

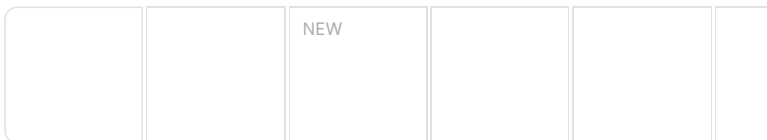
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USSR launches Sputnik-3

On May 15, 1958, the USSR launched the Third Artificial Satellite of the Earth. While two previous Soviet orbiters had been propelled into space primarily for political considerations, Sputnik-3, as it became known in the West, was designed to be a true scientific laboratory. According to original plans, it was supposed to be the first Soviet satellite, but, as it transpired decades later, it became the fourth, after its sibling crashed in a botched launch less than three weeks earlier.

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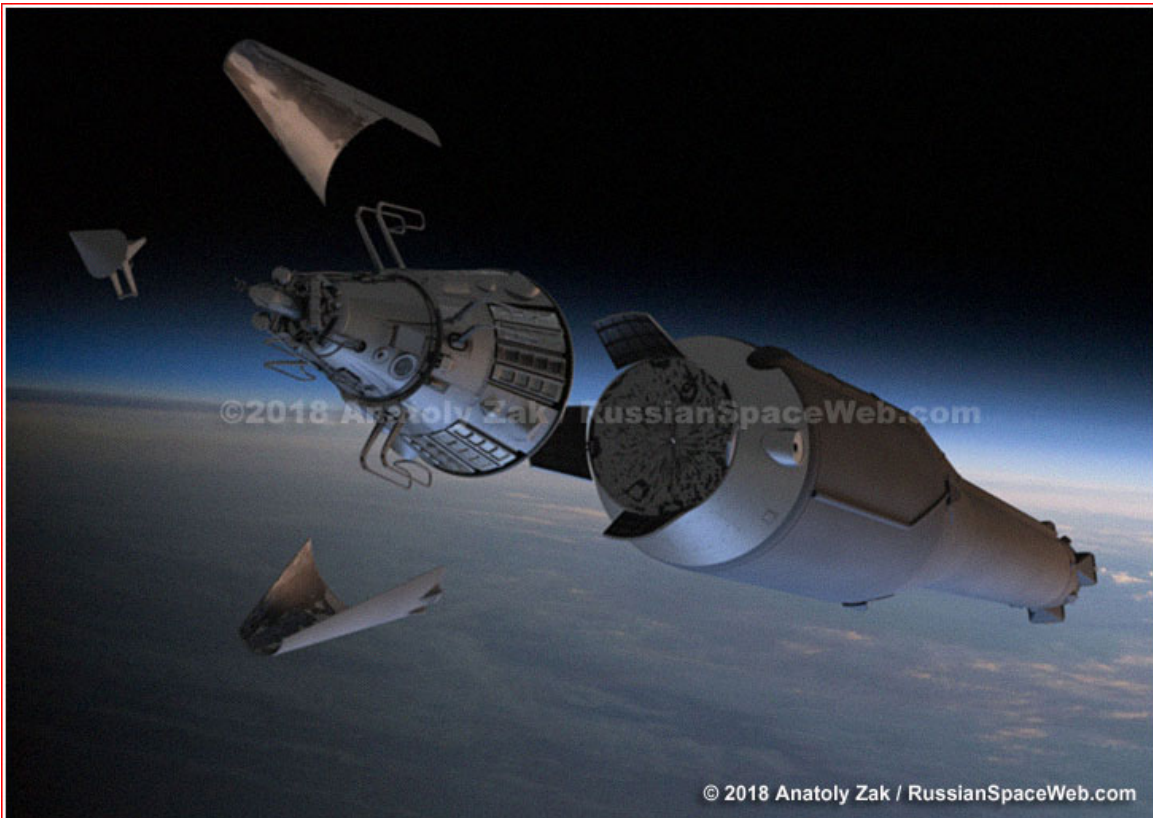
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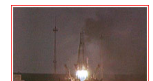
Mstislav Keldysh (left) and Sergei Korolev were key figures behind Object-D. While Korolev led the "rocket" part of the project, Keldysh mobilized the Soviet scientific community to provide instruments and experimental program of the satellite.



Ground processing hardware for Object D. Credit: KBOM



A pre-launch processing of Object-D. Credit: RKK Energia



Sputnik-3 mission at a glance:

Launch date and time	1958 May 15, 10:00:35.5 Moscow Time
Spacecraft designation	Third Soviet Artificial Satellite of the Earth (Sputnik No. 3)
Launch vehicle	8A91 (B1-1, Sputnik)
Launch site	Tyuratam (NIIP-5)

Payload mass	1,327 kilograms
Orbital parameters	Period: 105 minutes; 225 by 1,880 kilometers

Final design of Object-D

After a [controversial triumph](#) of Laika on the world's political stage, [Korolev](#) and his team turned their attention back to the long-delayed project of a [truly scientific satellite](#) code-named Object D (or Article D). At the time, OKB-1 design bureau was still primarily occupied with difficult tests of the [R-7 ballistic missile](#) and, particularly, with its troublesome warhead. Fortunately, a huge propaganda wins from the [first orbital launch](#) in 1957 had ensured the political support of the Kremlin for further space shots.

By the beginning of 1958, a modified R-7 rocket variant designated [8A91](#), as well as the two copies of the Object D were approaching completion. The actual spacecraft was modified in comparison to its [preliminary design](#) completed a year and a half earlier. The satellite gained an extra telemetry system, experimental sensors for solar orientation and a Mayak (Beacon) transmitter, which had been flight-proven in two previous orbital launches. However this time, it was to be powered primarily from solar panels, with a chemical battery serving as a backup power source.

Two additional instruments featuring their own memory storage were installed to register cosmic rays. In the meantime, deployable reflectors and angular velocity sensors were dropped from the scientific package.

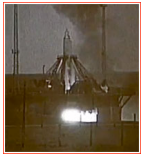
The payload fairing covering the front section of the satellite was redesigned to feature three spring-loaded components. They would be dropped immediately after the separation from the launch vehicle.

The chosen flight altitude would enable the satellite to make from 13.5 to 15 orbits a day, with six or seven data-transmission sessions planned during the first three days. [\(84\)](#)

A total of 12 scientific instruments would be carried aboard measuring the pressure and composition of the ionosphere, positive ion concentration, electrical charge, electric and magnetic field, solar radiation and meteorites.

On January 15, 1958, top rocket industry officials reported to the Kremlin that the launch of the Object D satellite was scheduled for April, following [three test flights](#) of the R-7 ballistic missile with a new warhead protection system at the end of January, February and March of the same year. The plan received the official blessing at the meeting of the Presidium of the Central Committee just two days later (on January 17). [\(509, 473\)](#)

Still in February 1958, OKB-1 decided to replace the RTS-8 telemetry transmission system aboard the satellite with the Tral telemetry system previously used on ballistic missiles. It included the TBZ memory storage, featuring a thin steel wire. [\(537\)](#) In the same month, five



The ill-fated launch of Object-D in April 1958. Credit: RKK Energia



Sputnik-3 enters orbit on May 15, 1958. Copyright © 2018 Anatoly Zak



Soviet poster commemorating the launch of Sputnik-3 on May 15, 1958.



A Soviet poster dedicated to the Third Artificial Satellite. Anatoly Zak's collection.

Kvarts computers for the calculation of the satellite's trajectory in real time went through factory testing and were ready for delivery to five [ground stations](#). The devices were to be tested for the first time during the [launch of the R-7 missile](#) on March 29. (644)

First time is not charm

Trains with [strap-on boosters](#) and the [core stage](#) of the 8A91 No. [B1-2 rocket](#) designated for the launch of Object D arrived at Tyuratam on April 5 and 10, respectively. (537) The launch was originally planned for April 20 to mark birthday of Vladimir Lenin, the founder of the USSR, but it was later postponed. (645)

By April 22, everything was finally ready for launch, including a draft of the official statement to be released to the world two or three hours after the satellite would successfully reach orbit.

The 8A91 rocket with the Object D No. 1 satellite lifted off from [Site 1](#) in [Tyuratam](#) on April 27, 1958, at 10:01 Moscow Time. (509) The vehicle was climbing normally for about a minute and a half, then it suddenly disintegrated into multiple flaming fragments and plunged to the ground.



At the calculation center of the NIIP-5 launch site in Tyuratam, radar data tracking was flowing into the Kvarts computer, which was plotting the trajectory of the flight. Engineers monitoring the machine saw the angles of the trajectory toward the horizon turning negative, followed by a "no data" signal. After deciphering the last data packet, engineers calculated that the rocket had flown for 227 kilometers. They reported this data to Moscow by telephone. A few minutes later, security officers burst into the room and confiscated all the recordings. Engineers did learn that the launch had failed and the vehicle exploded. (644)

Naturally, the accident would remain secret for decades, however ironically, on that very day, the

Pravda newspaper carried an article on the scientific results of the first and second satellites. (199)

The next day, Korolev and his team sent a classified telegram to Khrushchev reporting that the rocket had begun experiencing abnormal vibrations 90 seconds after the liftoff and then disintegrated 97 seconds into the flight. According to the telegram, the vehicle had crashed between 69 and 225 kilometers downrange from the launch site and search aircraft had located the impact site. The telegram also noted that a decision had already been made to proceed with preparations for the launch of the second Object D between May 15 and 18, while specialists were continuing their investigation into the cause of vibrations. (509)

At the time, specialists apparently concluded that the vibration phenomenon had been accidental and the preparations for the second launch attempt were allowed to proceed immediately. However it was decided to throttle down the rocket's engines just slightly, beginning at the 85th second of the flight, just before the fatal vibrations had started in the previous launch. (51)

The lack of adequate sensors aboard the rocket apparently prevented a true understanding of the resonance effects taking place during the emptying of propellant tanks at the end of the first stage burn. As a result, the vibration problem would crop up again during early lunar campaign, when the same type of vehicle would have to carry an additional third stage. (537)

After the loss of the first Object D, search teams discovered that the satellite had crashed separately from the rocket and had suffered relatively little damage. It was transported back to the assembly building at Site 2. However, when technicians removed the aft bulkhead, the spacecraft caught fire from a short circuit in its damaged wiring. As a result, three or four fire extinguishers were emptied into its interior. (248)

Despite this fiasco, Korolev remained upbeat and even told his engineers that they would be paid bonuses, as long as they agree to stay at the launch site for urgent processing of the second Object D and its rocket. (62)



Finally a success

An 8A91 rocket No. B1-1 carrying the second copy of Object D lifted off on the morning of May 15, 1958, 10:00:35.5 Moscow Time. This time, the ride to orbit went without a hitch. (473) A total of four objects were detected by Western radars after that launch: the satellite itself, the core stage of the R-7 rocket and the two halves of its payload fairing, while the front tip of the fairing was probably too small to be detected from the ground.

The personnel at Tyuratam received the news about the successful launch with a huge relief. Naturally, a big celebration with vodka followed. However, the first post-launch analysis quickly showed that the vibration problem that had doomed the previous launch attempt, had surfaced again, coming close to destroying the launcher. The chief of testing at OKB-1 Arkady Ostashev was ordered to explain the situation the very next morning to a State Commission chaired by the fearsome commander of Strategic Rocket Forces, Mitrofan Nedelin. By his own admission, Ostashev stumbled around delivering bad news to high-ranking officials, while being still heavy headed from the previous night of drinking. "Yeah, you are not Levitan," Nedelin noted light-heartedly, referring to a legendary Soviet radio presenter famous for his broadcasts during World War II.

In the meantime, the Soviet press exploded with triumphant reports about the latest space first. Four days after the launch, the *Izvestiya* daily published a line art revealing the overall design of the satellite and even illustrating its process of separation from the launch vehicle. Obviously, all

the details about the mysterious rocket which had delivered the latest satellite, remained secret.

On May 29, a press-release dedicated to the third sputnik revealed the general dimensions of the satellite and boasted that the spacecraft was 2.5 times heavier than the [second satellite](#) and 16 times heavier than the [first](#). (199)

As it transpired decades later, most systems on the third satellite functioned for more than two weeks, even though its data recorder had failed earlier. The onboard system for orbit tracking was misbehaving in the first days of the mission.

For a month and half following the launch, five Kverts computers at Tyuratam and other [ground stations](#) conducted several daily computations of the trajectory parameters of the third satellite and transmitted them to the calculation center of the Ministry of Defense in Moscow for processing. The resulting orbital parameters were then published in daily TASS reports. However the computer No. 5, installed at the ground station in the Kamchatka Peninsula, consistently produced errors and its data had to be discarded.

Due to lack of proper housing in [Tyuratam](#), the engineering team manning the Kverts computer was housed in dugouts at [Site 2](#), not far from the main calculation center. During the night, engineers had to keep a watch against scorpions, which became especially active in the spring. As June came, the temperatures at the launch site reached 42 degrees C. As a result, during each 10- or 12-minute period, when the Kverts computer had to operate, the temperature inside the building housing the bulky machine would climb to 50 degrees -- the highest acceptable limit. To avoid overheating, the computer would be booted up just before the satellite's pass. Still, one of the engineers had a heat stroke during his duty. After that incident, team members with the exception of their boss and a few military officers were allowed to work in their underwear! (644)

The Third Artificial Satellite remained in orbit for 692 days, about twice as long as predicted. It reentered the Earth's atmosphere on April 6, 1960, when the [Soviet manned space flight project](#) was well underway.

In August 1958, key personnel involved in the Object D project met at a ground control facility in Moscow to review the results of the mission. The head of the OKB-1 design bureau Sergei Korolev told the team that the launches of the first [probes to the Moon](#) and [manned missions](#) were in the works.

Failed launch of Object D No. 1 at a glance (51) :

Launch date	1958 April 27, 12:01 Moscow Time
Vehicle disintegration time	T+96.5 seconds
Spacecraft designation	Object D-1 No. 1
Launch vehicle	8A91 B1-2 (later known as Sputnik)

Sputnik-3 mission at a glance:

Launch date	1958 May 15, 10:00:35.5 Moscow Time
End of operation	1958 June 3
Reentry date	1960 April 6 (537)
Flight duration	692 days
Number of orbits	10,037 (2)
Spacecraft mass	1,327 kilograms (2)
Payload mass	968 kilograms (2)
Orbit	226 by 1,881 kilometer, inclination 65.2 degrees; orbital period 105.95 minutes (537)
Projected radio transmission period	40-45 days (509)

Sputnik-3 chronology:

1956 July: OKB-1 completes a preliminary design of Object D. ([84](#))

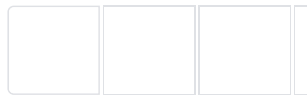
1958 April 5: Strap-on boosters for the [8A91 rocket](#) No. B1-2 (intended for the Object D mission) arrive to Tyuratam. ([537](#))

1958 April 10: A core stage for the [8A91 rocket](#) No. B1-2 (intended for the Object D mission) arrive to Tyuratam. ([537](#))

1958 April 27, 12:01 Moscow Time: The 8A91 B1-2 launch vehicle lifts off carrying the [Object D No. 1 satellite](#). The rocket disintegrates 96.5 seconds after liftoff and crashes 225-227 kilometers downrange.

1958 May 15, 10:00:35.5 Moscow Time: Launch of the 8A91 No. B1-1 rocket, carrying a second version of the [Object D satellite](#). After a successful orbital insertion, it was announced by the USSR as the Third Artificial Satellite and became known in the West as Sputnik-3. ([51](#))

Next chapter: [Russia's science satellites](#)



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