

The Soviet/Russian Manned Space Program



Quick Write

How do you think you would have felt if you had made a spacewalk like Leonov's? Have you ever had an experience where you felt you were far above, or far away from, ordinary cares and had to be called back in, as he was?

When Soviet cosmonaut Alexei Arkhipovich Leonov took his first steps outside his spaceship, *Voskhod 2*, orbiting miles and miles above the Earth, his 4-year-old daughter, Vika, could see it all on live television down below. She didn't know what was going on. She hid her face in her hands and cried. "What is he doing? What is he doing?" she wailed. "Please tell Daddy to get back inside."

Leonov's elderly father, too, was upset. The Soviet space program was "open" enough at that point that its missions were televised, like the American ones. But the civilian public, including the cosmonauts' families, had no idea what to expect. Such was the Soviet habit of secrecy. The senior Leonov, unaware of the plans for the spacewalk, thought his cosmonaut son was simply misbehaving in space. "Why is he acting like a juvenile delinquent?" he shouted in frustration to the journalists gathered at his home. "Everyone else can complete their mission properly, inside the spacecraft."

But then the voice of Soviet President Leonid Brezhnev could be heard delivering a message of congratulations to the cosmonauts: "We are proud of you. We wish you success. Take care. We await your safe arrival on Earth."

Meanwhile, back in outer space, Leonov heard his commander calling him, "It's time to come back in." Leonov later said, "In that moment my mind flickered back for a second to my childhood, to my mother opening the window at home and calling to me as I played outside with my friends, 'Lyosha, it's time to come inside now.' "

Learn About

- the history and accomplishments of the Russian *Vostok* project
- the history and accomplishments of the Russian *Voskhod* project
- the history and accomplishments of the Russian *Soyuz* Project

The History and Accomplishments of the Russian Vostok Project

Historians often cast the story of the US and Soviet parallel space programs as the Cold War's space race. It would be wrong to play down the competitive aspect of space exploration. But the Soviet Union made a major effort at space exploration, and this effort made serious contributions to science. In this lesson you will read about ways the two countries' space programs differed, but also how closely they tracked each other.

Vocabulary

- air lock
- retrofire
- retrorocket



Cosmonaut Yuri Gagarin, the First Man in Space

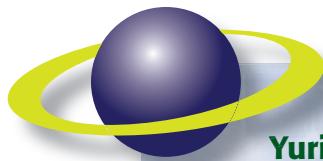
Like Project Mercury, Project Vostok was meant to show that it was possible to put a man in orbit, observe his reactions to being in space, and return him safely to Earth at a known point. (*Vostok* is the Russian word for *east*.) NASA wanted to prove that an astronaut was not just a passenger in space but “an invaluable part of the space flight systems as pilot, engineer and experimenter.” Soviet designers,



Cosmonaut Yuri Gagarin rides a bus to the launch pad on 12 April 1961 for his famed Vostok 1 spaceflight.

He flew only one mission, but that one made him the first human in space and the first to orbit Earth.

Courtesy of NASA



Yuri A. Gagarin

Yuri A. Gagarin, who would become the Soviet Union's first man in space, was born the son of a carpenter on a collective farm west of Moscow on 9 March 1934. After six years of local schooling he continued his education at vocational and technical schools. In 1955 he joined the Russian Air Force. In 1957 he graduated with honors from the Soviet Air Force Academy. He became a military fighter pilot, and by 1959, his country had selected him for training as one of the first group of Soviet cosmonauts.

Col. Gagarin died on 27 March 1968 when the MiG-15 he was piloting crashed near Moscow. At his death, he was in training for a second space mission.

on the other hand, assigned limited tasks to their cosmonauts. The tradeoff was that the Soviets put a man in space first, and that first flight was longer than either of the first two American manned space missions.

The man whom the Soviets launched into space was Col. Yuri A. Gagarin. He flew only one space mission. But that one made him not only the first human in space but also the first to orbit Earth. On 12 April 1961 his spacecraft, *Vostok 1*, circled the Earth at nearly 17,000 mph (27,400 km per hour). His flight lasted 108 minutes. At his highest point, he was about 200 miles (327 km) above the Earth.

Star POINTS

Although the controls of Gagarin's spacecraft were locked, Soviet space engineers had placed a key in a sealed envelope in case an emergency arose and he needed to take control.

In orbit, Gagarin had no control over his spacecraft. A computer controlled its reentry by sending radio commands to *Vostok 1*. Gagarin's return to Earth was different from that of American astronauts. According to plan, Gagarin ejected from the spacecraft after reentry into Earth's atmosphere and parachuted to the ground.

Valentina Tereshkova, the First Woman in Space

Valentina Tereshkova was an amateur parachutist who happened to be working as an assembly worker in a textile factory when recruiters signed her up for the cosmonaut program. She was one of four women selected for a special woman-in-space program, at the direction of Soviet Premier Nikita Khrushchev. Tereshkova was the only one to complete a space mission. But hers was quite a mission.

She became the first woman in space when she went up aboard *Vostok 6* on 16 June 1963. Her mission lasted nearly three days, in which she orbited Earth 48 times. This meant she had stayed up twice as long, and made more than twice as many circuits, as the Mercury program's marathon man, L. Gordon Cooper Jr., whose mission had taken place a month before hers.

Valentina Tereshkova (1937–)

Valentina Tereshkova, who would become the first woman in space, had a background very typical of the Soviet people of her time. She was born on 6 March 1937 in the Yaroslavl region of Russia, an industrial area not far from Moscow. Her father drove a tractor, and her mother worked in a textile mill. Valentina started school at age 8 and left eight years later to begin work. But she continued her education by correspondence school.

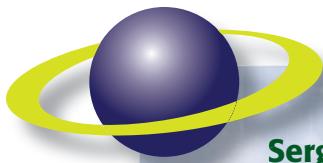
The way Tereshkova became a cosmonaut wasn't very typical, however. She wasn't an air force pilot, for example, as Yuri Gagarin was. While still very young, she developed an interest in parachute jumping. She took up the activity and became good at it. It was this expertise that led the Soviet space agency to select her for its cosmonaut program.

After she completed her space mission, the Soviets honored Tereshkova as a "Hero of the Soviet Union." She also received the United Nations Gold Medal of Peace as a goodwill ambassador for her country.



Cosmonaut Valentina Tereshkova (right) shakes hands with *Expedition 10* commander and NASA International Space Station science officer Leroy Chiao in Kazakhstan in 2004. Tereshkova became the first woman in space when she went up aboard *Vostok 6* in 1963.

Courtesy of NASA/Bill Ingalls



Sergei P. Korolev (1906–1966)

Sergei P. Korolev, the man who designed the rocket that put *Sputnik 1* into space on 4 October 1957, was also a leading advocate of Soviet efforts to put a man on the Moon before the Americans. Korolev was an early experimenter with rockets. In the early 1930s he and his colleagues were testing liquid-fueled rockets of increasing size.

Their work caught the Soviet military's attention. Within a few years Korolev, by now at a military research institute, had designed the RP-318. It was Russia's first rocket-propelled aircraft. But then his career made an abrupt detour: At the peak of the Soviet leader Stalin's purges—campaigns to “cleanse” society of political undesirables—Korolev and a number of other aerospace engineers were thrown into prison. Korolev himself spent a year doing forced labor in the dreaded Kolyma gold mines.

Eventually Stalin realized that rocketry could be useful in the expected war against Nazi Germany. He brought some engineers out of prison. Others he left in place. But he set up a system of “prison design bureaus” to create new weapons for the Red Army.

Korolev was saved when senior aircraft designer Sergei Tupolev, himself a prisoner, asked for his help in one of these bureaus. Some years later Korolev's R-7 rocket launched *Sputnik 1*.

The hardest part of getting a man to the Moon, Korolev and his team found, was building a big enough rocket. The Soviets needed something like the American *Saturn V*. Korolev's design bureau began work on the so-called N-1 rocket in 1962. But even though work continued for years after his death, by the time the project was finally canceled, it had never made a successful flight.

Other ‘Firsts’ Achieved by the Russian Vostok Project

The cosmonauts of the Vostok program were rightly proud of the “firsts” they racked up in the early 1960s. Among their other achievements:

- In 1961 Gherman Titov became the first person to spend a full day in orbit, aboard *Vostok 2*
- In 1962 *Vostok 3* and *Vostok 4* carried out the first two-spacecraft mission
- On 14 June 1963 the crew of *Vostok 5* carried out the first long-duration mission, five days in orbit.

The History and Accomplishments of the Russian Voskhod Project

For Americans, Project Gemini followed Project Mercury. For the Soviets, the Voskhod Project (which means “dawn” or “sunrise”) came after the Vostok Project. In both countries, in fact, engineers were hard at work on the second phase of the quest for the Moon, even as the Mercury and Vostok missions were still being carried out.

The *Voskhod* as the First Three-Man Spacecraft

As the Vostok Project gave way to the Voskhod Project, and Mercury gave way to Gemini, designers in both countries were looking to improve on the spacecraft they had relied on for those first missions. Both Soviet and American designers wanted vehicles that were more flexible and were capable of carrying more than one person.

NASA engineers started out trying to improve the *Mercury* capsule but ended up designing the new *Gemini* craft pretty much from scratch. The Soviets, however, took the *Vostok* spacecraft and modified it to hold two or three astronauts.

The Soviets were apparently eager to beat the goals set for Project Gemini and convinced they didn't have time to design a new spacecraft from the beginning. The *Voskhod* was an attempt to make the most of a tested design.

The *Voskhod*'s First Crew

Voskhod 1, which carried three men into space, was the first "multimanned" flight. Vladimir M. Komarov was the command pilot. Boris B. Yegorov was the physician on board. Konstantin P. Feoktistov, a scientist and spacecraft designer, rounded out the crew. It was Feoktistov who had figured out how to modify *Vostok* to hold more than one astronaut. The Soviet space program rewarded him for his achievement with a trip into outer space himself.

The *Voskhod 1* mission was designed:

- to test out the new spacecraft
- to see how well a group of cosmonauts from different professional backgrounds would work together in space
- to conduct physical and technical experiments
- to perform an extensive medical-biological investigation program.

The crew returned live television pictures from space. And they had enough confidence in the space cabin's life-support system that they could wear overalls rather than cumbersome spacesuits and helmets. (The crowded capsule didn't have room for them.) The Soviets deemed *Voskhod 1* a success.



Voskhod 1 cosmonauts (from left) Vladimir Komarov, Boris Yegorov, and Konstantin Feoktistov make their way to the launch pad for mankind's first multimanned spaceflight. The crew returned live television pictures from space.

Courtesy of NASA



Voskhod 2's external movie camera captured these photos of Alexei Leonov as he took man's first spacewalk on 18 March 1965. During his brief adventure, which lasted only about 20 minutes, he felt both tension and euphoria.

Courtesy of NASA

The Experiments Conducted During the Voskhod Project

Yegorov was the first trained medical doctor in space. He conducted a number of medical experiments during his flight. He tested the cosmonauts' lung function and their sense of balance. He also took the first blood samples in space. This will confirm that the health challenges of spaceflight you read about in Chapter 5, Lesson 4, have been under study for some time.

Alexei Leonov, the First Man to 'Walk' in Space

On 18 March 1965 the Soviets launched the spacecraft *Voskhod 2* with two men aboard, Pavel I. Belyayev, pilot, and Alexei A. Leonov, co-pilot. On this mission, Leonov made the first spacewalk.

Leonov's spacecraft had an extendable air lock. An **air lock** is *an airtight chamber, usually located between two regions of unequal pressure, in which air pressure can be regulated*. An air lock lets people flying in space close one door behind them, so to speak, before they open another. On *Voskhod 2*, the air lock let Leonov step outside without having to spill all the air in the main cabin out into space.

Leonov put on a spacesuit to go outside. It was a sign of progress that cosmonauts no longer had to wear spacesuits inside their capsules. He carried a life-support system in a backpack. A TV camera recorded his spacewalk, and he had a handheld movie camera as well. During his brief adventure, which lasted only about 10 to 20 minutes, he felt both tension and euphoria. He was floating alone outside his little spaceship, at the end of a 10-foot tether, miles above the Earth's surface.

It was a spectacular achievement, but the mission went downhill from there. Leonov had trouble getting back into the spaceship because his suit had become unmanageably stiff from too much pressure. The automatic orientation system for the retrofire malfunctioned. (*Retrofire* is the ignition of a *retrorocket*, a small rocket used to slow or change the course of a spaceship.) And so the cosmonauts had to bring their ship back into Earth's atmosphere manually. They ended up landing in six feet of snow in a Siberian pine forest, hundreds of miles from their target area. Once rescuers had located them, it took them a whole day to cut through the trees and bring the crew out on skis.

When a Land Power Takes to the Heavens

The US-Soviet space race played out against the larger backdrop of the Cold War. The two countries' space programs reflected differences in the kind of power each was. Americans who watched the missions of the Mercury, Gemini, and Apollo astronauts took it for granted that they would "splash down" in the ocean. Then US Navy helicopters would pluck them from the water and ferry them to a waiting aircraft carrier. But the Soviets decided to have all their manned space missions "land" in the fullest sense of the word—on solid ground. Usually Soviet spacecraft landed in southern Kazakhstan. It's now an independent country, but back then it was part of the Soviet Union.

The United States was and is a great sea power, with bases around the globe. It has many small island bases across the Pacific. Russia is a great land power, and so was the Soviet Union before it, to an even greater degree. Spacecraft coming down in sparsely populated Kazakhstan were unlikely to hit anyone on the ground, and would be generally within reach of rescue crews coming overland. Soviet "land landings" were not always without incident, however, as *Voskhod 2*'s return to Earth showed.

Alexei Arkhipovich Leonov (1934–)

Alexei Arkhipovich Leonov attended the Kremenchug prep school for pilots and then the Chuguyev Higher Air Force School in Ukraine. After graduating in 1957, he served as a jet pilot in East Germany. He was a student at the Zhukovsky Air Force Engineering Academy when, on 5 March 1960, he got word that he was to be one of the first 12 Soviet cosmonauts.

Leonov is an artist as well as an aviator. His first stop after finishing secondary school was to enroll in the Academy of the Arts in Riga, Latvia, where he expected to train to become a professional artist. He withdrew soon after to begin his training as a pilot. But he continued his art studies in evening classes even as he was also qualifying to be a parachute instructor in the Soviet Air Force. The paintings he made of his spacewalk won him admission to the Soviet Artists' Union. He has displayed his paintings internationally and written a number of books.



A Soyuz rocket soars toward the International Space Station from the tarmac at the Baikonur Cosmodrome in Kazakhstan in March 2009 with the Expedition 19 crew.

Soyuz is also the name of the rocket used to launch the earliest Soyuz spacecraft.

Courtesy of NASA/Bill Ingalls

The History and Accomplishments of the Russian Soyuz Project

If the Vostok program was the Soviet counterpart to Project Mercury, and the Voskhod program the Soviet equivalent of Project Gemini, then the Soyuz Project was the Soviets' Project Apollo. *Soyuz* means *union*, as in the name of the former Communist state in Russia, the Soviet Union. *Soyuz* is also the name of the rocket used to launch the *Soyuz* spacecraft.

The History of the Russian Soyuz Project

In the year and a half between the last Voskhod mission and the first unmanned Soyuz flight, the Soviet space program lost three important advocates. Premier Nikita Khrushchev stepped down from his post in October 1964. And rocket designer Sergei Korolev and his chief assistant both died during this period. But their successors continued the work on Soyuz, under the new Soviet leadership.

Among the issues the designers faced was the need for a new upper stage for their basic launch vehicle. They needed a rocket with enough power to boost the *Soyuz* spacecraft, heavier than its predecessors, into orbit. They finally developed one. And then they made some test flights.

Soon they would be ready to launch *Soyuz 1*. The Soviet engineers designed their new spacecraft to take advantage of what the space program had learned from earlier flights. The Soviets also expected to learn more from *Soyuz 1* about how humans function in space and to investigate the problems of rendezvous and docking.

According to the Soviets, the purpose of the *Soyuz* missions was to develop a space station that would orbit Earth. Others speculated that the *Soyuz* program's real goal, like that of Apollo, was to put a man on the Moon.

And just as the United States lost its *Apollo 1* astronauts in a tragic fire, so, too, the first *Soyuz* mission ended in disaster. Vladimir M. Komarov, who had commanded the successful *Voskhod 1* mission a few years before, launched into space as the sole cosmonaut aboard the *Soyuz 1* on 23 April 1967.

After 24 hours and 18 orbits, he successfully accomplished retrofire. In this case, Komarov needed to use his retrorocket to slow down to reenter Earth's atmosphere and return to the ground. Communication proceeded normally. But the ship's parachute system failed. The main chute didn't deploy on schedule. *Soyuz 1* came crashing to Earth at high speed. The impact destroyed the ship and killed Komarov.

Star POINTS

At times people on both sides of the US-Soviet rivalry wondered whether cooperation might have served the two nations better than competition. But the competitive mode remained the most common.

The Docking Experiments Conducted During the Soyuz Project

Subsequent Soyuz missions were more successful. The next two represented an attempt to dock two craft in space. The next two after that succeeded in docking.

The Soviets launched the unmanned Soyuz 2 on 25 October 1968. The next day Soyuz 3, with cosmonaut Georgy Timofeyevich Beregovoy aboard, went up.

Soyuz 3 went into co-orbit with Soyuz 2, and got within 200 meters of it. Based on reports in the Soviet newspaper *Pravda*, people in the US space program assumed the mission's goal was to dock the two spacecraft. But although Beregovoy made repeated attempts and did get very close, he didn't quite make the connection.

Then came Soyuz 4. On 14 January 1969 the Soviet Union made its first wintertime launch of a manned spacecraft: Soyuz 4, piloted by Vladimir A. Shatalov. The next day, Soyuz 5 went up, and a day after that, Soyuz 4 began a docking exercise with Soyuz 5.



After their historic mission, Soyuz 4 Commander Vladimir Shatalov illustrates how his spacecraft and Soyuz 5 docked in Earth orbit on 16 January 1969.

Automatic systems brought the two ships within 100 meters of each other, but the cosmonauts managed the final docking manually.

Courtesy of NASA

Automatic systems brought the two ships within 100 meters of each other. The cosmonauts managed the final docking manually. During the 4½ hours the ships remained docked together, they completely interlocked controls, power, and telephones.

After Soyuz 4 had made 51 orbits, two cosmonauts from Soyuz 5 put on their spacesuits and opened their outer hatch. Floating and climbing hand over hand along the Soyuz 5 handrails, they made their way through the open hatch of Soyuz 4 and slipped inside. When Soyuz 4 returned to Earth after three days, it carried, instead of the single man it went up with, a crew of three.



The First Space Station

Salyut 1 ("salute") was the first space station of any kind. The Soviets put it into space—unmanned—on 19 April 1971. *Soyuz 10* was meant to deliver a crew to the space station. But it failed to dock properly. *Soyuz 11* did bring a crew to *Salyut 1*, and they had 23 productive days in space. The three cosmonauts perished on their return journey, however, because of an air leak on *Soyuz 11*. Three further space stations of the same class failed because they either never reached orbit or broke up before crews could get to them.

The Apollo-Soyuz Test Project

As the final mission of Project Apollo, the United States undertook a new joint project with the Soviet Union. The Apollo-Soyuz Test Project (ASTP) was the first human spaceflight mission managed jointly by two nations. It was also the first spaceflight in which ships from two different nations docked in space. Scientists designed the mission to test the compatibility of rendezvous and docking systems for the two countries' spacecraft. The test project was meant to prepare for future joint flights.

The Americans and Soviets had many challenges to work through, however. The two countries had developed their spaceships independently, so they weren't technically compatible for docking. The two space programs even had their astronauts and cosmonauts breathing different mixtures of air, at different pressures.



With the *Apollo* and *Soyuz* spacecraft docked in space, American astronauts (*upside-down from left*) Donald Slayton and Thomas Stafford visit with cosmonaut Alexei Leonov (*right side up*) in the *Soyuz Orbital Module*. The ASTP was a resounding success for both sides.

Courtesy of NASA

But the two sides met and overcame these issues. On 15 July 1975 the space agencies launched their two ships, *Soyuz 19* first and *Apollo* seven hours later. At 2:17 p.m. US Central Time on 17 July the two ships docked. Three cosmonauts and two astronauts carried out joint operations for two days. Then the ships separated. *Soyuz* landed in the Soviet Union on 21 July. *Apollo* splashed down near Hawaii on 24 July.

The mission was a resounding success for both sides. The two ships' crews had successfully docked. While docked, they had managed to move between spacecraft. And they carried out a series of scientific experiments.

Star POINTS

One of the most difficult problems the Apollo-Soyuz project faced was that of language differences. To bridge the language gap, the Americans studied Russian and the Russians studied English. The two groups found the best way for them to communicate was for the Russians to speak English and for the Americans to speak Russian.

The mission was important not only for its success as a space effort but for the mutual confidence and trust it engendered during the Cold War, when each country normally considered the other "the enemy." The repercussions of this mission continue today. Astronauts visited the Russian Space Station *Mir* numerous times over the years. And cosmonauts have flown on US space shuttle flights frequently as well. US and other astronauts regularly ride to and from the International Space Station aboard *Soyuz* spacecraft. Russian *Progress* cargo ships take supplies back and forth. This cooperation looks likely to last well into the future as both programs improve the means to get human beings into space, to the Moon, and maybe one day to planets in our Solar System.



CHECK POINTS

Lesson 2 Review

Using complete sentences, answer the following questions on a sheet of paper.

1. What two things did Colonel Yuri A. Gagarin accomplish on his one space flight?
2. How did Valentina Tereshkova's mission into space compare with that of L. Gordon Cooper Jr.?
3. What was Gherman Titov's accomplishment in space?
4. As Project Vostok and Project Mercury gave way to new space missions, what two goals did Soviet and American designers share?
5. For what accomplishment did the Soviets award Konstantin P. Feoktistov a place on the crew of *Voskhod 1*?
6. Who was Boris B. Yegorov and what was his particular work on *Voshkod 1*?
7. What "first" did Alexei Leonov achieve aboard *Voshkod 2*?
8. What, according to the Soviets, was the purpose of the Soyuz missions?
9. What was different about *Soyuz 4* when it returned to Earth?
10. What was the Apollo-Soyuz Test Project?



APPLYING YOUR LEARNING

11. What was the larger context or historical backdrop of the Apollo-Soyuz Test Project, and why did the project's success matter in that larger context?