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Above: A historic globe built at Korolev's OKB-1 shows ground track of the Vostok-2 mission on August 6-7, 1961.

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Previous chapter: *Gagarin's landing*

Less than four months after Gagarin's triumphant return to Earth, USSR stunned the world with yet another manned launch. This time, Yuri's backup -- Gherman Titov -- piloted the Vostok-2 spacecraft on a day-long mission. Titov's 25-hour flight looked even more startling, given the fact that the flight of this length had been the ultimate goal of NASA's Mercury spacecraft.

Preparing the Vostok-2 mission

Even heavily censored Soviet accounts of the Vostok-2 mission provided hinted about a great debate which had been raging over the proposed flight duration in the runup to Titov's launch. (507) During his vacation in Sochi, Crimea, following Gagarin's return, Korolev pondered over the plan of the second flight. At the time, medical specialists and "other experts" insisted on the mission limited to three orbits. Their main argument was that the first three orbits were ensuring landing within southern Russia, with the landing site drifting westward with each consequent orbit. Between the 8th and 13th orbit, the landing would fall into the ocean. (506) After the 13th orbit, the landing would be again possible in the USSR, however only in inhospitable and remote regions of the Soviet Far East covered with taiga, rocks and tundra. (507)

Only after a day-long flight, the landing opportunity would shift back to the European part of Russia, however such duration was considered unacceptable to many. Data from Vostok test missions indicated that dogs apparently experienced vestibular problems after six or seven orbits.

Nikolai Kamanin, the head of cosmonaut training, and Vladimir Yazdovsky, leading space medicine expert, arrived to Sochi for a meeting

IMAGE ARCHIVE

In Sochi, Crimea, Korolev (left), Yazdovsky (center) and Kamanin hotly debated the possible duration of the second Vostok mission.

A meeting of the State Commission before the launch of Vostok-2 on Aug. 6, 1961. The chairman of the launch commission, L. Smirnov, is on the right from Korolev (standing).

Following a tradition established on the eve of the Gagarin's launch, Nikolaev and Titov (left), accompanied by Korolev, visited Pad 1, where they met with military specialists who were preparing Vostok-2 for launch.

with Korolev with a plan for a three-orbit flight. Coincidently, it would be the same duration which NASA had planned for the first orbital mission of the Mercury spacecraft.

However Korolev insisted on the day-long program, since it would have to be inevitably achieved either in the second or in the third flight. Such flight would validate that a human can function in space during a complete day-long cycle. While still in Sochi, Korolev disclosed to Titov a program of a day-long flight and mentioned proposals about a three-orbit mission. (507)

Flight program

On July 3, 1961, top Soviet officials overseeing rocket industry, including Korolev, signed a top-secret note declaring preparations for the Vostok-2 mission completed. Although the document was addressed to the Central Committee of the Communist Party, its was essentially a request to the Soviet premier, Nikita Khrushchev, to bless the flight plan for the second Vostok.

According to the document, the mission would last up to 24 hours with a landing at the beginning of the 18th orbit along the Rostov-Kuibyshev-Perm line. The goals of the mission included:

- The study of the influence of weightlessness on the human body during a long-duration flight;
- Testing the possibility of control and orientation of the spacecraft under manual control;
- Testing of the possibility of filming and observation with optical devices of the Earth surface by the pilot. (509)

The document placed available window for the Vostok-2 launch between July 25 and August 5, 1961. As in Gagarin's mission, the document asked to issue a public announcement about the mission, immediately after the confirmation that Vostok-2 had reached its orbit. (509)

On July 6, a Presidium of the Central Committee signed off on the mission plan.

Korolev returned to Moscow in June 1961, to personally lead preparations for the Vostok-2 mission. He oversaw final tests of the spacecraft in Podlipki from July 23 to July 26 and boarded a plane heading to the launch site in Tyuratam on July 31, 1961. (506)

To ensure radiation safety during the mission, Soviet astrophysics centers conducted careful monitoring of the Sun's activity. High-altitude balloon flights were also launched to measure radiation levels in the stratosphere. In addition, the spacecraft was equipped with radiation-measuring equipment onboard, which had capability to transmit data to ground stations, and the cosmonaut had a portable radiation counter in his cabin. (505)

Titov had a professional Soviet-built Konvas movie camera onboard, which was modified for space flight (52) and could record on black and white and color film. The cosmonaut also received an optical telescope with magnification from three to five times. Vostok-2 also carried an upgraded air-conditioning system, which went through a 12-day laboratory testing. (509)

As in Gagarin's mission, the orbit was expected to have a perigee of 180 kilometers, low enough to ensure natural decay and reentry of the spacecraft within 2-8 days of the mission, in case of a failure of the braking engine. At the same time, the spacecraft had enough power and air for a 10-day mission. (509)

The spacecraft modifications

Learning a great deal from the Gagarin's pioneering flight, engineers managed to incorporate a number of modifications in the design of the Vostok spacecraft for its second manned mission. The TV transmission system, which worked poorly, was upgraded. The telemtery system was also updated with the Signal short-wave transmitter, which was designed to help track the spacecraft and also to serve as a backup downlink channel for medical data, when more reliable UHF communcations were not possible outside of the Soviet territory. (27)

Final preparations

One Soviet source claimed that the cosmonaut was "allowed to eject during landing in case of the good health condition"! (505) According to Titov's Soviet era memoirs, during a formal approval of the mission duration, officials asked his opinion about the duration of the flight and Titov, naturally supported Korolev's call for a day-long flight. However, the commission cautiously decided to plan the flight for a day, however make a final call based on the health of the cosmonaut after three orbits. (507)

The flight

On the eve of the flight, Korolev personally visited Titov and Nikolaev at Site 2 and assured them that preparations for launch had been going on as scheduled. "Sleep well," he reportedly told them before going back to the pad. (508) In the meantime, most engineers did not get to sleep well. Most key specialists were awaken at 03:00 and an hour later arrived to the launch faiclity. At 05:00, the State Commission gave a green light to the fueling and the launch. (27)

A cosmonaut training specialist Evgeniy Karpov woke up Titov before dawn on August 6, 1961, in the cottage at Site 2. Stars were still out, but the sky was turning red in the East. As four months before, Titov went through suiting up procedures, this time with Nikolaev as his backup. Titov later shut at medical team in his post-flight report that a planned hour-and-half operation of sensor attachments to his body lasted 40 minutes longer, disrupting the pre-launch schedule. (509)

Again, there was a now familiar ride to the pad onboard a blue bus, concluding with a "space helmet kiss" with Nikolaev at the base of the Vostok rocket, some two hours before a scheduled liftoff. (27) As Titov climbed to his spacecraft struggling with summer heat, Nikolaev stayed in the bus until a 30-minute readiness for the launch had been announced. He then put off the spacesuit and went to a viewing point to see the liftoff. (508)(509)

Vostok-2 lifted of on Aug. 6, 1961, at 08:59:57 Moscow Time. After a flawless launch, it entered a 183 by 244-kilometer orbit. Titov said he received a word from mission control that his orbital period (time of making single orbit) was 88.6 minutes. (507)

The confirmation of the correct orbit was made some 20 minutes after the launch and soon the Soviet media announced it to the world.

At 10:00, Titov activated manual attitude control of the spacecraft. At the beginning of the second orbit, Titov conducted filming of the earth surface and the sky with the total duration of 10 minutes. This footage then made it to the general media. (52) He tried to use an exposure measuring device, but discovered that it failed as a result of the loads during the launch.

Titov attempted to photograph view of the Earth in the Vzor window, which was used by the pilot for the manual orientation of the spacecraft in flight. These images could be used for training purposes. (507)

Nikolaev in August 1961, when he served as a backup pilot for the Vostok-2 mission.

The official portraits of Titov in spacesuit.

Titov and Nikolaev try space food during a bus ride to the launch pad on Aug. 6, 1961.

According to the flight program, Titov was suppose to sleep from 18:30 on Aug. 6 to 02:00 on Aug. 7. While trying to fall asleep, he discovered his hands floating above his body, so he tried to hold them by the safety belts. (507)

Titov took lunch out of tubes around 12:30, during the 3rd orbit. On the 6th orbit he had dinner. Although the Soviet sources did insist that Titov was in excellent health during the flight, they did admit that his vestibular system had experienced "some changes manifested in unpleasant feelings."(505) Titov tried not to make sharp movements with his head to alleviate the situation.

At 18:30, before his historic nap in space, Titov used the toilet for the first and last time during his mission, another first and space, which Soviet press preferred not to advertise around the world. However, it was a great relief for life support engineers and doctors, whom Titov assured without any hesitation that to his surprise the "flow" was as easy as on Earth. (509)

He woke up several times in the middle of his sleeping period, the last time, just 15 minutes before the end of the rest. He then fall asleep again and woke only 35 minutes late! However, ground controllers, apparently seeing normal pulse of the pilot did not sound any alarms. (507) Yet, Korolev's associate, Boris Chertok, remembered a mounting nervousness at mission control and the chief-designer's swift readiness to blame military personell at ground control stations for "oversleeping" communication sessions. (27)

The Soviet sources also said that the temperature onboard the spacecraft varied from 10 to 25 degrees C during the mission. (505)

Return to Earth

On the morning of August 7, during the 17th orbit, the automated system oriented the spacecraft for the braking maneuver, which was initiated around 09:57 and lasted 40 seconds. Titov expected the separation between his reentry capsule and the instrument module some 10 seconds after the engine shutdown and he apparently heard the explosion of pyrotechnic devices cutting belts, which tied the ball-shaped capsule to the instrument module. Titov reported the normal separation to ground control, however seconds later he discovered that lights on the control console in the cabin, which were powered from the instrument module, remained on. Clearly, the separation did not happen. Titov was informed about the problems during Gagarin's reentry and could assume that a similar situation was developing during his mission. Fortunately, the tumbling, which followed the first Vostok's engine shutdown, did not take place. (509) Unknown to Titov, the separation between the capsule and the instrument compartment did take place, however a multi-cable umbilical line between two compartments apparently failed to cut off. This fact, likely explains why Titov heard the separation jolt, but did not see control lights go out. The electric current was still flowing to the control panel via umbilical cables. Ironically, decades later, this situation was mistakenly attributed to Gagarin's descent in countless documentaries, books and journalistic articles. In fact, a similar situation did happen in unmanned testing of the Vostok spacecraft.

The geography of the Vostok-2's reentry trajectory emulated that of Gagarin's, with braking maneuver near Africa, reentry over the Mediterranean Sea and the landing near Saratov. As Vostok-2 spacecraft entered the atmosphere, with its two main components still loosely connected by the umbilical cable, Titov left blinds of the cabin windows open "out of curiosity," as he later explained it. He saw ominous orange glow appear behind the glass and later pieces of melting antennas zoom by.

According to Titov, the separation between the reentry capsule and the instrument module finally took place around 10:07, followed by the chaotic tumbling of his cabin in various directions. Flames were now raging behind the window tearing pieces of thermal insulation off the spacecraft. A layer of sooth started slowly crawling across the window glass. As capsule approached maximum loads, Titov's vision became blurry and tears started flowing. Fortunately, after few dozen seconds the pressure subsided and he could breath again.

Following the reentry, Titov ejected from the spacecraft. A moment before the catapult rocketed him out of the cabin, Titov was distracted by a peeling piece of interior insulation, which was probably torn off after the jettisoning of the hatch. He slightly turned his head away from a prescribed ejection position and the following jolt of the ejection caused his nose to hit the helmet interior. As he soared away from his capsule on the ejection seat, several drops of blood from his injured nose fell onto the glass of the helmet. After several wild turns caused by the messy opening of the stabilization parachute, the seat started smooth descent toward cloudy mist below with only few breaks revealing the ground. The next jolt thrown Titov away from his seat and the main parachute opened next. This time his feet were hit, apparently by the separation of the emergency supply kit. (509)

Titov then pierced the clouds and finally saw the ground below -- fields, a railway with a moving freight train, a river, villages. His descent seemed smooth until, suddenly, a backup parachute came out and hanged below, repeating the situation in Gagarin's landing. To prevent tangling in the spare chute with his feet, Titov tried to hold it with his hand as far away as possible. As he descended to an altitude of one kilometer, the spare parachute started unfurling. In process, it started spiraling around the main parachute almost all the way to its canopy. All Titov's attempts to get the spare parachute out of the way failed, until the second canopy finally opened.

In the last hundreds of meters before the ground, Titov struggled to control the parachutes in the incoming wind, which rotated him wildly. He saw his cabin land not far from the railway line, quickly approached by a car and people. To his surprise, the wind carried him toward the railway line, as a Moscow-bound train was rumbling just below him.

In the last gust of wind, he hit the ground with his back, just few dozen meters from the railway into the field and just seconds after the train have passed by. His head hit the helmet again and he made a somersault on the plowed dirt, as pain was ringing in his ears. After being dragged for around 15 meters, Titov finally managed to detach parachutes. (509)

Agricultural workers arrived just in time and helped Titov to get out of the spacesuit. Titov then took a ride on one of two cars to his landing capsule some five kilometers away. Surrounded by cheerful crowds, Titov recovered his journal and film from the capsule and had some water.

According to the official statistics, Titov's landing took place at 10:11 near the village of Krasny Kut in Saratov Region. Vostok-2 mission lasted 25 hours 18 minutes. The spacecraft covered 703,143 kilometers. (505) As his backup Nikolaev asked Titov about the flight, Titov reportedly replied: "Andruykha, train your vestibular system!"

On Aug. 8, 1961, Titov reported his impressions about the flight to the State Commission overseeing the launch. As previously with Gagarin, numerous officials events and receptions had followed. Along with many awards and privileges for Titov and his family members, the Soviet of Ministers decreed to pay Titov 15,000 rubles from its reserve fund -- an unprecedented amount of money by Soviet standards. (465) On Sept. 11, 1961, Titov turned 26-years old.

Next chapter: *Vostok-3 and Vostok-4 dual mission*

APPENDIX

The Vostok-2 mission at a glance:

Titov on the TV screen in mission control during the flight of Vostok-2.

View of the Earth during the mission of the Vostok-2 spacecraft.

Titov shortly after landing on Aug. 7, 1961.

Titov, still in his flight suit, emerges from the aircraft shortly after his landing on Aug. 7, 1961.

Call sign:	Orel (Eagle)
Launch	1961 Aug. 6, 08:59:57
Landing	1961 Aug. 7, 10:11
Inclination (planned)	65 degrees
Perigee (planned)	180 kilometers
Flight duration	25 hours 18 minutes
Distance covered	703,143 kilometers
Number of orbits	18
Landing site	Krasny Kut, Saratov Region

Page author: Anatoly Zak; Last update: June 13, 2013

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