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Chapter 29

The Race to the Moon: A Look Back From Baikonour*

Oleg A. Sokolov†

I would like to reminisce about those events that will remain in human history that got the name "Race to the Moon." I would like to hope that the point of view of the average participant would be of interest because most of the existing information comes from the memories of the managers.

In 1968, after graduating from MAI, I was assigned to the Tourajevo Machine-building Design Bureau (TMKB) "Soyuz." At that time TMKB "Soyuz" had a monopoly on liquid bipropellant thrusters manufactured in the Soviet Union. These thrusters were mounted on a majority of all modern Soviet automatic and manned spacecraft. I was lucky to have a job in the flight test department of TMKB, because that gave me the possibility to take part in a wide range of Soviet lunar programs.

All the work connected with lunar missions was channeled in three directions. The first was to carry out the N1-L3 program, the ultimate aim of which was a manned landing on the Moon. This program included work conducted with the launch vehicle N1, the lunar orbital spacecraft (LOK—"lyunny orbitalny korabl"), and the lunar module (LK—"lyunnaia Kabina"). The rig trials of all systems for that complex had been completed by 1968, and the test flight preparations were going at full speed at the specially constructed sites and buildings of the Baikonur cosmodrome.

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The second direction involved the L1 program. It focused on a manned fly-by of the Moon utilizing an elliptical geocentric orbit. The two-seater L1 was a lightened and modified spacecraft of the "Soyuz" type. It was injected into the flight trajectory to the Moon by the modern (at that time) Proton launch vehicle. The test flights of the whole Proton-L1 complex also began at that time, but there were significant malfunctions in the process: upper stage engine failure, and the unsuccessful reentry of the unmanned L1 spacecraft recovery capsule (this spacecraft had been given the name "Zond" by TASS). The new test flights were being prepared first as unmanned missions (2-3 flights), and then as manned ones.

And last, the third direction centered on the Moon-rover ("Lunokhod"). In the middle of 1968 Lunokhod was undergoing ground tests at the specially constructed facility near the Simpheropol "lunodrome" in the Crimean, and its landing stage (a specially developed automatic lunar landing module in fact) was being prepared for the firing stand tests.

At the end of 1968, I took part in the firing stand test of the E8 Lunokhod landing stage module. The tests turned out successfully: from the five complex tests simulating engine and thruster function during the mission cyclogram there was only one test which was not completely successful (the unexpected shut-off of the engine during spacecraft braking). At the adjacent firing stands the work which was connected with the "race to the Moon" was performed, while at the giant stand designed for 1,000-ton thrust engines (to the left of our stand) recovery work was going on with the firing tests of the N1 launcher second stage. To the right of our stand we heard the distinctive roar and claps caused by the operation of the oxygen/hydrogen engine which was intended for the replacement of the N1 third stage oxygen/kerosene engines. The L3 lunar module engine units waited for their turn at the preparation shop of our stand.

Right after the end of our stand tests the first flight Lunokhod sample, together with the landing module, the upper stage, and the faring, was sent to the cosmodrome (the Proton launch vehicle was delivered separately). This happened in early 1969. At the cosmodrome I joined my flight test department colleagues who had already been carrying out the preparation of the N1-L3S first launch complex. The unmanned orbital spacecraft of the N1-L3S complex should have performed injection into a near-lunar orbit with a succeeding reentry. I therefore concentrated on the Lunokhod launch preparation.

At last all the testing and preparation operations had been completed. The main unit enclosed by the faring was rolled out to the fueling station and fueled with the propellant and pressurized gases. A diesel locomotive slowly rolled out a flat car with the unit on it to the site of the launch. A dazzling white Proton launcher with our main unit was already standing on the launch pad. Some tens of kilometers away were two other giant launch sites, one of which housed the N1-L3S complex, no. 3L. A "duplicate" shot to the Moon was prepared.

We were the first to fire. On February 19, 1969 the launch of the Proton-E8 space complex was performed. We could see the launcher ascend, leaving behind a white inversion track in a bright blue sky. But suddenly... I have seen this type of thing many times, including the recording of the *Challenger* accident, but always at the first instant when a flaming, smoky ball is swelling in the sky the brain of the specialist cannot absorb this fact; instead, one asks "why" and "what next," which the subconscious mind displays, as on an emergency panel, the only possible conclusion: "It is the end." A beautiful red and black flower was by now blossoming in the sky. Falling debris, leaving black and white tracks, moved away from it. The largest piece of debris was the ill-fated Lunokhod. A portable tape-recorder was installed on this Lunokhod, and after landing on the Moon it was to perform the Soviet national anthem. After the accident, members of the launch crew were made fun of, being asked "Do you know why somebody performed our national anthem in a steppe near your site on February 19?".

I took part in the emergency committee work. We collected all the debris immediately after the accident, and different explanations for the cause of the failure were offered. But in two days time we got a break, because on February 21 the N1-L3S space complex was launched. From a distance of 30 kilometers we saw how easily the 105-meter high rocket took off from the launch pad and arched toward the horizon. We were just on our way to our car to go to the Ground Measurement Point (NIP) when an enormous torch blazed near the horizon.

The emergency failure committees came to the conclusion that the E8 failure had occurred because of a faring break in the aerodynamic load, and the N1 failure occurred because of some first stage engine malfunction (30 engines of 150 tons thrust each were installed on this stage) and it caused the shut down of the whole engine unit through the engine operation control system (KORD—"Kontrol raboty dvigateley").

We were reminded that the Americans were planning their manned lunar landing for the Summer of 1969. The situation reminded me of the time (in a reverse fashion) when after the flight of Gagarin the Americans were trying to shorten the gap with the Glenn flight: yes, we are not the first, and yes, we are late, but only by some months, not by years! The second N1-L3S complex, no. 5L, was already at the cosmodrome. Practically without any break I joined its preparation. We were soon preparing the second N1-L3S launch. We went along, assembling, having test malfunctions, and testing again.

At this time a new E8 complex arrived. It was not a new Lunokhod, however. It was an E8-5 complex, a robot for extracting lunar soil samples and delivering them to Earth. This complex forestalled the second N1-L3S launch. And failure occurred again. Because of a mistake with the electric joints layout, the upper stage could not fire. The complex fell into the Pacific Ocean. All that time we had a grey-white nose cone on the N1-L3S towering above on one of our two launch pads.

On June 4, 1969 the rocket of approximately 3,000 tons mass took off from the launch pad and reached a height of about 100 meters. Suddenly, it began to descend slowly. Even those who were observing the launch from a distance of 30 kilometers fell down in an attempt to shelter themselves from the consequences. An explosion took place, and a fire column so bright that it was impossible to look at sprang up at the space complex that had taken so much effort, time, and hope to construct. Later, a shock wave passed, bending grass bushes and dropping dead birds on the ground. But besides this wave, another wave was rolling on us—the wave of despair. Another failure had occurred, and this one had destroyed a launch pad and damaged the launcher assembly building. The total explosive power equaled ten kilotons by our calculations.

The second pad was not ready for launch yet. Moreover, we did not have ready-for-start rockets. At the same time Apollo 11 was being prepared at Cape Canaveral. How could we respond to it? Only one E8-5 complex was left in reserve. The preparation took on an accelerated schedule. We launched, and everything went smoothly. The robot-driller reached the Moon almost simultaneously with Apollo 11. Luna 15 (the official designation of this spacecraft) was approaching the landing site when Armstrong and Aldrin had already been on the Moon, but the gap was only a few hours! But during the landing the trajectory turned out to be sloppier than the calculated one, and soon the spacecraft was swinging. The radio-altimeter defined both the vertical distance from the Moon surface and the slope one, thus the brake engine was not started up in time. The result was a "hard" landing. The "race to the Moon" was over.

However, we had some hope for a consolation round. The next E8-5 mission was prepared, and the launch was performed in October 1969. During the launch I was at the ground measurement (tracking point) (NIP) near the city of Simpheropol, Crimea. We were tracking the operations in the real-time mode. The launch was successful, and the spacecraft was injected into near-Earth orbit. When an hour had passed, the upper stage was fired to transfer the trajectory to the Moon. Then the reading of the pitching turn went beyond the scale limits and communication with the object was interrupted. What happened? During the next two hours we tried to regain communication. Then we received a report from the NIP located in Kamchatka: the object had fallen down into the ocean near Australia. Failure again! This launch was officially announced as the Kosmos-300 satellite launch, and in honor of such a round figure some artel (an association for common work) issued commemorative badges. Those badges were presented to the members of our staff, whose reactions were in correspondence to their sense of humor.

The L1 program in 1969 took over another unmanned mission, which was considered successful. The next mission was supposed to be manned, and a flight crew consisting of A. Leonov and O. Makarov was even nominated, but everyone felt that the interest of the authorities in this program was fading. In fact, this program finally ceased to exist in 1970.

In 1970 the main efforts were concentrated on the E8 program. After a number of failures, on September 12, 1970 the "Luna-16 automatic station" performed a soft landing on the Moon and automatically extracted lunar soil samples which after several days were delivered to the Earth. At that time I was at the Flight Control Center near Moscow. I remember very well how attentively we listened to the telemetry information reports when the tubular drill was digging into lunar soil, hearing that the resistance was increasing with the depth, and then getting a sudden report that the soil resistance sharply decreased. Somebody exclaimed: "Maybe we have drilled our own leg?" A man who was better acquainted with the spacecraft design muttered thoughtfully: "Not our leg, but maybe ejected tanks." However, this fear was groundless, and in a short time the lunar soil was being investigated on the Earth. Soon after this event, it was the turn of the Lunokhod. On November 17, 1970 "Lunokhod-1" slid from the landing module of the "Luna-17 automatic station."

However, from the "state prestige" point of view all that was like mustard after eating. Only the success of the N1-L3 program could save face. Two other launches were performed, but both were unsuccessful. V. P. Mishin, who headed the program after Korolev's death, was replaced by V. P. Glushko, who immediately ordered a stop to the program. All the hardware was turned into scrap metal. Now there are only a few museum exhibits left to remind us of the N1-L3 program's existence.

A quarter of a century has passed. Nowadays, when waves of "razryadka," "perestroika," and "glasnost" have washed off the cover of secrecy, many things have become known. However, I have no answer to the question which I asked myself in past times: How did it happen that two countries spent the enormous amounts of money and effort on parallel science programs? Only by having a basis for the analysis of the history of modern rocketry is it possible to put together (in a very simplified form) a logical sequence of events.

After centuries of fantasies about flights to the Moon, at the beginning of our century real theoretical works on rocket flight appeared. During World War I rocketry techniques did not witness any real development, in contrast to the significant progress made in aviation. However, in the 1920s and 1930s different people in different countries (having little or no support from their governments, military departments, or scientific organizations) began to design rocket engines and rockets which looked like toys. By the beginning of World War II large-scale work had been performed only in Nazi Germany and in the Soviet Union. This work did not bear any relation to the investigation of space; it was aimed at a purely military application of rocketry techniques. What had happened? The most far-seeing and talented "rocketeers" understood that a lot of money was necessary for a full-scale and rapid development of their projects, and nobody would give that kind of money for abstract space tasks. The only field where there was a chance to create large rockets (the prototypes of future launch vehicles) was unfortunately the military one. It was not accidental that Germany and the Soviet Union, the most militarized countries, sponsored rocket development at that time. The results of the V-2 (A-4) ballistic missile, which were not very significant from a military point of view but were stunning from the technical perspective, gave a powerful impulse for post-war rocket development.

Stalin was the first to realize its importance. He could very well imagine a picture of a future war when his enemies would try to destroy all the military and industrial power of the Soviet Union from the air without any danger of a reverse strike. However, a similar situation had existed in Germany at the end of World War II, and Stalin followed the German way. One of the heads of the rocket program was S. P. Korolev—a man who did not forget his "space dreams." He understood that a launch vehicle could be developed only in the form of a ballistic missile, and even more precisely, in the form of an intercontinental ballistic missile which possessed sufficient power. Thus, to a certain extent the interests of politicians and space proponents coincided, and with the aid of all of the efforts which only a totalitarian social system could provide, Soviet rocketry moved ahead quickly.

At this time, on the other side of the ocean, Wernher von Braun, another space enthusiast, continued his work. The U.S. was not as interested in intercontinental ballistic missile development as the Soviet Union. Von Braun was developing the Redstone missile—a further modification of the V-2—and apparently his possibilities were limited. The International Geophysical Year was approaching and the U.S. officially reported that they would undertake an attempt to launch a scientific artificial Earth satellite. It was possible that this information would have remained only within scientific circles, if there had not been an absolutely unexpected reaction from the Earth's other hemisphere.

Stalin did not succeed in waving a "rocket sword," but his successor, Khrushchev did. Korolev and his comrades-in-arms suggested that the launching of an artificial satellite would be an excellent demonstration of our achievements. In fact, who can see missile tests? Who can completely believe the boastful declarations of the politicians. Here you can see results supported on a scientific-progressive basis.

Everybody knows what followed. Khrushchev was worthy of the title "cosmonautics greatest propagandist," although he thought about a pure cosmonautical development least of all. He threw a gauntlet to America, and its politicians accepted the challenge, not realizing what race they were starting. We must recognize that Khrushchev and his associates could not realize how much this race would cost, and even more so they did not foresee the results of this race.

The work which had already been done in the USSR allowed Soviet cosmonautics to gain considerable success. The Vanguard project failures pushed von Braun ahead again, and the first American satellite was launched by a vehicle of his design. And when the U.S.S.R. left the U.S. behind in the launching of the first man into space, President Kennedy declared the program to land a man on the Moon. The launch vehicle for implementing this program was also developed by von Braun.

Everybody had already forgotten about the possibility of a military application for these developments. Military ballistic missiles and reconnaissance and military communication satellites were developed somewhere apart from the "race." It was another "game" where other people were engaged.

The magical word "prestige" had turned a game against those who had begun it. In fact, under an excuse of a demonstration of the success of Soviet military rocketry, Korolev and his colleagues manipulated the party-state leadership onto the course of the penetration of space with scientific aims, which was their long-time dream. Moreover, they disclosed the way for their colleagues who were working on the other side of the ocean. However, the successful demonstration was so impressive that instead of a rivalry in the military field, where creation of analogous armament by both sides could be justified by military parity, they started a competition to see whose citizen would be the first to make a manned Moon landing. Moreover, this landing would not make the winning country the owner of the Moon or any part of its surface.

When the U.S. announced its lunar program, it would have been more reasonable for the Soviet leadership to make a public declaration about the development of a manned mission to Mars (isn't it more prestigious?), and to concentrate all efforts on it. The ill-fated "race" wouldn't have occurred, the efforts wouldn't have been duplicated, and rubles and dollars would not have been spent on two parallel programs. You never know, however, because the U.S. might have reoriented its work toward a Mars mission. Politicians who are preoccupied by their country's prestige don't only live in the Soviet Union.

So the rocketry technique created by the Ministry of Defense was adroitly directed by its designers for space implementation. However, when they reached their aim they were entrapped by "state interests" and were forced to lead a senseless fight with their foreign colleagues, who had the same views. However, these people—Korolev, von Braun, and many others—did reach their aim. Our life is unthinkable without cosmonautics now.

What is going to happen? Nowadays it is already difficult to trap any government with words like "prestige" or "demonstration of our might in space." Today there are proposals for a Russian-American project to effect a manned landing on Mars. However, who will pay for that? The U.S. and Russia have more urgent needs. So we shall, evidently, have to expect the next interplanetary manned mission when new enthusiasts trap politicials and financiers into spending money for a program "vitally necessary for the interests of the state (or planet?)," under the cover of which they would reach their aim. Well, so what of it? Was it so important which way Columbus used to make the king and queen of Spain interested? The main thing is that he reached America!

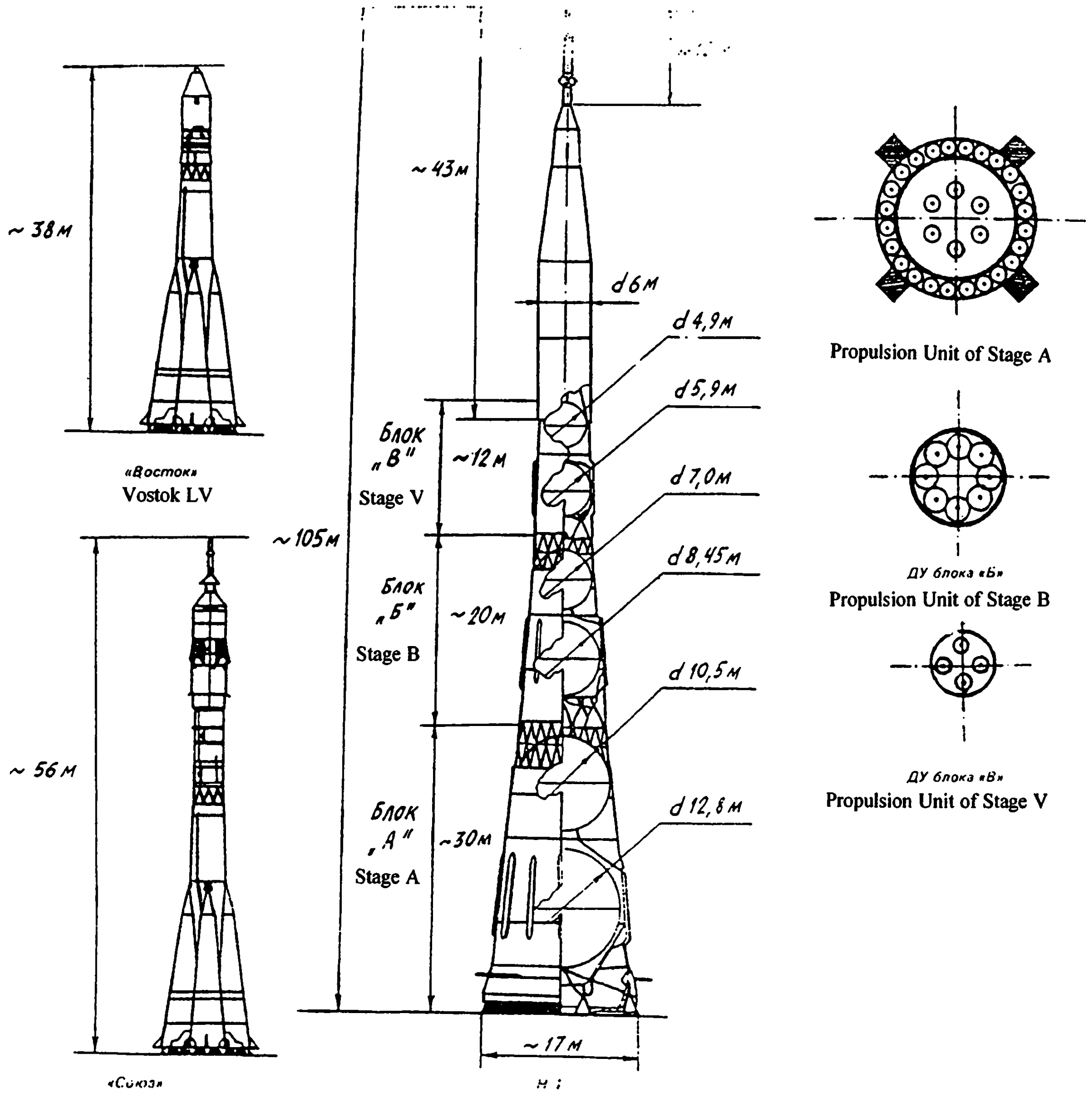

Рисунок А. БАЛДЕНКОВА

N-I LV Specifications

Overall Length (m)	105
Max. Diameter (m)	17
Lift-off Mass (t)	2700
Payload Mass (t)	95
Thrust (t):	
– first stage	4620
– second stage	1430
– third stage	164

Технические данные ракеты-носителя Н-1

Общая длина, м	105
Длина без полезной нагрузки, м	65
Максимальный диаметр, м	17
Число ступеней	3
Стартовая масса, т	2700
Масса полезной нагрузки на опорной орбите, т	95
Тяга ДУ, т:	
– первой ступени	4620
второй ступени	1430
третьей ступени	164