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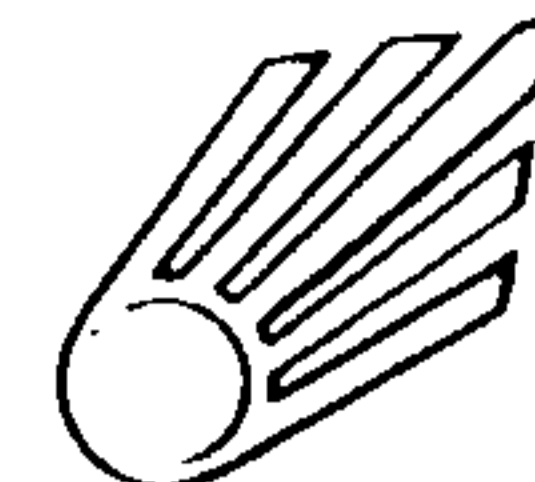
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Front Cover: In the early morning light the Soyuz TM-22 launch vehicle is rolled out to the launch pad at the Baikonur Cosmodrome on 1 September 1995 in preparation for the launch of the EuroMir 95 Mission.
E. RUDOLF van BEEST

Major Launch Failures

In the Early Soviet Space Programme

For the first approximately thirty years of the Soviet space programme, Soviet authorities rarely, if ever, announced orbital launch failures in any programme. This gave rise to much speculation among Western analysts in attempting to portray a realistic account of the early days of the Soviet space programme. Combining fairly unsubstantiated rumours with "leaked" accounts from the Western intelligence community, analysts were forced to rely on at best second-hand information. This major omission can be partially rectified at the present with the help of numerous detailed accounts of Soviet orbital launch failures, covering a wide time period, that have been recently published in the CIS media. This article is an early attempt to combine and integrate some of the recently released information and make a preliminary contribution to a very important aspect of the Soviet space programme.

The article is divided into eight parts, each section describing failures in a particular project.

Sputnik

While there were three successful Sputnik launches, it has been revealed that there was one concealed orbital failure in the programme:

Spacecraft	Launch Date	Launcher	Mission
Sputnik (Object D)	Apr 27 1958	Sputnik	science

According to a report, "resonant frequencies" destroyed the launch vehicle prior to separation of the strap-ons from the core stage [1]. The payload was originally meant to be the first Soviet artificial satellite, but was later replaced by the famous PS-1. The backup Object D was finally launched as Sputnik-3 in May, 1958.

Luna

The automated lunar programme suffered from numerous orbital launch failures in its entire history covering 1958 to 1976, as the following listing shows:

Spacecraft	Launch Date	Launcher	Mission
Luna (E-1 No. 1)	Sep 23 1958	Luna	lunar impact
Luna (E-1 No. 2)	Oct 12 1958	Luna	lunar impact
Luna (E-1 No. 3)	Dec 4 1958	Luna	lunar impact
Luna (E-1A No. 5)	Jul 18 1959	Luna	lunar impact
Luna (E-3 No. 1)	Apr 15 1960	Luna	far-side photo
Luna (E-3 No. 2)	Apr 16 1960	Luna	far-side photo
Luna (E-6 No. 2)	Feb 3 1963	Molniya	soft-landing
Luna (E-6 No. 4)	Mar 21 1964	Molniya	soft-landing
Luna (E-6 No. 5)	Apr 20 1964	Molniya	soft-landing
Luna (E-6 No. 8)	Apr 10 1965	Molniya	soft-landing
Luna (E-6LS No. 112)	Feb 7 1968	Molniya	lunar orbit
Luna (E-8 No. 201)	Feb 19 1969	Proton-K	lunar rover
Luna (E-8-5 No. 402)	Jun 14 1969	Proton-K	sample return
Luna (E-8-5 No. 405)	Feb 6 1970	Proton-K	sample return
Luna (E-8-5M No. 412)	Oct 16 1975	Proton-K	sample return

Details have been released on the nature of some of the failures:

Sep 23 1958:

This vehicle fell apart at T+92 seconds and then impacted on to the ground [2].

Oct 12 1958:

This vehicle exploded after T+100 seconds. The failure of both launches was traced to resonant oscillations that had arisen as a result of adding the Block E stage on the basic R-7 missile. A solution was then proposed to mount damping devices to eliminate unbalanced loads on the vehicle [2].

Dec 4 1958:

There was a failure in the rocket engine of the Block A at T+245 seconds, aborting the mission [2].

Jul 18 1959:

This time a failure of a navigation instrument in the core stage prompted an accidental command to the emergency self-destruct mechanism [2].

Apr 15 1960:

This vehicle's failure was traced to a premature cutoff of the engine of the Block E stage [3].

BY ASIF A. SIDDIQI*

Amherst, MA, USA

Apr 16 1960:

At launch, only three of the four strap-on boosters ignited, and the vehicle deviated from its trajectory soon after launch. All control over the launcher was lost at an altitude of about 150-200 m, and all five boosters inadvertently separated from each other. The first and second strap-ons landed near the launch pad, the third landed only 30-40 m from an observation site, while the fourth also created an explosion at its impact. The core stage meanwhile landed near the Assembly-Test Building causing some minor damage. Finally the Block E stage flew about a kilometer from the launch pad exploding in a salt lake [3].

Apr 10 1965:

This launch is said to have been thwarted by a failure in the Block I stage of the Molniya booster.

Feb 19 1969:

The Proton-K/Block-D booster carrying the first Lunokhod rover was exploded on ground command following a spurious breaking away of the payload shroud; the wreckage landed some 15 km from the launch site [4]. This spacecraft was the first attempted launch of a Luna probe on the Proton-K booster.

Jun 14 1969:

The first three stages of the Proton-K/Block-D booster operated nominally, but the Block-D stage failed to fire, causing the payload to land in the Pacific Ocean [4]. This was the first of two lunar sample return missions attempted by the Soviets in 1969. Both were meant to steal some thunder from the impending Apollo-11 flight. The second sample collector was Luna-15 which crashed on the surface of the Moon in July 1969.

Korabl Sputnik

In the precursor series for the piloted Vostok programme, there were at least two complete orbital launch failures, both carrying dogs:

Spacecraft	Launch Date	Launcher	Mission
Korabl Sputnik (1K n1)	Jul 28 1960	Vostok	precursor
Korabl Sputnik (1K n4)	Dec 22 1960	Vostok	precursor

Details of the failures are given below:

Jul 28 1960:

The strap-on boosters broke away from the core of the Vostok booster just 19 seconds following launch, and there followed a powerful explosion that killed its canine passengers Chaika and Lisichka [5].

Dec 22 1960:

This time there was a premature shutdown of the engine of the Block E third stage [5]. The payload carrying the two dogs Zhemchuzhnaya and Zhulka reached an altitude of 214 km and flew 3,500 km downrange before landing safely by parachute near the impact area of the famous Tunguska meteorite. Both passengers were successfully recovered unharmed.

*The author wishes to thank J. McDowell for information on the Luna programme.

Mars

In the Mars programme, the record shows four complete orbital launch failures that occurred in pairs eight years apart:

Spacecraft	Launch Date	Launcher	Mission
Mars (M1 No. 1)	Oct 10 1960	Molniya	Mars landing
Mars (M1 No. 2)	Oct 14 1960	Molniya	Mars landing
Mars (M-69 No. 1)	Mar 27 1969	Proton-K	Mars orbit
Mars (M-69 No. 2)	Apr 2 1969	Proton-K	Mars orbit

Details of the failures are given below:

Oct 10 1960:

The engine control system failed during firing of the core stage of the booster (what the Soviets called the 2nd stage) due to resonant oscillations of the Block I stage. The booster exploded at approximately T+200 seconds [6].

Oct 14 1960:

This failure was traced to frozen kerosene in the inlet leading to the pumps of the Block I (3rd) stage as a result of a liquid oxygen leak. Subsequently a valve failed, and the payload re-entered the Earth's atmosphere without entering orbit [6].

Mar 27 1969:

One of a series of Proton-related failures that occurred in 1969, the vehicle exploded at T+438 seconds into the launch, due to a fire in the turbine of the engines of the third stage of the Proton-K/Block D [7,9].

Apr 2 1969:

The second and last attempt at a Mars launch in 1969 also failed, although this time the failure was at a much earlier point in the mission. At the instant of launch at T+0.02 seconds, a fire began in one of the first stage engines of the Proton-K/Block D [7]. After rising a short distance, the rocket veered towards the ground and crashed close to the launch site [9].

Early Zond

There were at least two orbital launch failures in the early Zond lunar and interplanetary programme:

Spacecraft	Launch Date	Launcher	Mission
Zond (3MV-1A No. 2)	Feb 19 1964	Molniya-M	Venus flyby
Zond (3MV-1 No. 3)	Mar 1 1964	Molniya-M	Venus flyby

Although details are not known on the nature of the failures, the mission goals are given below:

Feb 19 1964:

This was a Venera craft meant for a Venus flyby [8].

Mar 1 1964:

This was a Venera craft meant for a Venus flyby [8].

Venera

Only one launch failure is known to have occurred in the Venera programme:

Spacecraft	Launch Date	Launcher	Mission
Venera (3MV-2 No. 2)	Nov 26 1965	Molniya-M	Venus flyby

The spacecraft was part of a group of four attempted missions in November 1965 which were meant to reach the planet. Of the four, only two managed to reach the vicinity of Venus, Venera-2 and Venera-3 [8].

Proton

Only one launch failure has been identified in this scientific programme:

Spacecraft	Launch Date	Launcher	Mission
Proton (N-4)	Mar 24 1966	Proton	science

No details are available on the failure, although the attempt has been reported in CIS sources [10].

Zond

There were several failures in the piloted circumlunar programme otherwise known as the UR-500K/L-1 project. It was in fact the spate of failures that seriously delayed the project, and eventually resulted in its cancellation.

Spacecraft	Launch Date	Launcher	Mission
Zond (7K-L1) No. 4	Sep 28 1967	Proton-K	circumlunar
Zond (7K-L1) No. 5	Nov 22 1967	Proton-K	circumlunar
Zond (7K-L1) No. 7	Apr 23 1968	Proton-K	circumlunar
Zond (7K-L1) No. 13	Jan 20 1969	Proton-K	circumlunar

Details of the failures are discussed below:

Sep 28 1967:

The Proton-K/Block D booster was evidently launched with only five of its six first stage engines operating. The launch vehicle remained steady until T+61 seconds, when it finally began deviating from a nominal flight path. The emergency rescue system of the L-1 spacecraft was activated and the booster exploded on command. The remains of the Proton-K impacted about 65 km from the launch site, while the L-1 descent apparatus was safely recovered [11].

Nov 22 1967:

On this occasion, the launch went perfectly, but upon firing of the second stage, only three of the four engines came into operation. For four seconds, the vehicle remained steady, but all engines were then disabled by a safety system. The L-1 emergency rescue system deposited the spacecraft 80 km southwest of Dzhezkazgan, while the booster impacted approximately 300 km from the launch site [11].

Apr 23 1968:

At T+260 seconds into the launch, there was a sudden and unexpected shutdown of the engines of the second stage of the booster. It was later discovered that a short circuit in the control system of the 7K-L1 spacecraft inadvertently resulted in a spurious command to shut off the second stage engines. The spacecraft was however safely recovered [12].

Jan 20 1969:

A failure in one of the four second stage engines prompted the booster control system to abort the mission. At T+501 seconds, the launcher began to deviate from its planned trajectory, and the emergency rescue system was activated. The 7K-L1 spacecraft was recovered successfully. It was discovered later that orbital insertion could have occurred despite the engine failure, but the activation of the safety abort system precluded continued firing of the third stage to compensate for the premature shutdown of the 2nd stage [4].

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