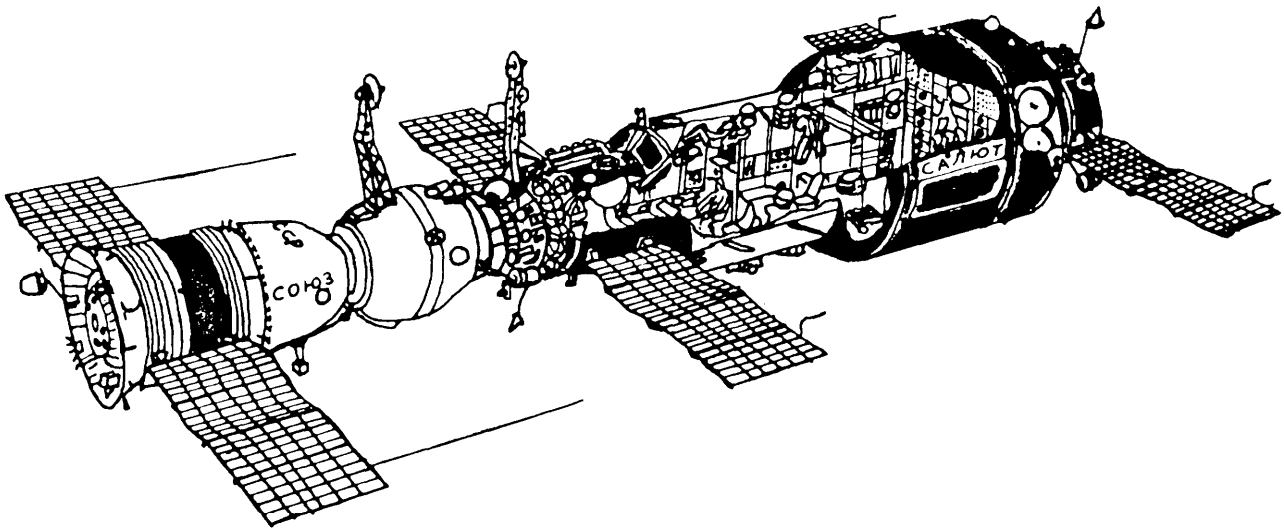
**Soyuz carried three cosmonauts on four flights. Soyuz 4 was launched with one cosmonaut, but returned carrying two cosmonauts from Soyuz 5; Soyuz 5 was launched with three and returned with one. After three crewmen on Soyuz 11 died from depressurization during reentry on June 6, 1971, cosmonauts were required to wear pressurized suits, and crew size was limited to two.

[9]Craig Covault, "Extensive Design Changes Mark Soyuz T," *Aviation Week & Space Technology* Jan. 14, 1980, p. 57.

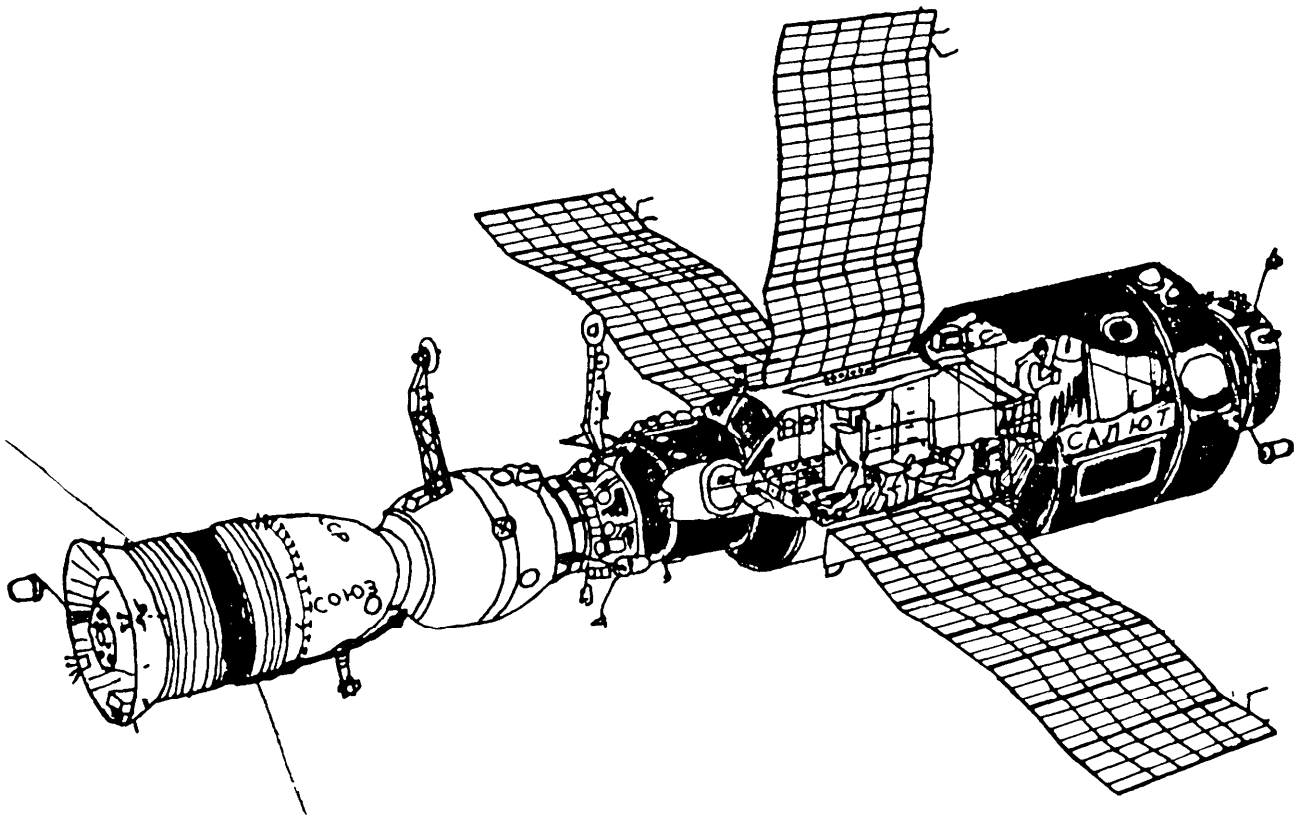


Cred/t C P V/ck, 1982

Salyut launch vehicle: The Proton D-1 Launch Vehicle used to launch the Salyut Spacecraft Laboratory. It is a three-stage launch vehicle

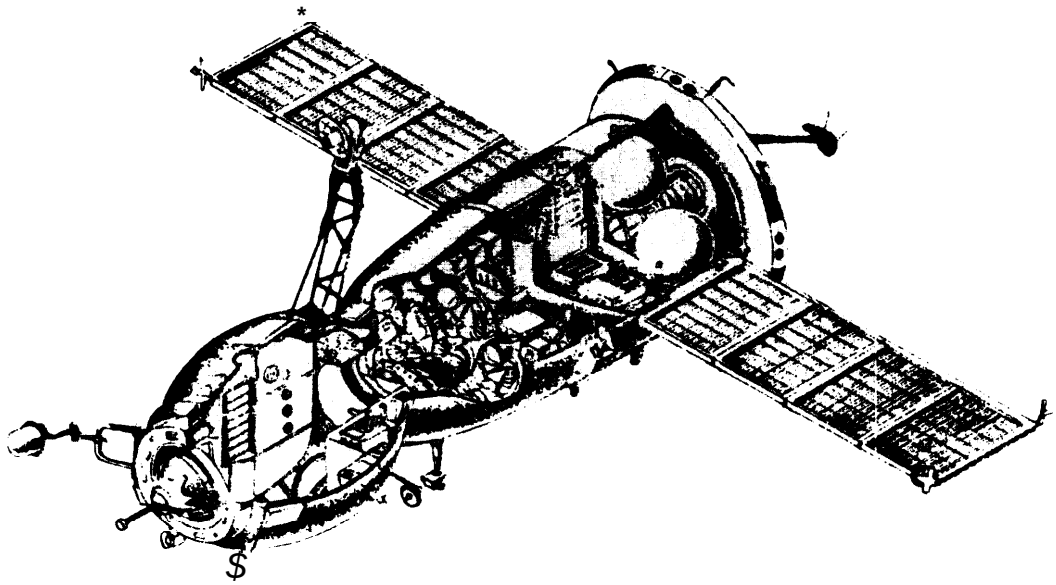


Soyuz 11 docked to Salyut 1



Soyuz 17/Salyut 4 represents a further development in the civilian Salyut Program. Major revisions are the absence of solar panels on the Soyuz ferry and the change to three large, steerable solar panels on the station

Soyuz T Spaceship



Principal Characteristics

Crew	2-3 persons
Weight	6,850kg
Weight of descent module	3,000kg
Length of the body	6,98m
Maximum diameter	2.72m
Span of extended solar battery panels	10.6m
Type of booster rocket	Soyuz

Cfed/t Drawing from "MIsslon S:lentlflque" Franco-Sovietique Saliout-7 France-USSR ScientIflc MIsslon "Salyut-7 (F)ress Kit) for Soyuz T-6, 1982

transport as many as three people wearing pressure suits (or two people and a cargo pod) to the Salyuts. ' Operating with solar panels, the craft sports advanced electronics and computers; it is more maneuverable than its predecessor, providing an automatic navigation control system that can be overridden for manual control, if desired, The orbital module of the vehicle, once its cargo has been undoaded into the station, can act as a container to hold used equipment and trash for subsequent destructive reentry.** The command module of Soyuz T is used to return the crew to Earth.

- Progress. —An unmanned transport of slightly over 7 tonnes, based on Soyuz design and using internal batteries rather than power derived from solar cells, it links to Salyut automatically, delivering equipment, parts, fuel, and other consumables.'" The cargo capacity of Progress is about *2.3* tonnes of food, water, mail, film, equipment, and propellants. Oxygen regenerators for Salyut's life-support system are resupplied, along with gaseous nitrogen, if needed. [11] Salyut cosmonauts transfer much of this cargo into the station manually, but propellant for the station is pumped automatically. Using residual propellant, Progress spacecraft also double as space tugs, capable of pushing Salyuts into higher orbit. The last service which Progress can render to Salyut is to accept its refuse. Because it is not designed for recovery, Progress is jettisoned and destroyed upon reentry into the atmosphere.
- Cosmos *929-Class Module.* "—Designed to double the habitable volume of Salyut, this module is flown without crew to the station and docked automatically. Carrying its own propulsion, guidance, and life-support systems, it is designed with several docking ports and an ejectable "sub-module" which is large enough to return the station's crew and/or heavy equipment to Earth. The first such module, Cosmos *929,* was orbited July 17, 1977, and tested as a freeflyer. The next in the series, designated Cosmos *1267,* docked with Salyut *6* in 1981, forming an orbital complex that flew, uninhabited, for 13 months while a variety of automated system checkouts and flight-stability experiments were carried out. The latest module of this type, Cosmos 1443 (which may weigh as much as **20** tonnes), docked with Salyut 7 in March 1983.[13]*

*Soyuz T-3, T-6, T-7, and T-8 had crews of three.

*● The orbital module has not been left attached to Salyut. Without propulsion and flight control, its disposal would be difficult.

[10] K.P. Feoktistov, *Scientific Orbital Complex,* Monograph reproduced in English in Joint Publications Research Service (JPRS), *USSR Report: Space,* June *17, 1980.*

[11] *Tass* in English, **0753** GMT, Jan. 24, 1978.

[12] "Soviets Show Assembly of Space Station Units, " *AW&ST,* June 29, 1981, p. 21.

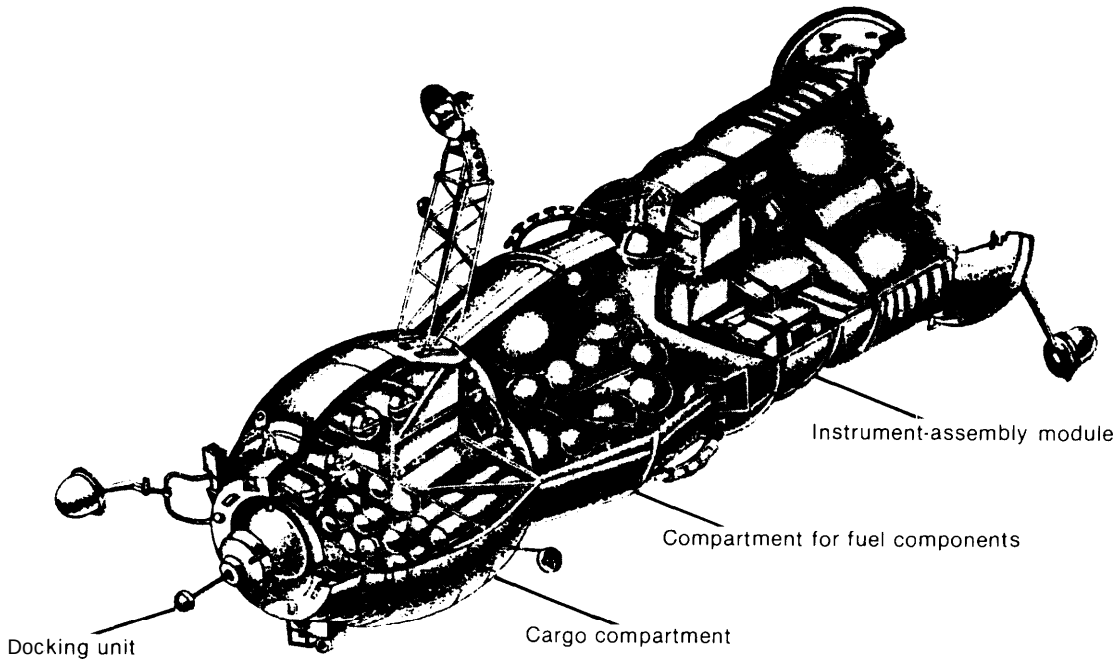
[13] "Soviets Launch Module to Enlarge Salyut 7," *AW& ST,* Mar. **7, 1983,** p. **IQ.**

*The long hiatus between the flights of Cosmos 1267 and 1443 can be attributed to the fact that the Cosmos 1267 test program was not terminated until the summer of 1982, at which point the Soyuz T-5 mission was already in progress.

Photo credit ***TASS***

Link-up in Orbit: On June **28, 1983,** the spaceship Soyuz T-9 linked up with the orbital complex Salyut T-7—"Cosmos-1443"

Progress Cargo Spaceship



Principal Characteristics

Weight	7,020kg
Weight of cargo dellvered to the station	about 2,300kg
includlng:	
-In the cargo compartment	Up to 1,300kg
-In the compartment for fuel components	Up to 1,000kg
Maximum length	7.94m
Maximum diameter of pressurized compartments	2.2m
Type of booster rocket	Soyuz
Duration of flight:	
Independent	up to 3 days
when docked with the orbital station	up to 30 days
Orbit parameters:	
height	200 to 350 km
Inclination	51,6 degrees
rotation period	about 89 minutes

Cred/t.' Drawing from "MI sslon Sclent Iflque" Franco-Sovietique Saliout-7 France-USSR SclentIflc MIssIon "Salyut-7 (Fress Kit) for Soyuz T-6, 1982