

# The soyuz 11 space disaster: a case study in engineering disasters

[Science](#), [Astrology](#)



## **ABSTRACT**

In 1971, Soyuz 11 was the first manned spaceship to contact the first space station. As the astronauts were preparing to re-enter the earth's atmosphere the crew cab depressurized and the astronauts were killed within seconds.

This paper will discuss the events that happened and how they were investigated. It will also discuss how the disaster affected future engineering decisions regarding the Soyuz missions as well as other future space adventures. i Table of Contents

## **Introduction**

The purpose of this paper is to provide background and information on the Soyuz 11 space disaster. This disaster occurred in 1971 and took the lives of three astronauts who took part in the first successful visit to the world's first space station. This paper will provide insight on how the disaster actually happened, what the causes were of this disastrous event. It will provide insight on how the events that occurred were investigated and also what was learned from these events and what changed. 2. 1 What Happened

Unless otherwise stated the information in this section is provided from About. com(n. d. ) 1 Salyut 1, a space station made by the Soviets was the first space station to ever be made. It was launched on April 19, 1971. It was a large cylinder with three compartments, could be used with or without people inside of it and it could only dock one spacecraft at a time. The primary use of this space station was to study the effects of long term space travel on a human body, as well as studying effects on growing plants.

On April 19, 1971 Soyuz 10 was the first spacecraft to attempt a mission out to the space station however this mission was unsuccessful. As the spacecraft attempted to dock it failed so the astronauts had to return to earth. On the return the ship's air supply turned toxic but only one man passed out, all three astronauts recovered fully. On June 6, 1971 Soyuz 11 embarked on a journey to the space station. This ship was originally supposed to be manned by Valery Kubasov, Alexei Leonov, and Pyotr Kolodin. Just before the launch, Valery Kubasov was suspected to have tuberculosis so this crew was replaced by three other men.

They were: Georgi Dobrovolski, Vladislav Volkov, and Viktor Patsayev. Soyuz 11 successfully reached the space station and managed to hand dock the ship once they were within 100 metres. Once docked, problems began to take over the mission. Instruments and telescopes were not working, cramped space made it hard to work, and personalities were clashing. A small fire had even broken out at one point. This is when the crew decided to cut the mission six days short and go home. Right after Soyuz 11 undocked and made its way back to earth, all communication with the crew was lost.

This happened much earlier than was to be expected. The ship made its way to earth and was discovered on June 29, 1971. When it was opened, all three members of the crew were found dead. The following images are from Space Facts (n. d.) Figure 2. 1: a) a view of Soyuz 11 docked b) a view of Soyuz 11 taking off (Space Facts, n. d.) a b Figure 2. 2: a) seating chart for the astronauts b) the three astronauts inside Soyuz 11 c) astronauts preparing for takeoff (Space Facts, n. d.) What Went Wrong Unless otherwise stated the

facts provided in this section come from Engineering Failures(n. . ) All the people on earth at the time thought this was a normal re-entry of a space craft. However upon opening the capsule the discovered differently. It was obvious to the people there that the crew had suffocated. Located between the orbital module and the descent module was a ventilation valve. As the two modules had been separated this valve was forced open. The two modules were connected via explosive bolts, these bolts were intended to fire sequentially or one after the other, but they actually fired simultaneously or at the same time.

Because of this there was extra force put onto internal parts of the space craft. The ventilation valve had been jerked open by all this extra force. This valve was intended to automatically adjust cabin pressure but because it was actually opened in outer space the cabin pressure of the space craft very quickly reached zero, a fatal pressure for the cabin to be at. This valve was located underneath of the astronauts chairs making it impossible for them solve the problem. One of the astronauts was wearing a suit with biomedical sensors that showed he died within 40 seconds of the pressure loss.

It only took 935 seconds for the cabin to reach a pressure of zero. The facts in the next paragraph are from abyss. uoregon. edu(n. d. ) What caused all this to go wrong was a poor design. It should have been placed in a more accessible place. When thoughts were going into its design it was thought that it would only need to be used in an emergency, however no one thought what would be happening that it would need to be closed. The valve was

intended for emergency but proved no use in the emergency because it was inaccessible.

This problem could have been solved if the design team performed more tests, however it is impossible for a design team of a safety device to know every single situation that could happen. The following is a quote from Geoff Perry, SeniorScienceMaster at Kettering Grammar School. 5 " I picked up my first signals for over 7 days on 28 June around 2110 UT - Salyut on 20. 008 MHz and assumed that recovery would take place on 29 June around 2000 UT. Consequently I set the alarm clock for 3. a. m. BST hoping to see two objects indicating that Soyuz-11 had separated from Salyut but that was not to be.

We had no signals during 29 June and when 2000 UT came and went I went off watch, but, fortunately, left the time switch to do the pass at 2230 and 0300 UT. I did not believe that the Russians would worry about a recovery in darkness at this time of the year, considering their usual precision landings. However, they did worry and Soyuz-11 went two extra revs to give a daylight recovery. The time switch recorded signals 45 s after it had operated with LOS at 2247: 15 +/- 15 s (allowing for possible variations in mains frequency affecting the clockwork).

Peter Bentley had banked on a daylight recovery and was listening at Menai Bridge and gives LOS at 2247: 27 +/- 1 s (or, as he says, +/- 5 s for 99% accuracy). I have therefore adopted 2247: 25 +/- 5 s as LOS and the time of separation of the descent module and instrument module. The tragedy must have occurred minutes, or even only seconds, later. Telemetry at LOS was

normal for a Soyuz recovery". (Svens Space Page, n. d. ) The following is a map taken from Svens Space Page (n. d. ) showing what information the Kettering group had received from Soyuz 11. Figure 3. : a) map of the landing route for Soyuz 11 (Svens Space Page, n. d. ) a 6 The following are images from after Soyuz 11 landed. Figure 3. 2: a) Soyuz 11 after landing b) workers covering up the astronauts a b Figure 3. 3: a) Funeral held for the three Soyuz 11 astronauts a 3. 2 What Was Learned 7 After this terrible and fatal accident much thought and consideration went into the next missions. First off the USSR never again attempted to send astronauts to the Salyut 1 space station. Eventually Salyut 1 was deorbited and burnt up. It took more than two years for another man mission to be attempted About. om(n. d. ) The Soyuz spacecraft went through a lot of modifications. The first main difference was that it was redesigned to only carry two astronauts instead of three. This allowed more room inside which allowed for the astronauts to wear space suits during the launch and the landing. The Soyuz capsule remained this way until a new design in 1980 which allowed three astronauts. 4. 0 Summary The Soyuz 11 space disaster was an extremely unfortunate event. Three astronauts died from a malfunction that should have been fixable. This is a