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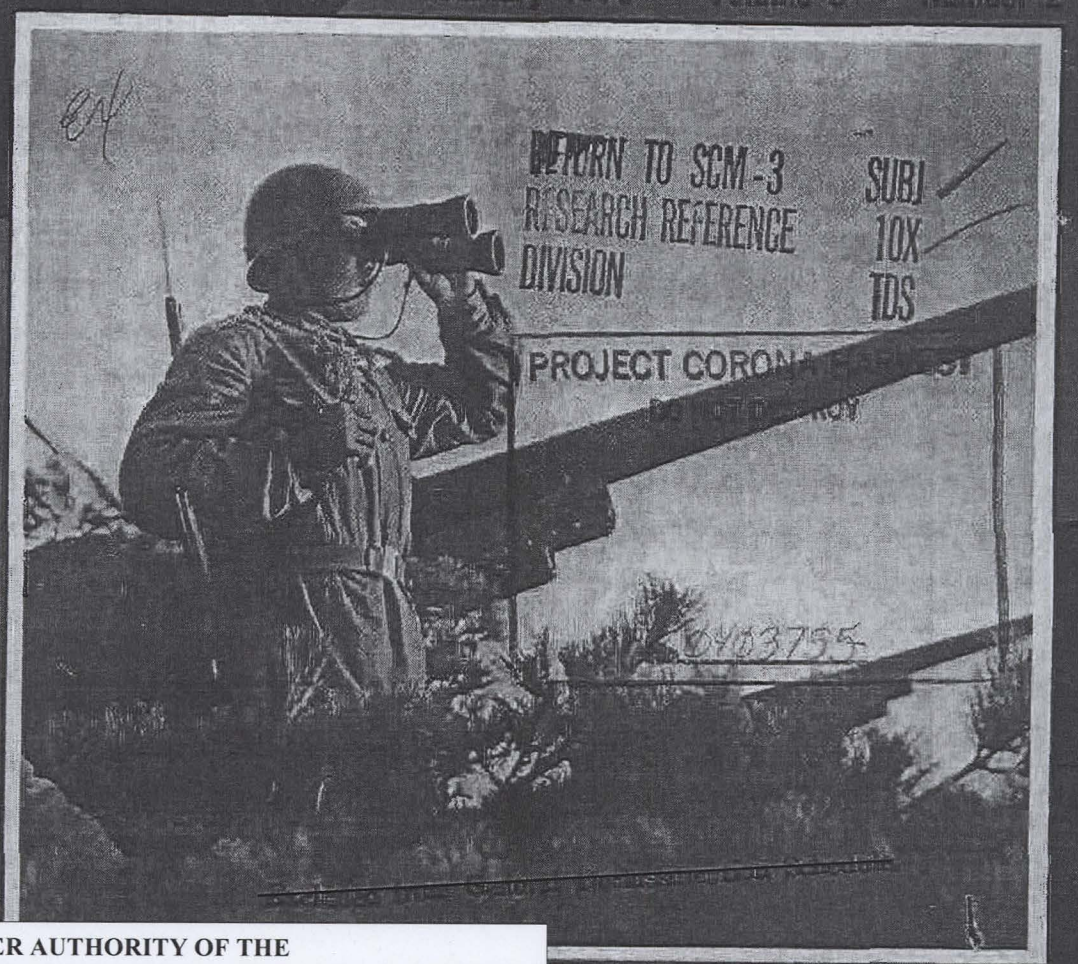

DEFENSE INTELLIGENCE AGENCY

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Coastlines of North Korea are under constant and responsive protection. For details see article beginning on page 12. [U]

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FOREWORD

MISSION: The mission of the monthly *Defense Intelligence Digest* is to provide all components of the Department of Defense and other United States agencies with timely intelligence of wide professional interest on significant developments and trends in the military capabilities and vulnerabilities of foreign nations. Emphasis is placed primarily on nations and forces within the Communist World.

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Lieutenant General, USA
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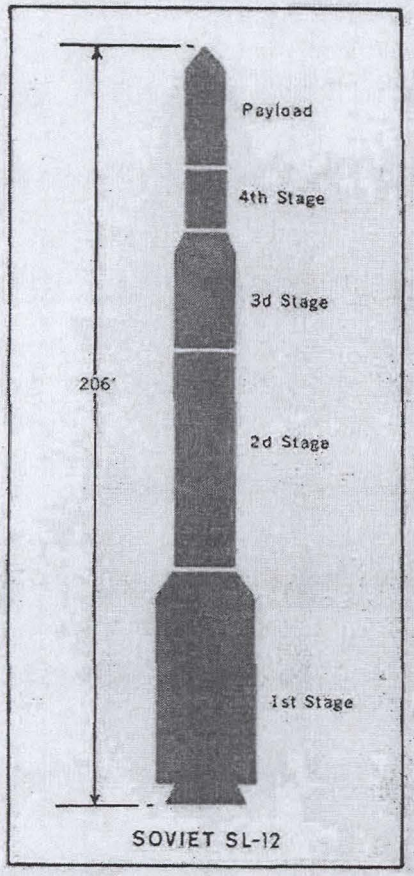

SOVIET SL-12

Malfunction in three of four stages, including 11 failures in 17 launches, have resulted in delays in lunar and interplanetary programs

SL-12 SPACE LAUNCH SYSTEM

The Soviets designed and developed the SL–12 to be the *workhorse* launcher for lunar and interplanetary missions. It is the largest space launch booster employed by the Soviets in the last three years. The SL–12's capability and low acceleration levels are consistent with manned applications. But the flight record of this system discloses a success rate which, in fact, is not suitable for manned flight.

A review of the SL–12 flight test program and the vehicle's performance characteristics provide the basis for judgments as to what the Soviets may attempt next in their lunar exploration/manned space station programs.

A four-stage vehicle, the SL–12 has a lift-off weight of about 1.6 million pounds and has demonstrated the capability of placing approximately 50,000 pounds in a low, earth orbit. This enables the Soviets to place 10,000 to 15,000 pounds of payload into a lunar trajectory. From a weight standpoint, the capability of the SL–12 is considered adequate for either a manned circumlunar mission or a medium-size, manned, earth-orbital scientific laboratory.

The lift-off thrust of the SL–12 is more than two million pounds, and all four powered stages are employed to attain earth orbit. The fourth-stage engine has demonstrated a restart capability in orbit, a necessary requirement for a lunar mission profile. Conventional cryogenic propellants, such as liquid oxygen, and an amine-based fuel, such as a mixture of hydrazine and unsymmetrical dimethylhydrazine (UDMH), are probably used in all four stages.

Six successful

Of the 17 SL–12 launches to date, only 6 can be assessed as completely successful (see chart). Nine launches were attempted in 1969; only two, Luna 15 and Zond 7, were successful. The initial launch of the SL–12 from Tyuratam, 10 March 1967, was designated Cosmos 146; the second launch, 8 April 1967, was designated Cosmos 154. The first three stages apparently functioned as programed; however, difficulties were encountered in the fourth stage ignition sequence. The Soviets apparently intended to restart the fourth-stage engine of Cosmos 146 and 154 after 24 hours in orbit, probably to boost the payload into a high orbit or to simulate injection into a lunar trajectory. In the case of Cosmos 146, re-ignition was accomplished on orbit 17, and the propulsion system apparently operated successfully for at least 140 seconds. However, orientation/attitude control problems possibly developed, causing the stage to re-enter the earth's atmosphere. After Cosmos 154 achieved orbit, it probably developed attitude control problems. The fourth stage failed to ignite [redacted] This mission was assessed as a failure.

The SL–12 appeared next on 28 November 1967, [redacted] mission. The apparent mission of this flight was to inject a payload into a lunar trajectory, pass around the moon, and return to earth for recovery.

25X1 and 3, E.O.13526

The next SL–12 flight occurred with the launch of Zond 4 on 2 March 1968. The fourth stage re-ignited successfully. It pushed the payload into a highly eccentric orbit with a seven-day period, thereby simulating a circumlunar flight profile. Zond 4 appeared to be fully successful from a launch vehicle standpoint—all stages performed satisfactorily.

The Soviets apparently believed that the test objectives had been met by the Zond 4 operation, and, on 22 April 1968 a second circumlunar probe was launched. [redacted]

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First splashdown

Zond 5, which was an unmanned circumlunar spacecraft, was launched successfully by an SL–12 on 14 September 1968. The vehicle was initially placed in a 52-degree parking orbit. It was injected into a translunar trajectory while over the South

Atlantic. On 18 September the spacecraft's closest approach to the moon was about 1,050 nautical miles, after which it swept past the moon and around its far side. On 21 September the capsule re-entered the earth's atmosphere ballistically, splashed down, and subsequently was recovered in the Indian Ocean. This was the first time a Soviet spacecraft was known to have been recovered from water.

On 10 November 1968 the Soviets launched an unmanned probe, Zond 6, which essentially duplicated the flight profile and mission of Zond 5 except for the final re-entry phase. Zond 6 had an aerodynamic shape which provided the lift for a landing within the Soviet Union.

On 16 November 1968 a three-stage configuration of the SL-12 was used to launch the 37,000-pound Proton 4 into a near-earth orbit. All three stages apparently performed as planned.

On 20 January 1969 an SL-12 was launched but its payload failed to achieve earth orbit [redacted] This was the SL-12 program's third failure caused by a second-stage malfunction.

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Mars failure

A Mars probe launched on 27 March 1969 from Tyuratam failed to achieve initial parking orbit. This was the first planetary launch attempted with the SL-12 launch system. All previous planetary probes had been launched by the SL-6. A second Mars probe attempt may have occurred on 2 April 1969. But propulsion failure apparently occurred during first stage thrusting, and the vehicle failed to achieve orbit.

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The failure-plagued SL-12 system was used again on 14 June 1969 and its payload failed to achieve parking orbit. [redacted] The timing of the launch and the deployment pattern of the support ships indicate that this was a lunar-related mission.

A month later, on 13 July 1969, Luna 15 was launched. All four stages performed successfully, and the spacecraft was injected into a translunar trajectory. On 17 July 1969 it went into orbit around the moon. Luna 15 apparently did not survive an intended soft landing on the moon's surface.

SL-12 LAUNCHES

Date	Soviet Designator	Mission	Assessment of SL-12 Performance
10 Mar 67	Cosmos 146	System Development	Success or Partial Success.
8 Apr 67	Cosmos 154	System Development	Failure (4th Stage)
22 Nov 67	—	Circumlunar Attempt	Failure (2nd Stage)
2 Mar 68	Zond 4	Circumlunar Simulation.	Success
22 Apr 68	—	Circumlunar Attempt	Failure (2nd Stage)
14 Sep 68	Zond 5	Circumlunar	Success
10 Nov 68	Zond 6	Circumlunar	Success
16 Nov 68	Proton 4*	Cosmic Ray Research	Success
20 Jan 69	—	Circumlunar Attempt	Failure (2nd Stage)
27 Mar 69	—	Mars Attempt	Failure (possible 4th Stage).
2 Apr 69	—	Mars Attempt	Failure (possible 1st Stage).
14 Jun 69	—	Nonrecoverable Lunar Probe.	Failure (4th Stage)
13 Jul 69	Luna 15	Nonrecoverable Lunar Probe.	Success
6 Aug 69	Zond 7	Circumlunar	Success
23 Sep 69	Cosmos 300	Nonrecoverable Lunar Probe.	Failure (4th Stage)
22 Oct 69	Cosmos 305	Nonrecoverable Lunar Probe.	Failure (possible 4th Stage).
28 Nov 69	—	Unknown	Failure

*This was a three-stage configuration of the SL-12 which placed the 37,000-lb Proton 4 in a near-earth orbit. At lift-off, the SL-12 is assessed as developing 2,100,000 pounds of thrust at sea level.

The objective of the mission was not announced by the Soviets; however, the vehicle executed several orbital maneuvers while in lunar orbit prior to the landing attempt.

On 6 August 1969 the Zond circumlunar series was continued with the launch of Zond 7. All four stages of the SL-12 apparently functioned flawlessly. The spacecraft essentially duplicated the Zond 6 flight; re-entry into the earth's atmosphere and recovery in the Soviet Union occurred on 14 August 1969. Zond 7, like Zonds 4, 5 and 6, is believed to have been a precursor of a manned circumlunar mission; its operation simulated a manned launch and included voice, video, and biomedical transmissions from the probe.

On 23 September and 22 October 1969, the SL-12 booster program suffered other major setbacks when probable lunar probes—with missions similar to that of Luna 15—[redacted] The probes were designated Cosmos 300 and Cosmos 305 by the Soviets. On 28 November the Soviets launched another SL-12 spacecraft from Tyuratam. Again the mission, probably an engineering test, ended in failure.

As indicated in the chart above the SL-12 has a history of frequent failures. Man-rating the vehicle would almost certainly involve additional flights. The SL-12 payload capabilities are estimated to be comparable to those of the US Saturn 1. The Saturn 1, however, has been successful in all 15 of its launches.

The hardware and launch costs for each SL-12 booster, not including the payload, are estimated at $45 million. In addition, the overall development costs for the SL-12 program would appear to be about $2 billion. The poor record of the costly SL-12 is certain to have caused considerable disappointment within the Soviet hierarchy, and to have raised controversy over the allocation of resources to a program which is tinged with failure. [END]

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