Yuri Okunev

Fight For The Moon

Dedicated to the 50th anniversary of the first manned Moon landing[1]

Christmas Eve of 1968

On December 24, 1968 the crew of Apollo 8 was completing their ninth orbit around the Moon. The sun had just set over Houston and Christmas Eve had arrived. Hundreds of millions of people on Earth, in all the countries except the USSR and her socialist allies, were watching the live TV broadcast from the lunar orbit. After a shot of the lunar landscape Bill Anders opened the flight plan and said:

"We are now approaching Lunar sunrise, and for all the people back on Earth the crew of Apollo 8 has a message that we would like to send to you."

The story of the Apollo 8's astronauts' message is dramatic and amazing. The first amazing thing was the fact that neither the American government nor any NASA officials had anything to do with the message and did not even know it existed; the message was wholly the astronauts' idea. The second amazing thing is the fact that they did not blare any propaganda from space, but found within themselves the respect deserved by the great words they read. Finally, it is amazing that these simple men understood their historical mission better than any career politician or scholar of history. That message ended the race to the Moon between the two superpowers and became an important point in the fight between the atheists and the believers for the souls of humanity and in the ideological conflict of the 20th century between the totalitarianism and freedom.

The lifeless lunar landscape passed by the spacecraft's window and the sunlight sharply divided it into the light and dark, into the lunar day and lunar night, and they were leaving the light and entering the dark abyss.

Bill Anders picked up the flight plan and quietly started reading and the great words of the ancient prophets that had once been uttered on Earth by the cradle of the human civilization and had come the long 3,000 year way with it to be delivered by the humans to the orbit of the Moon

[1] Translated by Anna Tucker

and broadcast by the Apollo 8's radio back to Earth through the hundreds of thousands of kilometers of space.

"In the beginning God created the heavens and the earth. Now the earth was formless and empty, darkness was over the surface of the deep, and the Spirit of God was hovering over the waters. And God said, "Let there be light," and there was light. God saw that the light was good, and he separated the light from the darkness. "

Only these famous words, wise, profound, and poetic, fit the importance of the moment. Millions of people on Earth sat still in front of the TV screens. In Houston, Valerie Anders whispered shakily: "Bill is reading the Bible from the Moon".

Jim Lovell took the text from Bill and continued:

"God called the light "day," and the darkness he called "night." And there was evening, and there was morning—the first day. And God said, "Let there be a vault between the waters to separate water from water." So God made the vault and separated the water under the vault from the water above it. And it was so. God called the vault "sky." And there was evening, and there was morning—the second day."

Millions of believers felt that the miracle they had been long waiting for had finally happened and the much desired victory that they had hoped for despite the frightening reality of the 20th century, had finally come. In Houston, Marilyn Lovell, who had not quite believed that a man was able to accomplish something so grand, thought humbly: "They must be in God's hands".

Jim passed the text to Frank Borman and Frank went on:

"And God said, "Let the water under the sky be gathered to one place, and let dry ground appear." And it was so. God called the dry ground "land," and the gathered waters he called "seas." And God saw that it was good."

Millions of believers and non-believers felt that something mysterious and magnificent was happening in front of their eyes. Those who could look ahead also understood that the human history that had so far been rolling inevitably downhill towards Hell suddenly and unexpectedly turned its face up to Heaven. For the first time millions of people simultaneously held their breath and choked with emotion. In Houston, Susan Borman wept.

Frank Borman looked out of the window. The lunar night was approaching quickly. In a few seconds the Sun was going to set behind the Moon's horizon and Apollo 8 would enter the darkness again. Frank took a deep breath and finished:

"And from the crew of Apollo 8, we close with good night, good luck, a Merry Christmas, and God bless all of you — all of you on the good Earth."

And so three American astronauts victoriously concluded the immense technological and ideological fight for the Moon that occurred in the middle of the 20th century. Over two billion people on Earth breathed a sigh of relief – God is with us!

The Grand Space Challenge of the Soviet Union and the Gauntlet Thrown Down

In the decade of mid-50s to mid-60s the USSR was the world leader in the field of rocket and space technology and was ahead of its only competition, the USA, in the power of the rocket engines as well as the accomplishments in space and the military rocket building. At the point of that leadership was the first manned space flight.

I remember well the Moscow of April 12, 1961 and the genuine jubilation of her people when that otherwise unremarkable spring day suddenly became the day of a world-wide importance. That morning I was at the Ministry of Communications. Suddenly the multitude of bureaucrats in the endless hallways of the huge Central Telegraph building halted and started buzzing. Abandoning their respectable laminar flow they headed for the central lobby where the Moscow radio could be heard broadcasting something at high volume. The unmatched voice of Yuri Levitan that made you heart pause and shivers run down your spine carried over the planet with growing power:

«Moscow speaking. All the radio stations of the Soviet Union are broadcasting. Today, on April the 12th of 1961 at nine hours and seven minutes Moscow time the spaceship ***Vostok*** *was launched from the Baikonur cosmodrome* ***carrying on board a man****. Major Yuri Alexeyevich Gagarin, upon completing a flight around the Earth, successfully landed at ten hours and fifty-five minutes near the village of Smelovka of Saratov region. This is the first manned flight into space. Glory to the Soviet scientists, engineers and technicians. Glory to the Soviet people, the builder of the Communist society."*

This was followed by the powerful song by Isaac Dunayevsky *Wide Is My Motherland.*

The world was amazed by the outstanding scientific and technological achievement of the Soviets and realized that it had missed a great military and political challenge of the Communists and the beginning of the last crucial stand that the Communists started. The words of the proletarian anthem "*This is our last and crucial battle"* were coming true in space. It is curious that the political and military leaders of the West had not fully anticipated this challenge despite the fact that they had had reasons to believe it was coming even before Gagarin's flight.

In May of 1957 at the secret proving ground Tura-Tam in Kazakhstan (which later became the Baikonur cosmodrome) the first in the world military intercontinental ballistic missile R-7 with the powerful RD-107 and RD-108 engines was tested. Both the rocket and the engines had been created by the engineering teams of S.P. Korolev and V.P. Glushko. On October 4, 1957 this rocket launched the first man-made satellite, and in May of 1958 it carried a geophysical laboratory that weighed in at 1327 kilograms. In January of 1959 the automatic space station Luna 1 having reached the second stage and for the first time having left the geocentric orbit passed close by the Moon. In September of 1959 Luna 2 for the first time reached the Moon's surface and delivered a Soviet pennant. During 1960 and the beginning of 1961 five satellites and two new heavy satellites were launched into Earth's orbit.

The Soviet scientists and generals reported to the political leadership of the country that the invincibility and unreachability of the USA were the things of the past and the USSR could deliver a hydrogen bomb to any location on the American continent. In 1959 R-7 was put into military use and the Soviet Armed Forces acquired a new branch, the Strategic Missile Forces lead by a marshal of the artillery Mitrofan Nedelin. The new missiles were aimed at the cities and military bases in the US. A huge space industry was developing in the USSR. By the early 1960s there were three rocket corporations headed by S.P. Korolev, M.K. Yangel, and V.N. Chelomey and the rocket engine corporation of V.P. Glushko. The factories in Moscow, Samara and Dnepropetrovsk were producing new rockets and space launch systems.

The Soviet Union rapidly increased its record achievements in space leaving no chance to America to prove itself. Less than four months after Gagarin's flight, on August 6, 1961 the spaceship *Vostok 2* piloted by German Titov orbited the Earth 17 times and proved the possibility of long-term human survival in space.

The first cosmonauts: Yuri Gagarin and German Titov

"He who owns space owns the world" was the new slogan of the world-wide revolution. In the socialist camp there was an elevation of spirits. Finally, socialism proved its advantages over capitalism in the scientific and technological field and the abstract concepts of the Marxo-Leninist classics turned into the unbeatable achievements of the Soviet space technology. The feelings of the intellectuals who never accepted the communist ideology of the Soviet totalitarianism, both in the West and in the Soviet Union, were more complicated. As far as Stalin's regime went, it all seemed quite clear. That regime had been based upon on the slave labor of prisoners, collective farmers, powerless workers and terrorized intellectuals. That regime and its achievements were unacceptable by default. Now the time of Khrushchev came and millions of political prisoners were released from the concentration camps; the industrial workers, doctors, teachers and engineers were assigned their quite decent private apartments for the first time in forty years. Even the yoke of *kolkhoz* was loosened a little and the slave labor was replaced by financial and creative motivation. However, the totalitarian essence of the regime never changed and yet the socialist achievements grew. Those who resisted the totalitarian government started to have frightening doubts. What if the despised classics had been right and totalitarian socialism was indeed more efficient than democratic capitalism? In this case, what was their resistance and fighting worth?

We have to give credit to the US President John Kennedy. He soon enough realized what the Soviet hydrogen bombs meant combined with domination in space and what a powerful ideological weapon was the mere fact that the USSR dominated in rocket building. Besides, Kennedy quickly appreciated the chance he had been given to earn his place in history. A little over a month after Gagarin's flight, on May 25, 1961, after consulting with the director of the

NASA's Space Flight Center in Huntsville, AL, Wernher von Braun, John Kennedy gave a historic speech at the joint session of Congress. He admitted that the Soviet Union had beaten America in the space research and military technology due to the successes of the Soviet scientists and engineers in the development of more powerful rocket engines than those of the US. At that session of Congress President Kennedy declared landing an American on the Moon and his safe return to the Earth within the next decade the most important goal of the American nation.

This date of May 25, 1961 should be considered the start of the race to the Moon between the USA and the USSR. That race turned out to be more important for mankind than the fact of a man landing on the Moon by itself. Back in those days the Soviet Union had a huge lead in space exploration, but America challenged it by setting a long-time dream and fantasy of the human race to visit the Moon as a realistic goal. A technological battle commenced. It involved immense financial and the best intellectual resources of the two superpowers.

Clash of the Titans

The next few years after Yuri Gagarin's and German Titov's flights saw the continued impressive and bold triumph of the Soviets in space. From 1962 to 1965 one hundred and three man-made satellites of the Kosmos series were launched into orbit. In August of 1962 the spaceship *Vostok 3* piloted by cosmonaut A. Nikolaev was launched and *Vostok 4* with the cosmonaut P. Popovich was orbiting the Earth. It was the first group flight that lasted more than 70 hours and that broadcast the first TV programs from space. In June 1963 the second group flight by *Vostok 5* and *Vostok 6* piloted by the cosmonauts V. Bykovsky and V. Tereshkova set the record at 72 hours and delivered the first woman into space. In October 1964 a new three-person spacecraft *Voskhod* with the cosmonauts V. Komarov, K. Feoktistov and B. Yegorov equipped with soft landing gear launched into orbit. In March 1965 *Voskhod 2 e*quipped with an airlock for performing extra-vehicular activities with the cosmonauts P. Belyaev and A. Leonov was launched and the first man walked in space. This was all done for the very first time in the whole world. All the launches were successful. The Soviet space equipment worked flawlessly. The more and more complicated goals were reached consistently and on time.

In 1964 the Central Committee of the Communist party of the Soviet Union adopted a secret resolution that declared the landing of man on the Moon the priority goal of the Soviet space program. This resolution was backed by the emotional directive of the First Secretary of the Central Committee and the Chairman of the Council of Ministers of the USSR Nikita Khrushchev: "*Do not give the Moon up to the Americans! We will find all the funds necessary."* Despite the secret status of the resolution, the measures were taken to leak some information into the media for propaganda reasons. The media immediately came up with a new slogan: *"A Soviet citizen will be the first human on the Moon".* A Soviet citizen, meanwhile, was already training in a cosmonaut team and it was quite clear when that man was going to land on the Moon: In 1967, of course, to mark the 50th anniversary of the Great October Revolution.

The Space Race led by the Soviet Union was gaining momentum. In February 1965 the final draft of the Soviet lunar launch system was signed into production. The Soviet engineers were putting the last touches on the spaceship *Soyuz* that weighed in at over six tons and was to carry a man to the Moon. In the USA the engineers started working on the lunar module *Apollo*. At Baikonur a launch vehicle for the giant rocket N1 was being readied. N1 was to launch into the Earth's orbit an Earth to Moon complex that weighed in at about 60 tons. In the US they were

working hard on a similar huge rocket *Saturn V.*

By early 1967 the Space Race had turned into an intense political and technological duel of the two superpowers that caused human casualties. Both sides were in a rush and the first attempts to launch the first lunar modules *Apollo* and *Soyuz* into orbit ended in their destruction and death of their crews. On January 27, 1967 three American astronauts, Virgil Grissom, Ed White and Roger Chaffee burned alive in the cabin of *Apollo 1* during a launch rehearsal test that was scheduled for four weeks later. On April 23, 1967 the Soviet Union was the first to launch the lunar module *Soyuz 1* piloted by Vladimir Komarov into low Earth orbit. According to the flight plan it was supposed to rendezvous with *Soyuz 2* with three cosmonauts on board and work on practicing all steps of docking and putting together the lunar complex. However, technical problems plagued *Soyuz 1* from the very first minutes of the flight. First, one of the solar panel failed to unfold. Then the main radio quit and finally the orientation detectors failed. Between orbits 7 to 13, in the span of nine hours, Vladimir had no communications with the Mission Control Center near Moscow. When the communications were restored, Komarov reported the total loss of control of the ship and asked to let him talk with his wife for the last time. Cosmonaut Vladimir Komarov bravely fought for his life and at orbit 17 by some miracle managed to fire the retrorockets and reenter the Earth's atmosphere. He seemed to have been saved, but then the main parachute did not unfold. As the last desperate attempt to save his life Vladimir deployed the manually activated reserve chute, but it was too late. The fireball of *Soyuz 1* fell to Earth at about 140 km/h south of the Ural mountains in Russia.

The tragic failures of *Apollo 1* and *Soyuz 1* made the USA and the USSR revise the designs of the spacecrafts and postpone manned flights. However, the speed of the race and the anxiety grew. In April 1968 *Kosmos 212* and *Kosmos 213*, the test spacecraft of the Soyuz series, docked in the Earth orbit. In September 1968 the Soviet automated interplanetary space station *Zond 5* that closely resembled a full-size lunar module, successfully reached the orbit of the Moon, orbited the Moon, returned to the Earth and performed a soft landing in the Indian ocean. For the first time the world saw a return of living creatures from the Earth from the lunar orbit to the Earth at escape velocity. It was only turtles, but it was clear that the Soviet Union was about to launch a mission to the Moon. In October 1968 both sides almost simultaneously resumed manned flights. On October 11 Walter M. Schirra, Donn F. Eisele and R. Walter Cunningham began a successful 11-day Earth-orbital test flight on board *Apollo 7* to check out the redesigned Block II CSM. On October 25 and 26 an unmanned spacecraft *Soyuz 2* and a manned *Soyuz 3* piloted by G. Beregovoy achieved a rendezvous. Beregovoy manually guided his ship to docking distance and later successfully descended and soft-landed back on Earth.

By December 1968 it looked like the most important steps of a lunar mission, including reaching Earth-orbit, traveling to the Moon, orbiting it and returning to the Earth, have been worked out by both sides. The remaining issue was the readiness of the carriers *Saturn V* and *N1* that were to launch to Earth-orbit the heavy lunar modules to take the astronauts to the surface of the Moon and command modules to orbit the Moon and return the crew to the Earth. Still, by December 1968 it became clear that the Space Race was on its home straight. Either party could make the final push and reach the goal first.

The Americans believed that they had finally caught up with the Russians, yet understood that the top-secret and unpredictable Soviet space program could surprise them like it had before. They

thought it was necessary to hurry. The new NASA Administrator Thomas Paine was faced with a dilemma either to conduct further unmanned testing of *Saturn V* or risk launching a manned flight.

On the other hand, the Russians possessed much more information of the Americans' plans and realized that their time was running out. Still, they were counting on the Americans not risking sending a crew to the Moon without additional test launches of *Saturn V* that so far had only carried unmanned flights and not always successfully.

However, the Americans could not bear the intensity of the race any longer and took the risk.

It happened early morning of December 21, 1968, a Saturday, at the John Kennedy Space Center at Cape Canaveral in Florida. At 6:51 five giant rocket engines in billowing smoke and fire launched the three thousand tons of *Saturn V* into the sky. At the top of the rocket in the command module of *Apollo 8* three astronauts, Bill Anders, Jim Lovell and Frank Borman were pushed back into their seats by acceleration by G-forces. They were carried into immortality and carried with them an unremarkable sheet of paper with their historic message to the people of the Earth that was to be read from the orbit of the Moon. Having burned 2,500 tons of fuel *Saturn V* brought to Earth orbit the 100 tons of the third stage carrying *Apollo 8* and its crew. They orbited the Earth twice, like many American and Russian astronauts before them. At 9:41, however, something unprecedented in planet Earth's history occurred. .

At Mission Control in Houston Fight Chief Cliff Charlesworth asked everyone involved the same fateful question: “Yes or no?” Everyone responded with a “yes”. Cliff nodded to Mike Collins and Mike calmly and quietly told the astronauts on the radio that they were go to leave Earth.

The third stage burned 80 tons of fuel and increased the speed of *Apollo 8* to 39,000 km/h over the span of five minutes. *Apollo 8* broke away from the Earth's gravity and launched for the Moon. Three men in a small ship were leaving the Earth. The three men saw their white and blue planet from a distance for the first time. The planet was getting smaller and smaller and turned into a tiny shining ball in the vast emptiness of the Universe.

On the second day of the flight *Apollo 8* entered the Moon's gravitation sphere of influence and started accelerating. Attracted by this new powerful force, it entered the zone of no radio contact with Earth and temporarily lost communications with Houston.

These were the most intense moments of the flight. Out of the radio contact with the Earth the Service Propulsion System engine ignited automatically at the command of the onboard computer and place the ship into the orbit around the Moon. A tiniest miscalculation or an execution mistake could lead to disaster and *Apollo 8* would strike the Moon or end up in an unstable orbit that would not allow it to ever return to the Earth, or be flung past the Moon into infinity. In Houston everyone was watching the clock. Every fifteen seconds Jerry Carr said into the microphone: *“Apollo 8, Apollo 8, this is Houston...”* If at 4:29 there was no response that would mean that the unthinkable had happened and that would in its turn mean that America lost the Space Race. The response came at 4:30 when the radio wave brought the voice of Jim Lovell: *“Go ahead, Houston. The SPS engine ignited on schedule and burned for 4 minutes and 6 ½ seconds.”*

These words crossed the finish line of the Space Race and put an end to the space battle of the century. The spaceship *Apollo 8* appeared from the dark side of the Moon into the light of the Earth. America won the Space Race!

Image of the Earth from the orbit of the Moon

The Bitter Fate of the Soviet N1 Rocket

The Soviet Union took the loss very hard. There was no official reaction, but all the media, cosmonauts, scientists and the President of the Academy of Sciences received a strict order from the Central Committee of the Communist Party:

"Do not allow even a hint of thought about our failures in space among the population. We go our own way. If the Americans are also succeeding, that is irrelevant to our main objective."

However, not everyone was able to put a brave front on. The Head of the Cosmonaut Training Center General Nikolai Kamanin wrote in his journal during the flight of Apollo 8:

"This is a day of celebration for the mankind, but for us it is a day of the lost opportunities. The Americans are flying to the Moon and we have nothing to match their achievement. The worst thing is, we cannot tell our people the truth. We try to write and talk about the reasons for our failures, but all our attempt drown in the bog of bureaucracy."

What was that general Kamanin wanted the people to know? And why did the Soviet Union, the unconditional leader in the field of space science and technology of the early 1960s, lost the Space Race late in the same decade?

We shall dedicate the rest of this article to answering this question, since the honest answer consists of many layers and includes many circumstances from purely technical reasons for the failure of the Soviet *N1* rocket to launch to the unprecedented in the history of science and technology power struggle between the two main figures in the Soviet rocket industry.

If we were to briefly summarize the technical reasons for the American's victory and the failure of the Soviet lunar program, the answer would appear very simple – the American engineers were able to create for their *Saturn V* rocket the brilliant and most powerful engines in the world and the Soviet experts worked with a most unfortunate combination of weak engines that did not allow *N1* to launch into space. Here are some technical details that are necessary to understand the Space Race.

The American three-stage launch vehicle was developed by the team of Wernher von Braun at the Marshall Space Flight Center in Huntsville, Alabama.

The weight of the rocket of about 110 meters tall was around 3,000 tons and the weight of the payload it was capable of carrying to the Earth orbit was about 130 tons. The rocket had five first stage engines with 680 tons of thrust each and fueled by liquid oxygen/kerosene. The combined thrust of the five engines was 3,400 tons which allowed for a lift of a 3,000 tons machine off the Earth and placing over 100 tons of payload into the Earth orbit. *Saturn V* also had five second stage engines with the thrust of 90 tons each and one third stage engine fueled by liquid oxygen/liquid hydrogen. The super powerful LOX/kerosene engines of the first stage and the LH2/LOX second and third stage engines were made by *Rocketdyne*, a division of Rockwell International. These uncontested engines are displayed at the National Air and Space Museum in Washington, DC. The first stage of *Saturn V* was manufactured by Boeing, the second – by North American Aviation, and the third – by Douglas Aircraft. The Apollo Lunar Module that eventually became a permanent exhibit at the National Air and Space Museum was built by Grumman Aircraft. Its APS engine was made by Bell Aerospace and the Instrument Unit – by IBM.

Before December 1968 *Saturn V* had only been launched twice: on November 9, 1967 and April 4, 1968 with the second launch being a partial failure. Still, on December 21, 1968 *Saturn V* took to the Earth orbit *Apollo 8* with a crew of three astronauts that proceeded to complete the first manned flight around the Moon.

The American lunar rocket Saturn V. Note the five jets of the humongous rocket engines weighing 8 tons each

The Head of Saturn V development Wernher von Braun at the Kennedy Space Center

The further triumphant history of *Saturn V* with serial numbers 4 through 12 is very well known:

March 3, 1969: Manned low Earth orbit test of Apollo 9

May 18, 1969: Manned translunar injection of Apollo 10

July 16, 1969: First manned lunar landing, Apollo 11

November 14, 1969: Second manned lunar landing, Apollo 12

April 11, 1970: Apollo 13 flight mission aborted by Service Module failure

January 31, 1971: Third manned lunar landing, Apollo 14

July 26, 1971: Fourth manned lunar landing, Apollo 15

April 16, 1972: Fifth manned lunar landing, Apollo 16

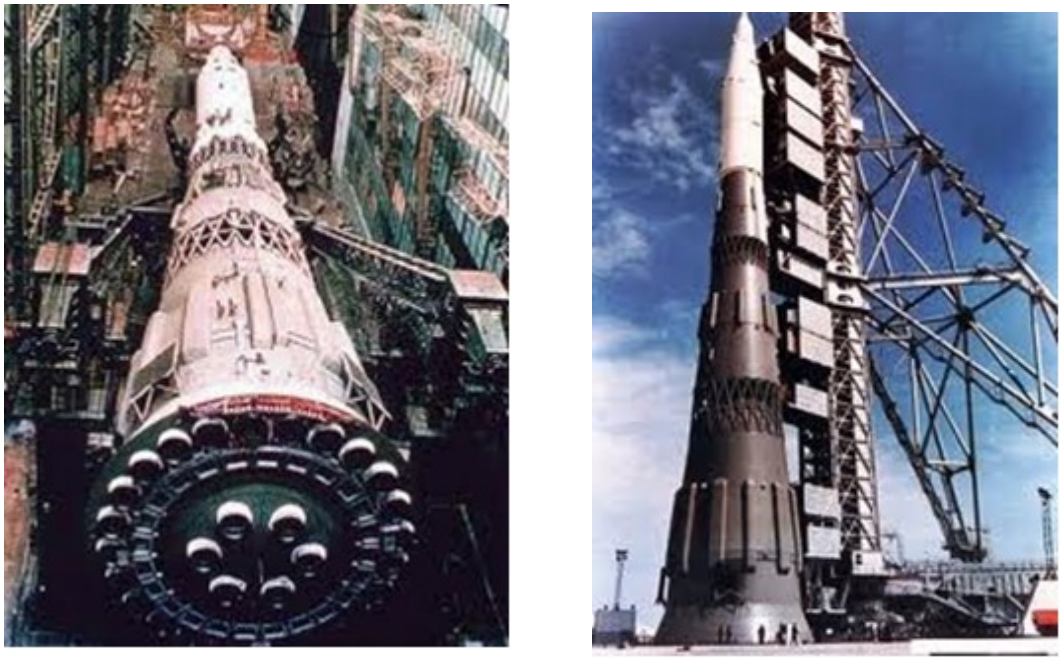
December 7, 1972: Sixths manned lunar landing, Apollo 17

The total of 15 *Saturn V* launch vehicles was built before the end of the manned lunar landing program.

The Soviet lunar complex was based on a enormous three-stage rocket *N1*. It was 113 meters tall and its diameter at the base was 17 meters. Even now, in the 21st century, its size seems astounding and *N1* remains the largest man-made flying structure. *N1* was so big that no vehicle could carry it from the factory in Samara (former Kuybyshev) on the river Volga to the launch site at Baikonur in the steppe of Kazakhstan. A huge assembly shop had to be built at Baikonur and the parts of the rocket were delivered there from Samara.

The first stage of *N1* had 24 circularly arranged engines and six more inside the ring with the

thrust of 150 tons each and fueled by LOX/kerosene. The second stage had 8 engines and the third stage had 4. *N1* was meant to take the lunar module L3 to the Earth orbit. L3 combined the lunar engines, an adapted Soyuz spacecraft and a lunar lander. Look at the 30 jets of the rocket's engines at the base of *N1* and compare it to those of the American *Saturn V* in the image above: the total thrust of the 30 weaker engines of *N1* was larger than that of the 5 more powerful engines of *Saturn V*, but it was precisely the larger number of engines of the Soviet rocket that led to failure.



The Soviet lunar rocket N1 on the assembly floor and on the launch pad.

To help the reader comprehend the resources dedicated to developing of *N1* and the Moon project as a whole, we shall name the main participants.

The project was headed by OKB-1 Design Bureau in Podlipki near Moscow (now *S. P. Korolev Rocket and Space Corporation Energia* in Korolev) and its then-Chief Engineer Academician Sergei Korolev and later, after Korolev's sudden passing in 1966, Academician Vassily Mishin. In 1968 at the peak of the Space Race OKB-1 had 40,000 employees. OKB-1's drawings were used to build Moon rockets at the huge Progress factory in Samara that employed additional 30,000 engineers, technicians and workers. The lunar spaceships and parts of the rockets were also assembled at the Khrunichev factory in Fili near Moscow. The technical documents for this factory were developed by OKB-52 led by an outstanding rocket engineer Vladimir Chelomei.

The engines for *N1* were developed in the aviation design bureau of the General Nikolai Kuznetsov in Samara and the Moon research instruments were created by Lavochkin Research and Production Association in Khimki near Moscow. The automatic engine control system was developed at the Science and Research Institute of Automatic Devices and its Chief Engineer Nikolai Pilyugin. The launch complex was created by the design bureau Spetzmash and the Chief Engineer Vladimir Barmin. The radio technical complex came from NPO of Space Instrument Making headed by Mikhail Ryazansky, the communication systems and radio telemetry systems – from NPO of Precise Instruments.

These are only the main and the largest participants of the creation of *N1* for whom worked dozens of academic institutes, universities, laboratories, Science and Research Institutes, design bureaus, communications centers and proving grounds.

In the early June of 1962 the twenty-nine volumes of the *N1* design were set on the desk of the President of the Academy of Sciences of the USSR Mstislav Keldysh. On September 24 of the same year based on his approval the USSR government adopted a resolution to begin the flight testing of *N1* in 1965. However, *N1* did not fly neither in 1965 nor in 1969. It never flew at all!

General Vladimir Gudilin, the head of the testing facility at Baikonur in the 1960s, talks in his memoir "The unforgettable Baikonur" about the multiple failed attempts to launch *N1*:

"The first launch of the space rocket complex N1-L3 on February 21, 1969 ended in a disaster. A leak of components developed that caused a fire. The second launch of N1-L3 was conducted on July 3, 1969 and also failed due to malfunction of the number 8 engine. The exact cause of the incident has not been determined."

The famous Six Chief Engineers (left to right):
Barmin, Glushko, Korolev, Pilyugin, Ryazansky, Kuznetsov. 1957, Baikonur.

Let's stop here for a minute and add in something that the general never mentioned. During the second launch that occurred two weeks prior to the American astronauts' landing on the Moon, *N1* left the launch pad and went 200 meters up after which it suddenly tilted and hit the ground with its 3,000 tons. A series of powerful explosions that followed destroyed all the launch facilities. Twenty-five hundred tons of liquid oxygen and kerosene burned bright enough to light the steppe for dozens of kilometers around. The impact shattered windows not only in the buildings near the

launch site but in a town six kilometers away.

Now let's go back to Gudilin:

"The third launch of N1-L3 was completed on June 27, 1971. From the start of the flight an abnormal stabilization process could be observed. The flight was basically uncontrolled. The fourth launch of N1-L3 was conducted on November 23, 1972. The first stage worked nearly flawlessly until 106 second mark when the oxygenation pump of Engine 4 deteriorated causing an explosion and destruction of the rocket. The fifth launch never happened. In June of 1974 all the work on N1-L3 was suspended. The materials were destroyed and the project was signed off as a total loss at 4 billion roubles in the 1970s currency. (B. Chertok estimates the losses at 6 billion roubles)

The leading experts in rocket building had not believed in the possibility of space flight with *N1*. The Chief Engineer of the Soviet rocket engines Academician Valentin Glushko mockingly called general Nikolai Kuznetsov's blueprints "a rotted mess of motors" and did not believe it would ever work. Later, the vice-Chief Engineer of Rocket and Space Corporation *Energia* V. Filin wrote on the subject:

"Now many believe that the fifth launch would have been successful. But I think with that approach to technology it would have been not the fifth, but the umpteenth."

The vice-Chief Engineer of NPO *Energomash* V. Rakhmanin summed it up:

"In the history of the Russian rocket building there has been no other occasion when the first four test flights of a new rocket in a row ended in failure and all due to malfunction of the first stage. It looked like the machinery itself was trying to tell us it was time to recognize that the whole project had been a mistake."

Now we begin to understand that the technical imperfections of *N1* were only the top of the iceberg of the Soviet Union's loss in the Space Race. Indeed, why did the Soviet engineers pick such an unfortunate realization of their most ambitious project? What happened to the unique experience in creating the most powerful and most reliable rocket engines of the '50s and early '60s? What happened to the brilliant scientific achievements of the Soviet applied mechanics and aerodynamics? Let's look at the opinion of the US President John Kennedy based on the evaluation of the American experts:

"Recognizing the head start obtained by the Soviets with their large rocket engines, which gives them many months of leadtime..."

So, in 1961 the Soviet Union had the best rocket engines that guaranteed it the leading role and in 1969 it had the engines that blew up at every launch and could not consistently carry out even a several-dozen-second flight? If you pardon the pun, that was not rocket science. It was clear to anyone that something was very wrong.

The Underlying Cause of the Soviet Loss in the Space Race

I am not normally prone to mysticism, but while studying the Soviet-American fight for the Moon I could not shake off the feeling that Providence itself had placed the main pieces of the Soviet lunar project on the board of history in the pattern that the project was destined to fail and even end in disaster and destined so profoundly that it could not have been saved neither by the

government and the Party resolutions, nor by the enthusiasm and experience of the thousands of its executors. The story of the Soviet lunar program is an unprecedented in the history of science bizarre tale of the two souls so absorbed in power struggle that they doomed the greatest technological project of a great country in that century. This story is told in detail in the sources cited at the end of this article. Here we can only trace its basic outline.

In the 1950s-1960s the Soviet space and rocket industry was headed by outstanding rocket scientists and lead engineers the academicians Valentin Glushko and Sergei Korolev. Those were talented, incredibly hardworking, ambitious, impatient and harsh leaders. Their lives intertwined in strange ways.

Both were born in the Ukraine in the beginning of the century. Both spent their early years in Odessa. Both in 1920s-1930s found themselves interested in aviation and the planetary ideas of Konstantin Tsiolkovsky. Both took up rocket engineering almost at the same time. Glushko took a job at the State Aerodynamics Laboratory (GDL) in Leningrad and Korolev – in a community Group for the Study of Reactive Motion (GIRD) in Moscow. In 1933 by the order of the First Vice Commissar of Defense Marshal Mikhail Tukhachevsky GLD and GIRD were combined to form the secret Reactive Engine Scientific Research Institute (RNII) in Moscow. Above its front doors it sported an innocent sign that read "All-Union Institute for Agricultural Machinery Building". Our heroes first started working together there and not at all in the field of agriculture. Korolev became the head of the rocket department and Glushko became the head of the liquid fuel rocket engines department.

Then there came 1937. After cruel torture Marshal of the Soviet Union Tukhachevsky was executed and the wave of prosecution drowned everyone who had had any, however weak, connections to him. In November 1937 Head of RNII Ivan Kleimenov and Chief Engineer Georgy Langemak were arrested and executed after the required information had been beaten out of them.

Then it was Glushko and Korolev's turn. Valentin Glushko was the first to be arrested by the NKVD. His story in all its gruesome detail is told in the non-fiction book "*Once And For All".* We shall mention here only the facts necessary to tell our story.

V.P. Glushko and S.P. Korolev

On March 25, 1938, two days after his arrest and into continuous torture Glushko allegedly

admitted to his participation in a Trotskist subversive organization of Kleimenov-Langemak. On March 28 Sergei Korolev was arrested. This chain of events later led to public assumptions that Glushko under pressure of the investigators falsely named Korolev his accomplice in the "subversive activities". It was not true. Professor Leonid Sternin, a famous aerodynamics scientist that worked alongside Glushko for many years, writes in his memoir:

"The thorough study of V.P. Glushko's so-called confession and the long record of his questioning showed that he had never falsely accused S.P. Korolev and never named him accomplice and member of the Trotskist subversive organization. S.P. Korolev could not have known that."

Let's note this very pertinent to our story detail: Korolev believed that Glushko had betrayed him.

Meanwhile, the events kept unfolding. Our heroes were not executed for a very simple reason: They were at the time just insignificant pawns in the tragic game of the Great Purge. Still they were sentenced to 8 years of prison camp followed by slave labor in prison design bureaus supervised by the NKVD. Working in those facilities born of the evil genius of the Soviets and called "*sharashka"* (from the slang word meaning "a band of hoodlums"; a poorly organized place) was a mixed blessing, since this was only the first circle of the GULAG hell. In 1941 Glushko, while still a prisoner, a *zek* in the Soviet slang, headed a design bureau of aviation jet engines in Kazan. At the same time another *zek,* Korolev, worked at an aviation *sharashka* headed by yet another *zek,* an outstanding aviation engineer Andrei Tupolev, in Omsk.

In 1942 the work load at Glushko's *sharashka* kept growing and he insisted on Korolev being transferred from Omsk to assist him. The future charismatic person, Sergei Korolev for the first time became Valentin Glushko's subordinate. At first Korolev was Chief Engineer and later Glushko's second in flight testing. Glushko must have not realized back then that he was creating his future merciless competition with his own hands. Had he not invited Korolev to his *sharashka,* Korolev would have probably forever remained in aviation and would have never become the legendary Sergei Pavlovich Korolev, Chief Engineer of the Soviet space rocket systems.

In 1944 both their lives seemed less than accomplished. They were almost 40 and their career paths ended at a prison design bureau. They were forever labeled *enemies of the people*. Everything changed suddenly when the Soviet government decided to urgently start military rocket building or, rather, revive what was destroyed with the RNII in 1937. In July of 1944 prisoner Glushko was urgently summoned to Moscow and taken by two guards to the Kremlin and to Joseph Stalin's office. Stalin enjoyed Glushko's report and Glushko was immediately paroled along with every prisoner from the list Glushko made on the spot. There were 35 people on the list, including Korolev. Glushko was awarded the Order of the Red Banner of Labor and Korolev – the Order of the Badge of Honor.

So began their exceptional rise to glory.

In 1945 Glushko was appointed Chair of the Kazan Aviation Institute rocket engines department. Korolev was at his side again as a department member and Glushko's subordinate. In the same year Colonel Glushko and Lt.Colonel Korolev were sent on a business trip to Germany to study the German military missile *V-2* and upon return ordered to immediately reproduce it.

In those first post-war years Glushko was way ahead of Korolev in his accomplishments as well as position. In 1947 Glushko became Head and Chief Engineer of OKB-456, the main organization working on developing powerful rocket engines, based at the site of a former aviation factory in Khimki near Moscow, later *Academician V. P. Glushko NPO Energomash.* At that time Korolev

was a mere head of ballistic missiles department of NII-8 in Podlipki near Moscow, now the Central Research Institute of Machine Building (TsNIIMash). Korolev was not easy to work with. People were afraid of his dictator's manners and so his walk up the career ladder was slow. However, Korolev was aiming for total independence and moved ahead crashing the absurd, in his opinion, structure of NII. Eventually his efforts to create his own company led to an impressive victory. In the mid-1950s Sergei Korolev was appointed Head of the lead space and rocket technology organization, the future S.P. Korolev Rocket and Space Corporation *Energia.*

Korolev finally was equal to Glushko in position. They were both Chief Engineers, leaders and masters of their own powerful companies that employed thousands of talented scientists and engineers. In 1956 Sergei Korolev and Valentin Glushko were simultaneously awarded the rank of Hero of Socialist Labor for the creation of the first intercontinental ballistic missile. In 1958 they both at the same time became secret full members of the Academy of Sciences of the USSR.

Those were two very different men. Valentin Glushko was an intellectual with aristocratic manners, a connoisseur of music and art, who was always impeccably and elegantly dressed. He could occasionally be arrogant, but never inappropriate or rude. Sergei Korolev did not possess even a fraction of Glushko's refinement and aristocratism. In his dealings with other people he could be crude and boorish, but he could also be artistic and was a gifted leader – the trait that Glushko lacked. Despite the obvious dissimilarities Korolev and Glushko were equally harsh and unforgiving bosses. They could emotionally destroy a man and banish him from the space industry and ruin his future. However, Glushko did that by using a cold stare and ironclad logic whereas Korolev employed a lot of cursing. Both were self-sufficient and did not tolerate competition or need friends. The total secrecy of their work did not allow for saying their names in vain and gave them and everything they did an aura of mysterious power and supernatural importance. They both enjoyed that aura and were rapidly going two parallel ways impersonating the two pillars of the new and mysterious science and technology. They did not recognize any authority other than themselves and did not tolerate any competition, only racing each other. The common people, who were not even allowed to know the names of the Great Ones, learned about their achievements from the triumphant broadcasts of the Moscow radio. One was making rockets and the other – engines for those rockets. Those were equally necessary. However, Korolev eventually takes the lead. His position of the head of the main space and rocket organization along with the support of the President of the Academy of Sciences Mstislav Keldysh and the bold, breathtaking, almost risky space projects that somehow were becoming reality, and, finally, his pushy manner brought Sergei Korolev to the offices of the highest ranks of the country.

Both Korolev and Glushko were top secret personas and either name was known to a very limited circle. And yet Glushko knew that when someone said in public *"Chief Engineer of the Soviet space and rocket systems"* they meant Korolev and not him. Glushko thought that unfair, since no such position existed. There were six of the Chief Engineers among which he, Glushko, deserved to be at top the same as Korolev. Glushko was certain that this outrageous injustice was Korolev's fault and knew that Korolev was aware of his opinion. As a scientist and an engineer Academician Glushko was a perfect match for Academician Korolev and had contributed no less to the victories of the Soviet space program. Glushko believed that Korolev's part was artificially exaggerated. Korolev knew that Glushko so believed.

Mutual alienation and enmity did not come right away. Until the late '50s the relationship

between these two different men could even be called friendly. They had much in common. They had been through thick and thin together. Sharing the newfound fame presented a problem, however. The confrontation began in the late 1957 after the triumphant launch of the first Earth's man-made satellite. Glushko and Korolev's relationship did not survive that. The balance between friendship and competition was destroyed. They suddenly realized how high the stakes were and that it wasn't only about the next award anymore but about gaining a place among the immortal heroes while still living. Glushko hoped to share the glory with Korolev, but Korolev thought differently. Like the O.Henry's *Roads of Destiny* character, Sergei Korolev decided that "*Bolivar, he's plenty tired, and he can't carry double"* and picked a road to his own glory, all to himself, without a companion and need to share the spoils.

By the start of the Space Race the relationship between the two Chief Engineers has reached the point where working together was impossible and the hostilities became open. The old grudges of 1937, the constant competition, the absolute resentment of the other's superiority in anything, and the clash of the insatiable hunger for power and the exorbitant ambition turned the so far hidden confrontation insurmountable. Korolev demanded full obedience from Glushko as he did from everyone else and Glushko refused to be like everyone else. The personal conflict between the two most important leaders of the space exploration quickly became obvious. Korolev and Glushko exchanged biting messages, presumably strictly confined to technical issues, and the copies were mailed to the Council of Ministers, to the Central Committee of the Party, and to Nikita Khrushchev himself. Korolev and Glushko openly fought for power and fame. The formal reason for the argument was the fuel for *N1*. Korolev insisted on using liquid oxygen and kerosene and Glushko promoted nitrogen tetroxide and unsymmetrical dimethylhydrazine.

Let's see what Professor Stepanin, an expert, has to say:

"V.P. Glushko considered that high boiling compounds (NT and UDMH) were well developed for the industry and widely used for military missiles and with strict safety measures could be successfully used for manned flights. The missiles using that type of fuel had proven to be very reliable which is most important for manned spacecraft. However, he failed to convince S,P. Korolev and the President of the Academy of Sciences of the USSR M.V. Keldysh who took Korolev's side."

He failed and he could not have succeeded, because Korolev did not want Glushko to be part of the lunar program. The vice-Chief Engineer V. Filin said that *"creating an engine with 600 tons of thrust would have greatly improved the image of V.P. Glushko's company that were the ones to suggest it be installed on the N1 carrier."*

Korolev made sure Glushko was removed from the project and the *N1* fuel contract was given to the Aviamotor Design Bureau of General Kuztetsov in Kuybyshev. Lacking any subtlety and obviously realizing that Glushko would not ever agree to be Kuznetsov assistant he suggested that Glushko work on a backup version of the engine. Glushko, of course, refused, believing the suggestion insulting. Professor Sternin describes this last act of the drama of Glushko's removal from the lunar program:

«The early 1960s marked the intensive development of rocket technology at the expense of aviation. It was no surprise that the head of the leading aviation engine design bureau of the country N.D. Kusnetsov was very interested in the participation in the ambitious lunar program.

In those circumstances the the intractable Glushko who held the monopoly in the field of the powerful rocket engines was highly frowned upon in Korolev's design bureau. With three major rocket companies and one engine company in the game, the alliance with Kusnetsov's DB was very convenient. We do not know for sure how exactly Glushko refused to build an oxygen engine, but it was clear that many benefited from his stubbornness. Here one of the meetings at our DB comes to mind. Glushko called it immediately after visiting Korolev's DB around that time. He was very depressed. He spoke quietly and made long pauses between his sentences. He informed us with regret that we were suspending our work with Korolev's DB. I clearly remember his last phrase: "This is a very unfortunate situation for both design bureaus, Korolev's and ours, and most importantly, it is unfortunate for our country."

Back in the day Glushko was the only man capable of building superpowerful engines for a lunar rocket N1 on a short notice. Everyone, including Korolev, understood that and also the fact that the rocket's engines would be the deciding factor in the success or failure of the lunar program. Still Korolev split away from Glushko and risked the project of the century to sate his hunger for power and aggravated the confrontation by rejecting the compromise that Glushko had aimed for.

Valentin Glushko was right and history confirmed it. Nikolai Kuznetsov's DB failed miserably at fulfilling the contract. That, however, came as no surprise.

Vladimir Gudilin writes about the work of the N1 project committee:

"Some committee members said it was necessary to involve OKB-456 (Glushko's company – Yu.O.) *in developing the engines for the carrier rocket. However, every attempt to accomplish that failed. The development of the engines was entrusted to OKB-276* (Kuznetsov's company – Yu.O.) *that did not possess neither the necessary theoretical base nor experience in development of liquid fuel jet engines and totally lacked the proving grounds and testing facilities. The consequences of Glushko's refusal to work on the engines and the involvement of a new organization were yet to come."*

The Soviet and Russian historians tend to avoid mentioning the confrontation between Korolev and Glushko. Academician Boris Chertok writes in his memoir:

"The historians of space exploration usually are very reluctant or outright refuse to mention the disagreement between Korolev and Glushko."

The venerable academician is not being quite honest when calling the cruel and implacable fight a "disagreement". He is right about one thing, however. The history of the Soviet space exploration has been deliberately misrepresented. In the famous grand movie "*Taming of the Fire"* directed by Daniil Khrabrovitsky Korolev played by Kirill Lavrov and Glushko portrayed by Igor Gorbachev are close and loyal friends and Glushko is thrilled to be working under his genius friend Korolev. This touching friendship of the two engineers is patronized by the Party represented by Andrei Popov as Ustinov.

Fortunately for the history Academician Boris Chertok who was once Sergei Korolev's closest co-worker has kept the priceless evidence of the last *"violent clash*" between Korolev and Glushko in the office of the vice-Minister of General Machine Building Grishin. It was the last mean public fight after which nothing by hatred for each other was left in the hearts of these men that had once been friends.

"It was the summer of 1960. At the start of the conversation Mishin and I were present. Grishin said calmly: "Why involve Khrushchev in these problems that he ordered us to solve in the first place. Khrushchev trusts us and we, apparently, do not trust each other."

A sincere conversation never happened, though. Glushko began talking very calmly, but hurt Korolev's pride by accusing him of flirting with the aviation industry and trying to acquire new obedient but incompetent developers for his liquid fuel jet engine. Korolev lost his temper. Both started throwing such insults at each other that Grishin, Mishin and had to leave the office. We waited in the hallway for about twenty minutes, depressed. "I hope it doesn't turn into a fistfight", *Grishin said with concern. At that moment the two Chief Engineers burst out of the office red in the face and ran out of the Ministry building without looking at each other or us and seemingly not quite aware of their surroundings.*"I think these two Russian intellectuals parted having exhausted their obscene vocabularies", *Grishin remarked."*

Neither Grishin nor the rest of the unwitting witnesses of the scandal could have known that they had just seen the future failure of the Soviet lunar program. They did not even notice that Glushko had quite clearly warned them about the reason for this failure which was handing the lunar rocket engine project over to incompetent developers.

«After this bewildering and violent clash I cannot remember a single warm and friendly interaction between Korolev and Glushko", Chertok writes seemingly wondering what had been there to fight about. They, unfortunately, had fought about something that could not have been divided – the immortal glory that does not take plural form in the Russian language.

This is the honest truth about the Soviet Union's loss at the Space Race. Sergei Korolev did not want to share the fame with Valentin Glushko and removed him from the lunar project and Valentin Glushko, who was the only one capable of building reliable superpowerful engines for the rocket did not wish to pull the chestnuts out of the fire for Sergei Korolev.

The tragedy that occurred on July 3, 1969 at Baikonur in the Kazakhstan steppe was a symbolic echo of this drama. Thirty fiery jet engines with deafening roar lifted the huge *N1* rocket, the ultimate result of the great country's intelligence and labor, off the ground. Suddenly it tilted and crashed its 3,000 bulk on the pad from the height of 200 meters. The explosions and the wall of fire destroyed the last hope of the USSR to win the Space Race. In the heavenly chaos that shook the Earth one could hear the clash of the two men of cosmic proportions who buried their common dream along with the country's greatest goal under the rubble of their ambitions.

Neil Armstrong: "Houston, Tranquility Base here. The *Eagle* has landed."

Precisely two weeks after the disaster in the Kazakhstan steppe, on July 15, 1969 NASA announced to the media that the objective of *Apollo 11* that was scheduled to launch the day after with a crew of three was to "*perform a crewed lunar landing and return to Earth".* It was emphasized that this unique space enterprise would *"complete a national goal"* set by President Kennedy eight years earlier. The agency said with careful reserve: *"If the mission - called Apollo ll - is successful, man will accomplish his long-time dream of walking on another celestial body."*

On July 16 three astronauts took their seats in the command module *Columbia* of *Apollo 11* at the top of a huge three-stage rocket *Saturn V* on the launch pad of Kennedy Space Center on Merritt

Island in Florida.

All three members of the crew were born in 1930, all were experienced astronauts and had participated in the Gemini program and a number of test flights into space. Commander Neil Armstrong was also a test pilot and a naval aviator. He saw action in the Korean War and was to be the first person to walk on the Moon. Lunar module pilot Edwin “Buzz” Aldrin was also an Air Force fighter pilot and held a Doctor of Science degree in astronautics from MIT. He had also fought in the Korean War. He was the one to land the lunar module *Eagle* on the Moon and be the second man to step on the Moon's surface. The command module pilot Michael Collins, a US Air Force officer, was to stay in the *Columbia* in the lunar orbit and provide support for the descent of Eagle to the Moon's surface and its return into orbit and docking with Columbia.

The crew of Apollo 11: Neil Armstrong, Michael Collins, Edwin “Buzz” Aldrin

The lift off of *Saturn V* with *Apollo 11* was attended by hundreds of dignitaries and representatives of the media and was televised live in dozens of countries on all continents. In the Soviet Union only a short news report mentioned this attempt to put a man on the Moon. The Soviet Ambassador in the US Dobrynin declined NASA's invitation to attend the launch of *Apollo 11*. However, the US Fleet Forces Command reported that a Soviet Navy squadron en route to Cuba intentionally passed by Florida at a distance that allowed for a perfect view of *Saturn V* launch.

Over half a million spectators watched the historic start of the man's journey to the Moon in the vicinity of Cape Canaveral. All the hotels and many private residences in the towns near the Cape were crowded with visitors. The owners offered them cots and mattresses near swimming pools and in the backyards to those who couldn't find better accommodations. The police was having a hard time handling the unusual amount of traffic and parking of thirty thousand vehicles. The restaurant owners hurriedly stocked up on supplies and set up extra seating in the streets.

Hundreds of thousands of people who came from all over the world understood the importance of the event much better than any officials. They wanted to witness the thousand-year-long dream of mankind come true. They understood that their distant descendants will remember the 20th century as the time when a man from the Earth first walked on a different celestial body. They did not want to miss the opportunity to see something that could be the one most glorious event of the century.

The next three days, July 17, 18 and 19, the *Apollo 11* flight to the Moon had few technical differences from those of *Apollo 8* and *Apollo 10*. However, the upcoming landing on the Moon created a new aura of exclusiveness around *Apollo 11*. On July 17 the US government announced that the *Apollo 11* astronauts were carrying with them to the Moon commemorative medals dedicated to the fallen Soviet cosmonauts Yuri Gagarin and Vladimir Komarov that Frank Borman had brought from his trip to the USSR. They also carried medals in memory of the fallen American astronauts Virgil Grissom, Edwin White and Roger Chaffee.

Only on the fourth day of the flight, on July 20, began the space Odyssey the likes of which mankind had never known before. Neil Armstrong and Buzz Aldrin entered the lunar descent module *Eagle* and activated and checked all its systems. They deployed the landing gear. *Apollo 11* received the order to separate the command and descend modules. At the beginning of the 13th orbit the *Columbia* and the *Eagle* separated and Michael Collins took the *Columbia* about 1,300 meters away. At the end of the 13th orbit the lunar module's descent engine ignited and the *Eagle* began its descent.

The last minutes of the *Eagle*'s descent have been vastly described in detail based on the official reports and the memories of the astronauts and the staff of the Mission Control in Houston. This unprecedented achievement deserves to be remembered in novels and poetry and we shall not try to replace that with a short summary.

For thousands of years the humanity watched the beautiful and unreachable Moon with curiosity and admiration. The oldest love songs were devoted to it and many mighty Gods served it. We learned to track time by the phases of the Moon and adopted a month as a unit of time based on the time between two new moons. While philosophizing that *nil novi sub luna – nothing new under the Moon,* we still aimed for the things new and knowledge and created numerous fantasy tales about flying to the Moon, believing in our hearts that sooner or later a man, maybe a distant descendant, will walk on the surface of this wondrous satellite of the Earth.

And that day had arrived. Two men in the lunar module *Eagle* were approaching the Moon.

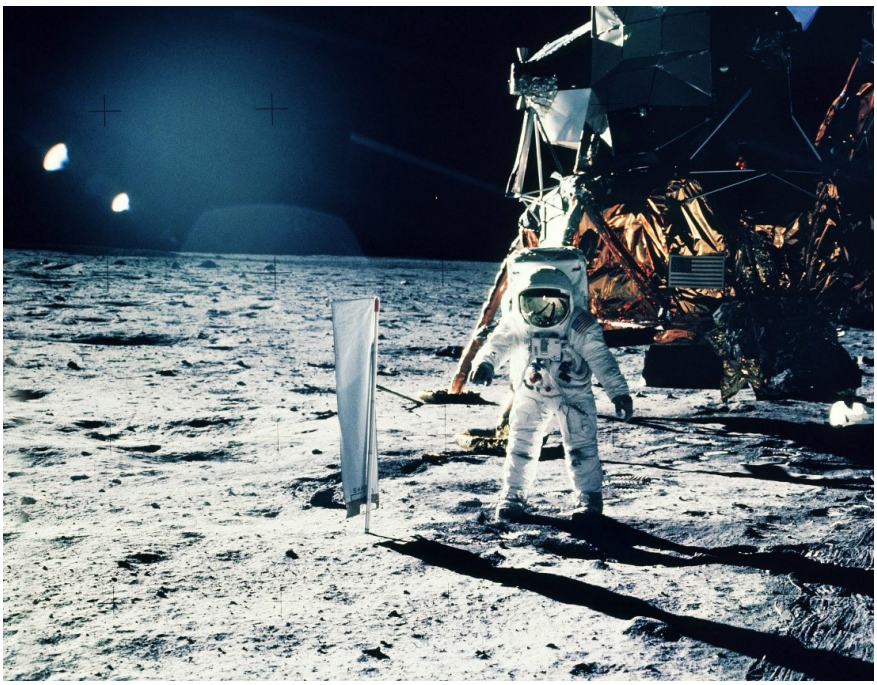
It is said that the encounter with the moon prompted a sense of awe in all the participants of the lunar mission. Michael Collins described his feelings with great emotion:

"To begin with, it is huge, completely filling our window. Second, it is three-dimensional: The belly of it bulges out toward us in such a pronounced fashion that I almost feel I can reach out and touch it... The sun casts a halo around it, shining on its rear surface, and the sunlight which comes cascading around its rim serves mainly to make the moon itself seem mysterious and subtle by comparison, emphasizing the size and texture of its dimly lit and pockmarked surface... This cool, magnificent sphere hangs there ominously, a formidable presence without sound or motion, issuing

us no invitation to invade its domain."

The lunar surface was swiftly coming close. Neil Armstrong's heart rate hit 150. At the altitude of about 400 meters he noticed that the lunar module was heading to a point on the edge of a large crater, surrounded by boulders and rocks. Neil realized that he could not land the *Eagle* in a safe spot before the crater and decided to fly over it. At the altitude of about 150 meters he pitched the lunar module forward until it was gliding over this field of boulders at 100 meters. Buzz Aldrin continued his audible readings of altitude, speed and remaining fuel. Suddenly Houston warned: "*Thirty seconds. That's how much fuel they have left."* Neil Armstrong acted swiftly and expertly as he deftly steered the *Eagle* to a soft landing. The braking thrust generated a huge cloud of dust and the astronauts lost visibility. First one landing pad and then the other three touched down and the instruments showed they were on the surface. *"Contact light,"* Aldrin reported to Houston. Houston asked for confirmation that the great deed had been done. After a few seconds Armstrong confirmed the triumph of mankind: *"Houston,* Tranquility Base *here. The* Eagle *has landed."*

After several hours, on July 21, 1969, in the southwest part of Sea of Tranquility on the Moon the astronauts Neil Armstrong and Edwin "Buzz" Aldrin exited the lunar module the *Eagle* of *Apollo 11* and stepped off onto the lunar surface, thus finishing the enormous ideological and technological race of the century. Millions of people watched the live TV broadcast from the moon. This was a first in the history of mankind.



The glory of a great accomplishment always goes to the pioneers!

Innumerable people traveled around the world, but the first to go around the globe and prove at the price of his life that the Earth was round was Ferdinand Magellan. Many brave explorers risked their lives to reach the North and South Poles, but the first to accomplish it was Roald Amundsen. Nowadays antibiotics are manufactured routinely, but penicillin that saved hundreds of millions of lives, was first discovered and produced by Alexander Fleming. Many cosmonauts and astronauts went to space and soon it may become an affordable tourist destination, but Yuri Gagarin was the first.

Following the historic flight of *Apollo 11*, over the next several years ten more American astronauts aboard *Apollo 12,14,15,16* and *17* went to the Moon, walked its lifeless deserts, studied it and brought Moon rocks back to the Earth, but Neil Armstrong and Edwin "Buzz" Aldrin were

the first. These trailblazers left on the Moon a plaque with the map of the Earth and these words:

Here men from the planet Earth
first set foot upon the Moon
July 1969, A.D.
We came in peace for all mankind

These majestic words must be the best and most expressive words that can be said about the long and intense fight for the Moon between the two super powers of the 20th century.

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