This chapter from my 1981 book "Red Star in Orbit "was an outgrowth of my research paper, "Korolev, Khrushchev, and Sputnik", published in 1977 in the British Interplanetary Society's monthly magazine 'Spaceflight' (and later winner of the 'Goddard Space History Prize' sponsored by the National Space Club in Washington, DC). That research first introduced the English-speaking world to Sergey Korolev and his role in getting Sputnik launched, so it's fitting to re-issue the chapter (and in coming months, additional chapters from the 1981 book) in honor of the 50th anniversary of the birth of the Space Age. Fortunately, we are also much better informed now than 30 years ago, so many of the statements, guesses, and assessments in this chapter have been modified (and sometimes overturned) by subsequent research. Without interfering too much in the narrative flow, I have tried to insert updates and corrections, in special font, where needed.

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The Birth of Sputnik

During the first week of October 1957, an international scientific conference was drawing to a close in Washington, D.C. One of the attendees at that conference was an American scientist who was born in Russia and had served as an officer in the tsarist navy until the Bolshevik Revolution forced him to flee. Constantine, as I will call him, was a long-time enthusiast of space exploration. He had read all of the works of Konstantin Tsiolkovskiy, Nikolay Rynin and other Russian space visionaries, and he chose the subject of space flight at the conference to tease the Soviet scientists.

The hundredth anniversary of Tsiolkovskiy's birth had been marked only a few weeks before. "Poor Tsiolkovskiy is turning in his grave," the ex-tsarist officer taunted. "His hundredth birthday has passed without even one Russian artificial earth satellite in orbit. Under the Tsar we would have had several of them long before now and would have celebrated the anniversary with a flight to the moon."

Most of the Soviet scientists took no offense at his ribbing, but one official, after attempting to restrain himself, finally blurted out, "Just you wait and see!" Constantine, sensing that

he had touched a nerve, pressed his attack: "That's easy for you to say, but you are returning to Moscow next Sunday" -- that would be October 6, just two days away. The man retorted, "It will be before then -- you'll eat your words." Constantine, surprised by the man's confidence, realized he had uncovered something significant.

Suspicions that the Soviets were about to embark on some spectacular space venture had been aroused even before the conference, ever since they had claimed that, like the Americans, they, too, were preparing to launch scientific satellites as part of the International Geophysical Year. Two months before, they had announced the successful flight of an intercontinental ballistic missile, an ideal booster rocket for such a space probe; only days before, they had quietly released the radio frequencies at which their sputnik (Russian for satellite) would soon be transmitting.

Other people at the Washington conference also came to the conclusion that something would soon break. Walter Sullivan, a New York Times science correspondent, had picked up several such rumors and had researched all the earlier hints and speculations. Late that Friday afternoon he submitted a story to the New York news desk for publication in Saturday morning's edition (October 5). The space shot, Sullivan had written, could come "at any time." The dateline on his story was Friday, October 4, 1957. The story was never printed.

Instead, in Saturday's New York Times, under a three-level full-page banner headline saved for particularly earth-shaking events, was the news from Moscow: the satellite, ‘Sputnik’, had been launched late Friday, Moscow time. Probably it had happened at about the same time that Sullivan was drafting his article and Constantine was teasing his Russian colleagues. Sullivan did not learn of the launching until late that evening; however, the Russian official's blurted boast had intrigued Constantine so much that he passed the story to some friends of his at the Naval Research Laboratory outside of Washington. They immediately tuned in their radio equipment to the frequencies which had been published a few days earlier -- and within hours were picking up the signals from the satellite even before its launching had been announced in Moscow.

The launching of Sputnik-1 is a convenient milestone at which to mark the birth of the space age and the subsequent space race between the United States and the Soviet Union. But to appreciate all the dimensions of that fascinating development, the roots of Sputnik must be traced in detail. How it was launched -- that was a technological question soon answered. Who were the men who had launched it -- that, too, was answered, although this question was more difficult. But why was the project carried out? Only after a quarter century can we really answer that question.

The careers of two exceptional men are intertwined in the development of the Sputnik project and the subsequent spaceflight explosion, which took men to the moon only twelve years afterward and set up permanent outer-space outposts within a quarter of a century. These men were Nikita Sergeyevich Khrushchev, the former miner, party bureaucrat, purge master and canny political manipulator, and Sergey Pavlovich Korolev, the engineer, pilot, GULag survivor, rocket magician and, finally, master of the embryonic Soviet space program. The Sputnik and the space age were born from the combination (and often conflict) of these two men's needs and capabilities.

The life of Korolev falls into several distinct phases. It has been frustratingly difficult to untangle the threads of adulation, cover-up and falsehood that have been wrapped around him by official biographers. The first phase of his life, which can be styled his "apprenticeship," has been described in a fairly straightforward manner even in the official chronologies -- but it stops abruptly in 1938, when Korolev (then aged thirty-two) was swallowed up into the monstrosity of the GULag Archipelago so vividly documented by Robert Conquest and Aleksandr Solzhenitsyn.

For the next fifteen years of his life, the most that Moscow has made available is a careful selection of isolated impressions and half-truths, with many years passed over in silence. Korolev emerges again as a real person in the mid-1950s, but with one particular drawback: while he was alive (he died in 1966), Khrushchev kept him anonymous, referring to him only as the “chief designer” and allowing him to publish only under the pseudonym “Sergeyev”; when his existence was finally

acknowledged after a solemn state funeral, Khrushchev's turn had come to be deleted from the Soviet loose-leaf history books, and he was never thereafter referred to in relation to the development of the Soviet space plans in the 1950s. So a complete and honest appraisal of this relationship has never been published inside the Soviet Union.

[2007: This became possible years later, but it took the USSR's collapse to enable it – an eventuality unbelievable in 1981 – JEO]

Korolev's early life in the Ukraine, his studies at an aeronautics institute run by the great airplane designer Tupolev in Moscow and his amateur enthusiasm for flying homemade gliders have been well documented even in Soviet accounts By the mid-1930s, just before his thirtieth birthday, he switched his spare-time enthusiasms from glider design to rocket propulsion research; he joined a small group led by the Latvian engineer Friedrich Zander. Their unofficial organization was named GIRD, which nominally stood for Group Studying Rocket Propulsion -- but in recognition of the fact that they received no official support and had to acquire all of their materials from their own resources, they often jokingly referred to themselves as the Group Working for Nothing which worked out to the same letters in Russian.

During this period, Korolev earned his living as a professsional engineer designing aircraft in the bureau run by Tupolev, Russia's greatest aeronautical engineers and the creator of the line of aircraft bearing the Tu prefix – the Tu-20 (Bear), Tu-16 (Badger), Tu-56 (Blinder) and the supersonic Tu-144, as examples. But Korolev's enthusiasms were aimed at higher targets, and he avidly read books on rocketry and space travel. In 1934 he visited the home of Russia's revered space prophet, Konstantin Tsiolkovskiy (or Ziolkowsky -- his father was a Polish lumberjack who had moved to Russia), and met briefly with the great man himself. Within a year, Tsiolkovskiy had died -- but his dreams lived on in many Russians, including Korolev.

Rocketry research, meanwhile, took a great leap forward when it received the official blessing of Soviet Armaments Minister Mikhail N. Tukhachevskiy, who was intrigued by the possibility of rocket weapons. He was also apparently a genuine enthusiast about the concept of space travel, which, of course,

would be accomplished by Soviet pioneers! So GIRD suddenly received a substantial budget and several full-time employees, first among them being Korolev, who was granted a commission of general-engineer (one star) in the Red Army.

Under the patronage of Tukhachevskiy, rocket research flourished. In 1933 the first free flight of a Russian-made liquid-fuel rocket took place at an army base near Nakhabino, outside of Moscow. Development continued for several years, spurred on by reports of the work of Robert Goddard in the United States (where it was ignored by the government and by the academic community) and of a group of German engineers. But this embryonic three-way space race ended disastrously for the Russian side in 1937.

The Stalin purges had been ravaging the nation's intelligentsia, while the collectivization drives were wiping out millions of peasants -- but Korolev and his team no doubt felt safe under the wing of the highest-ranking Soviet military officer in the Red Army. But they were fooling themselves: Tukhachevskiy was suddenly arrested on June 10, 1937, and his whole staff followed him into prison and to their deaths. Stalin evidently suspected him of "Bonapartist" tendencies, believing perhaps that forty-three-year-old Tukhachevskiy planned to overthrow the Communist party and set up a military dictatorship. Stalin's distrust was also evidently fueled by falsified documentation implicating Tukhachevskiy, documentation prepared and planted by German agents. The politics of this episode remain obscure, but the effect on the fledgling Soviet rocket program was immediately obvious: annihilation.

All of Tukhachevskiy's favorite projects were automatically suspect since they no doubt would be staffed by numerous pro-Tukhachevskiy people. Stalin's secret police took no chances: everyone within reach was arrested. Korolev's life nearly ended -- his official biographies stutter at this point and leap many years into the future.

A former fellow prisoner of Korolev's recounted how the future chief designer was initially interrogated by the secret police at Butyrskaya Prison in Moscow: "Your pyrotechnics and fireworks are not only unnecessary to our country but are actually dangerous," he was told. To protect the country

Korolev was shipped off in a boxcar with a number and a life term. There were millions like him in those years, and most of them died.

Information about this phase of his life must be gathered from a number of independent (and, of course, unofficial) sources. However, defecting Soviet science writer Leonid Vladimirov has listed a series of oblique references which have made their ways into official books. Other sources are the samizdat underground newsletters which circulated in Moscow in the late 1960s and early 1970s. Chronicle of Current Events, number 10, issued October 31, 1969, criticized Politizdat (Political Publishing House) because a new book by A. Romanov about Sergey Pavlovich Korolev was deliberately incomplete: "There is no mention of the fact that Korolev was arrested and subjugated to repressive measures, nor of what became of Korolev's immediate teachers and close friends."

Throughout his prison term Korolev was described by former comrades as "absolutely firm, never disguising his contempt for the regime" Another Russian engineer who knew him in prison described him as "a cynic and a pessimist" whose favorite slogan was "We will all vanish without a trace." The closest any work has come to an official admission of this imprisonment was a fairly honest biography of Korolev by Yaroslav Golovanov, who made this suggestive comment when referring to Korolev's work in the 1930s: "He could not then by any means know that there would be many very hard times, sometimes cruelly unjust to him." Golovanov's ambiguity may have been fueled by Korolev's own utter refusal to discuss that period with strangers: "Several times I led the conversation round to his past," Golovanov wrote in 1967. "But as far as I remember, he did not like this theme and always tried to switch our talk in another direction."

Well could he have wished to avoid such themes, especially about the events of 1937. For months he had been packed in a boxcar heading eastward along the Trains-Siberian Railroad, only to be transferred at the Pacific coast into the crowded hold of a prison ship. The final destination was the east Siberian port of Magadan, staging area for the Kolyma gold mines, an infamous charnel house even by GULag standards. But back in Moscow a card with his number on it had been flied in a box in

some police archive – and as if by a miracle, he survived a full year at Kolyma before receiving a reprieve in the form of an order back to a special prison in Moscow.

As it turned out, Tupolov had saved him. The aircraft designer and his entire staff had also been arrested but had been locked up in a special prison, a 'sharashka', as the inmates called it, where they continued their engineering work on military projects. Korolev's time there was mentioned in Solzhenitsyn's documentation: "The father of space navigation, Korolev, was taken into a sharashka as an aviation scientist. The sharashka administration did not allow him to work on rockets and he had to do that work at night." Tupolev had been instructed to gather together any other of his engineers who had been scattered throughout the GULag, and it was his request for Korolev (and the officiousness of some secret-police bureaucrat who was actually able to trace Korolev's sentence) that had snatched him to the relative safety of the sharashka.

Korolev spent several years in the prison near Moscow while World War II was ignited and Germany invaded Russia. As the Wehrmacht neared Moscow, the Tupolev group was evacuated (still under guard -- there was always the chance they might try to escape and join the Nazis!) to Omsk. Korolev had been there for only a few months when he was transferred to Special Prison Number 4 (location unknown), where a group was working on rocket-assisted airplane takeoff systems, on bombardment rockets, on an in-flight emergency acceleration rocket for conventional aircraft and on pure rocket- and jet-propelled aircraft. The engineer in charge of the unit was Valentin Glushko, an old friend and colleague of Korolev's from the GIRD days who had somehow struck a deal with the secret police and was now a free man.

[2007: Glushko, it now turns out, was a prisoner as well, but had come to the sharaska directly from his arrest, not via the GULag. There remains some question of whether Glushko had denounced Korolev originally, with how much coercion – JEO]

The team worked for four years on these projects, with Korolev serving as Glushko's deputy for flight testing. After the war ended, Korolev's position improved, although he was still nominally a prisoner serving a life term for treason.

He and Glushko were assigned to a new rocket group under the command of an opportunistic and ambitious engineer named Chelomey (or Chalomei -- sources disagree on the spelling).

[This was Chelomey, who later hired Khrushchev's son as an engineer and became a bitter rival of Korolev's, although it's no longer at all likely that Korolev ever worked for him – JEO]

When Glushko went to Germany in 1946 to study captured V-2 equipment (the first trainload of material from Peenemunde had been hijacked by Americans and replaced with wrecked farm machinery), he took Korolev along -- under heavy guard. They both attended a British-sponsored test launch of an extra V-2 from the Baltic town of Altenwaide ("Operation Backfire"), but Korolev's name had not been officially submitted to the British site commander -- perhaps because the Soviet secret police would not let him out of their direct custody -- so he was forced to watch the test from outside the barbed-wire compound.

When Glushko returned to Russia, Korolev remained in Germany (no doubt under appropriate supervision) to direct the repair of the underground V-2 factory at Niedersachswerfen and to coordinate the shipment of V-2 equipment to the Soviet Union. He escorted the last shipment back to Russia in the summer of 1946 and supervised some test firings at a Soviet missile range on the lower Volga River, not far from Stalingrad. Korolev then returned to the Russian zone of Germany, where he interviewed dozens of former V-2 engineers and technicians (he was self-taught in German and English). Having prepared a list of useful Germans, he turned it over to Soviet security forces -- and on the night of October 22-23, 1946, soldiers rounded up everyone on the list for immediate departure for Russia. There they were split into numerous design teams and put to work on various research programs; most did not return to Germany until 1950-1951.

The Russians, meanwhile, pursued their own rocket research with their own surviving experts. The German teams were used for collateral research or to cross-check each other and confirm Russian developments, and were never integrated into the mainline Russian development program. The first all-Russian ballistic missile, code-named the R-1, was created under the

leadership of Korolev in late 1947; somehow Glushko returned to his subservient position and was in charge of the rocket engine while Korolev directed the entire project. Eleven test flights in October and November 1947 marked the resumption of forward motion of Korolev's dreams for space flight. He was even called to the Kremlin to personally brief Stalin on the military missile program.

Golovanov, the most candid of the official biographers, made a poignant commentary on Korolev's life during this period, a comment that could not be fully appreciated without knowing about the GULag years. "Korolev was a most exact reflection of an epoch," wrote Golovanov in 1968. "He has become part of it, it would seem, forever and imperishably. He knew all its triumphs and drained the cup of its bitterness to the dregs. Korolev's biography is the concretization of the history of our land in one man.

After a few years of near freedom, Korolev may have been thrown back into prison. Some of his former colleagues have reported that he was sent back in a sharashka in 1948 (although other reliable sources make no mention of this second incarceration).[2007: There is no longer any evidence suggesting this second arrest occurred, although Beriya did apparently threaten it – JEO] These special prisons have been eloquently described by the Russian novelist Solzhenitsyn in his First Circle. (According to Dante, the first circle was the highest and least uncomfortable circle of Hell.) Many observers regard a peripheral character in Chapter 17, a man named Bobynin, to be based on Korolcv himself during his second imprisonment. In one bristling retort to a Soviet army interrogator, Bobynin/Korolev expressed the thoughts which might have gotten him into prison in the first place--and certainly kept him there:

"We could make you talk."

"You are wrong, Citizen Minister!" Bobynin's strong eyes shone with hate. "I have nothing, you understand, nothing! You can't get your hands on my wife and child -- a bomb got them first. My parents are already dead. My entire property on this earth is my handkerchief; my coveralls and my underwear are government issue. You took my freedom away long ago, and you don't have the power to return it because you don't have it

yourself. I am forty-two years old [so was Korolev], and you've dished me out a twenty-five-year term. I've already been at hard labor, gone around with a number on, in handcuffs, with police dogs, and a strict-regime work brigade. What else is there you can threaten me with? What can you deprive me of? My work as an engineer? You'll lose more than I will..."

Only two circumstances need revising to convert the fictional Bobynin into the authentic Korolev. First, Korolev's mother was still alive (and, indeed, was to survive him by more than fifteen years). Also, his wife and child were alive -- but separated from him. In 1946, upon regaining his freedom for the first time, Korolev had divorced his first wife, Oxana (or Xenia) Vincentini. (Their one daughter had been born about 1935.) She had apparently yielded to pressure and had denounced him while he was at Kolyma, and then had never communicated with him again. The next year, 1947, Korolev had remarried, to Nina Kotenkova.

[2007: This may not have been the reason for the breakup, since we later learned that Korolev's mother sided with her daughter-in-law against her son's actions in this affair – JEO]

Following Stalin's death in 1953, Korolev was rehabilitated, along with hundreds of thousands of other purge victims. In Korolev's case, he was offered membership in the Communist party, and whatever his personal feelings, he knew it would increase his political influence -- so he accepted. Korolev was also quickly rewarded for his previous work by election to the Soviet Academy of Sciences, first as a corresponding member (there are about three hundred) and soon afterward as a full member (of which there are about one hundred and fifty).

His rapid rise in the post-Stalin years may not have been based purely on merit: it was Khrushchev's policy not merely to rehabilitate purge victims, but to promote many of them above others who had gone along with Stalin's regime, thus providing Khrushchev with cadres of ready-made loyalists who owed their new positions to him -- and would *fall* with him.

The new field of military missiles was one which obviously required careful watching. Russia's need for modern rocket weapons had become indisputable, and even before Stalin's death, industrial organizations had been set up to produce the new equipment. In mid-1953 a new organization called the

Ministry for Medium Machine Building was founded, with the sole purpose of directing the manufacture of missiles. Some junior members of the Soviet government were assigned to maintain liaison between the engineers and the politicians. One was Dmitriy Ustinov, a young but highly competent armaments manager; the other was Leonid Brezhnev, an engineer turned politician.

Khrushchev first met Korolev when the "collective leadership" which followed Stalin's death in 1953 tried to grapple with the issue of the new rocket weapons. Stalin had favored such rockets because Tupolev's airplane bureau had been unable to design bombers with ranges sufficiently great to reach the United States -- powerful missiles promised to overcome this restriction. (Korolev had taken charge of the project after his rehabilitation.) But as Khrushchev later admitted in his memoirs, the new leaders had been kept in the dark by Stalin and knew very little about rockets at all: "Korolev came to the Politburo meeting to report on his work. I don't want to exaggerate, but I'd say we gawked at what he showed us as if we were sheep seeing a new gate for the first time. When he showed us one of his rockets, we thought it looked like nothing but a huge cigar-shaped tube, and we didn't believe it would fly. Korolev took us on a tour of the launching pad and tried to explain to us how a rocket worked. We were like peasants in a marketplace. We walked around the rocket, touching it, tapping it to see if it was sturdy enough -- we did everything but lick it to see how it tasted.... We had absolute confidence in Comrade Korolev. When he expounded his ideas, you could see passion burning in his eyes, and his reports were always models of clarity. He had unlimited energy and determination, and he was a brilliant organizer."

This impression of Korolev was a common one. Biographers both inside and outside the Soviet Union seem to paint a consistent portrait of Korolev's character. For example, another official biographer, Pyotr Astashenkov, wrote: "Korolev combined an excellent theoretical background, scientific foresight and organizing ability with the determination to fight hard for his ideas." Romanov's 1968 biography was even more graphic: "I study the scientist: a high and handsome forehead, as though intentionally modeled by a sculptor in order to

emphasize the unusual qualities of this uncommon man. Black eyebrows, on the straight side. Over-wide and deep-set brown eyes. Energy blazes in them. At different times I have seen them angry and kind, raging and mocking, determined and good-natured. But in many years of knowing the man I have never seen them empty or indifferent. The mouth is firmly delineated, the corners down-turned, the chin juts forward. Taken all together, the appearance of the person sitting before me conveys tremendous energy, power, authority."

A former colleague, writing in the freer atmosphere of Yugoslavia, where he had taken political refuge, corroborated that image: "Korolev had great authority and commanded respect from those with whom he worked," wrote Sergey Korda in an obituary in 1966. "A man of inexhaustible energy, he combined great talent, excellent engineering intuition and surprising creative boldness with outstanding administrative capabilities and high spiritual values."

But a few words of caution are in order. Golovanov, most honest of the official biographers, pointed out that "there is no need to idealize Korolev. He was tough and harsh but cold and daring, sly and cunning but not devious. He was blunt, but he knew his business. And the main thing about him was his ideal."

That ideal, of course, was space exploration. But to achieve that purpose, to send men into space, as he had been planning for years, and to send probes to the moon and nearby planets, he needed an immense budget -- and Khrushchev was the one he had to persuade. Getting funding for military missiles was one thing, but for space projects -- that was an entirely different matter.

In 1956 his first attempts to get approval for an earth satellite project were rebuffed. As he later recounted it, "We closely followed reports on the building in the United States of an artificial earth satellite with the suggestive name of 'Vanguard.' At that time some people believed that this satellite would be the first in outer space.... We took stock of what we had, and decided that we could send a good hundred kilograms into orbit. So we went to the Central Committee of the Communist party. There we were told that the idea was attractive but needed more thought."

Even without approval for the satellite project, Korolev continued work on the R-7 rocket (in Russian, it was affectionately known as "ol' number seven," or *semyorka),* the giant missile designed to carry a bulky two-ton thermonuclear bomb more than four thousand miles, far enough to reach the United States. As it turned out, the *semyorka* was a very inefficient military missile but an excellent space booster, which is probably what Korolev had in mind all along.

To test this giant new rocket, with a lift-off thrust of more than one million pounds (three times that of its American counterpart, the Atlas), an entirely new missile test range was needed. Construction began in June 1955 near the Aral Sea, north of the small village of Tyuratam in Kazakhstan. The party secretary of Kazakhstan at that time was Leonid Brezhnev, and he took great interest in the development of the missile project. So did the American CIA: before the concrete on the launch pad was dry, U-2 spy planes were flying overhead to keep tabs on the project.

The first R-7 exploded on launch in the late spring of 1957. Several more attempts also ended catastrophically, and by July 1957 Korolev was facing serious criticism from rival rocket experts (particularly the engineer Chelomey) and from Moscow bureaucrats; his satellite project looked hopeless. According to a thinly disguised but highly sanitized semi-biographical movie *(The Taming of Fire,* Mosfilm, 1972), Korolev counterattacked: "You think only Atlas missiles can explode? We are building the most powerful machines in the world!" His reference to the Atlas explsion during its first launch on June 11 helps date this comment (if the comment is authentic) and the R-7 failures which preceded it; the statement must also have preceded August 3, when the first successful launch was finally accomplished. A second success followed a few weeks later, when the missile was sent full range into the Paciftc near the Kamchatka peninsula (and not too far from the Kolyma gold mines where Korolev had slaved in 1938 — 1939).

Meanwhile, fireworks had also been going off in the Kremlin. The position of Khrushchev as "first among equals" in the collective leadership was rapidly deteriorating as his colleagues found unexpected unity in a common fear of Khrushchev's growing power. While using a campaign of anti-Stalinism to

combat his rivals, and by flaunting the success of his bold (his rivals styled it “reckless”) crushing of the October 1956 rebellion in Hungary, Khrushchev reached for total and undisputed power. The showdown came in June 1957, when several Khrushchev allies were absent from Moscow: the anti-Khrushchev forces on the Politburo demanded a debate on the ouster of Khrushchev from his official posts, and then voted six to one to replace him with Shepilov. (Malenkov, Molotov and Kaganovich led the fight against him, and when he appeared to have lost, Bulganin joined the opposition; loyalists Suslov, Mikoyan and others had been out of town on party business when the meeting was convened, as the conspirators had planned.) But Khrushchev maneuvered adroitly and delayed certain official actions until a full Central Committee meeting could be convened. Meanwhile, he called upon Red Army leader Zhukov to organize an airlift of loyalists (and detours of unreliables) from all over the Soviet Union to the showdown vote in Moscow -- which he then won.

His victory, while sweet, must have been incomplete. No doubt he suspected continued disaffection within the party apparatus, even as he drove the leaders of the revolt into retirement or obscurity. No doubt he also feared having given Zhukov a taste of power, since Zhukov, the victorious general of World War II, was a far more popular figure than Khrushchev, not only among the armed forces but also within the party hierarchy itself. Lest Zhukov move to grasp full political power (as his American counterpart, Eisenhower, already had -- or so Khrushchev may have reasoned by analogy), he was the next target for elimination.

At the same time, Khrushchev was genuinely concerned about perceived military threats from the United States. If Russians in general seem to be paranoid about foreign invasions, they have also really been the victims of countless such invasions and attacks. From the Russian point of view, the American bases near their borders, combined with belligerent statements from American officials, were cause for genuine alarm. A way of reducing Russia’s susceptibility to attack was the development of a credible deterrent system, such as nuclear-tipped missiles -- but such a deterrent is useful only so far as it is believable, and any Russian claim to have invented such a

device would probably be laughed off along with previous claims to the invention of airplanes, steam engines, radio, tractors and decimal coinage.

In the light of these domestic and international problems, Korolev's proposal for a Soviet artificial satellite (to be launched by an R-7 missile with a reduced payload) suddenly became much more attractive to Khrushchev. First, it would signal to dissident political forces within the Soviet Union that Khrushchev was really leading the country to a glorious future; second, it would overawe the traditionalist "artillery generals" in the Red Army and allow a reorganization of the armed forces, including a reduction in obsolete ground forces (saving money and pulling the rug out from under possible opposition leaders); last, it would demonstrate in an unequivocal manner the existence of the long-range missile system, which was intended to discourage a potential attack from the United States. Under these circumstances, what had at first appeared to be a pointless diversion of technical resources suddenly became -- as far as Khrushchev personally was concerned -- a powerful idea. And so, as Korolev later recounted, "in the summer of 1957 the Central Committee [a euphemism for Khrushchev, who by that time exercised full power] finally endorsed the project." It should be noted that neither science nor world opinion seems to have entered into consideration.

[2007: We now know an even better reason: the warheads launched by the successful rocket tests in August had both disintegrated when they hit the atmosphere, so no further military tests could occur until their heat shields were redesigned – JEO]

If approval for the satellite project came after the first successful R-7 launches in mid-August, Korolev's team had only one month to go before the hundredth anniversary of Tsiolkovskiy's birth. (That anniversary would have meant little to Khrushchev anyway.) It took them, instead, about six weeks -- and Korolev literally lived at the launch pad to accomplish this.

The concrete stand from which the satellite would be launched stood at the edge of a two-hundred-foot-deep, half-mile-wide pit, a natural bay in a high ridge which crossed the missile center. Railway lines ran south.from the pad to an assembly building about a mile away; there the missile was

assembled horizontally (from sections shipped by rail from Moscow) on a railroad flatcar before being hauled out to the pad, erected and fueled for launch.

Halfway between the assembly building and the pad was a grove of trees surrounding a natural spring. In that grove Korolev had built a small wood-frame house for his own personal use. He would meet there with his deputies, or would walk fifteen minutes to the assembly hail in one direction or ten minutes to the launch pad in the other direction. Workers knew that Korolev could -- and did -- drop in at anytime of the day or night; he did not sleep much.

[2007: I have walked that route, astonished to be there, with my own two legs, and the cottage is actually south of the assembly building, with the launch pad farther to the northeast – JEO]

There were other workers at the missile center whom Korolev could not visit, even though he knew them well. They were the men who had poured the concrete, excavated the bunkers and erected the buildings in which the rockets were being assembled. But the color of their drab clothing, and the color of the uniforms of their guards, identified these men as zeks, political prisoners among whose ranks Korolev had spent many, many years. Their work, too, contributed to Korolev's dream of the conquest of space -- and no record exists of how he felt about their presence or what he could do (if anything) for them. They, too, must have been on his mind in those hectic weeks.

[2007: Prisoners were not used in building the cosmodrome, it turned out, not through mercy but due to demands of security, so all workers were military personnel and space engineers – JEO]

A simple test satellite was thrown together in one of the smaller machine shops in the assembly building. It consisted of a radio transmitter hooked up to a thermometer and powered by a pack of chemical batteries. The object was affectionately known as the "PS," the preliminary satellite -- and this caused some confusion among many newly arrived engineers, since Korolev himself was known to his men as "old SP," for Sergey Pavlovich. The two nicknames *"es-peh"* and *'peh-yess"* were often mixed together indiscriminately in those weeks, their intimate interrelationship blending in the minds of the workers into one entity. It *was* Korolev, or a significant part of him, who would be riding on that rocket.

Finally the payload was attached to the nose of the rocket as it lay on its carrier inside the assembly hall. As the nose cone was slid into place, a technician flipped a switch on the PS, activating its radio system. Someone had brought a shortwave radio into the hall, and the *beep-beep-beep* of the future Sputnik echoed strangely around the suddenly silent rocket specialists. The nose cone slid into place and the radio receiver was turned off; the men surged back to action.

Korolev took his place inside the command bunker, a steel-walled room built right into the concrete launch pad, about three hundred feet from the rocket itself. Some men watched the rocket through periscopes, while others monitored dials and meters. Korolev sat at a wooden desk, a white lab coat over his work clothes and a microphone in his hand.

As the countdown neared zero, a lone figure suddenly appeared on the concrete apron and blew a series of long trumpet blasts before vanishing back to his duty post. Nobody ever revealed who it was, and it might have been Koro1ev himself.

[2007: It was a military bugler sounding a 'now hear this' alert tocsin, and many witnesses remember it, but not his name – JEO]

The sun had long since set when the count reached zero after many exasperating delays. The firing command was given and an automatic sequence of pump activation began; moments later, the engines lifted off; dazzling the watchers at the periscopes and temporarily deafening the occupants of the control blockhouse. Then the PS was on its way; within four minutes it was only a tiny spot of light in the northeastern sky.

During the ascent, twenty separate engines in five long pods fired in unison. The central cylinder held the satellite in its nose, while four tapered cylinders were attached to its sides in "parallel staging." The tapered units exhausted their fuel first and peeled away like a flower unfolding its petals; the thicker central stage continued burning for another five minutes until it was soaring at more than 18,000 miles per hour, two hundred miles above earth's surface. Gravity still pulled the now freely falling PS back toward earth on a descending arc -- but so great was its speed (as Korolev had calculated) that the horizon of a spherical earth receded from the falling object at the same rate. PS was in orbit above the atmosphere. It was 1930 hours

Greenwich mean time (2:30 in the afternoon in Washington, and 10:30 at night in Moscow); an hour and a half later, the PS finished its first circumnavigation of its home planet, announcing its success to radio listeners via its distinctive radio call sign.

Korolev's rocket team assembled at the still-smoking launch pad to await the news from the tracking site. The soon-to-be-famous *beep-beep-beep* was played over the pad speakers and the men cheered. Korolev stood up on an improvised rostrum and addressed his colleagues with a speech that, although impromptu, had probably been part of his daydreaming most of his life. "Today the dreams of the best sons of mankind have come true," he told the crowd of engineers. "The assault on space has begun." It was a vindication of his long-standing insistence that space travel was possible; as a later biography put it, it "was the culmination of his efforts to persuade skeptics that rocketry and astronautics were not merely science fiction."

Khrushchev had just returned to Moscow that night from his vacation home in the Crimea A few days later he described his own reactions to reporter James Reston, who noted that "Khrushchev's attitude on the launching of Sputnik. .. was almost casual." Khrushchev recounted that "when the satellite was launched, they phoned me that the rocket had taken the right course and that the satellite was already revolving around the earth. I congratulated the entire group of engineers and technicians on this outstanding achievement and calmly went to bed."

In contrast, Moscow spokesmen trumpeted the launching to extract all the propaganda they could muster. The original launch announcement had set the tone: "Artificial earth satellites will pave the way for space travel, and it seems that the present generation will witness how the freed and conscious labor of the people of the new socialist society turns even the most daring of mankind's dreams into reality." That was to be the propaganda theme: success in space implied superiority on earth.

Khrushchev moved to exploit the impact of the announcement, for the purposes of which he had originally approved it -- but as the days went by, he seems to have been surprised by the depth of the feat's impact on the Western public. That would

turn out to be a bonus, but his original short-range purposes were also fully met: his reorganization of the armed forces proceeded swiftly, and less than five weeks after Sputnik-1, he removed Zhukov from his post. Within a year he had completed the demobilization of a million soldiers from the Red Army, had replaced additional dissident generals (including the army Chief of Staff) and had set up an independent missile force coequal with the army, navy and air force. “We had to overcome resistance among the traditionalist generals,” Khrushchev delicately worded it in his memoirs. To implement his new programs, he found loyal military officers who would obey him completely; one such man was Field Marshal Mitrofan Nedelin, a former artillery expert who was put in command of the entire Soviet missile forces and who thus became Korolev’s operational commander. Nedelin’s eagerness to fulfill Khrushchev’s orders would lead to tragedy and to his own death -- but that story comes later.

As far as the lesson Khrushchev had planned for the West, it also was completely successful: “When we announced the successful testing of an intercontinental rocket, some U.S. statesmen did not believe us,” he crowed. “The Soviet Union, you see, was saying it had something it did not really have. Now that we have successfully launched an earth satellite, only the technically ignorant people can doubt this.... We can launch satellites because we have a carrier for them, namely the ballistic rocket.”

In the long run, however, Khrushchev’s exploitation of Sputnik (and the long string of subsequent Soviet space spectaculars) in an attempt to overawe the United States met with, at best, mixed results. It created some initial panic, but this was followed by American determination to spend whatever was necessary to “catch up” -- and Khrushchev probably had counted more on a stunned paralysis than on the vigorous counterthrust that followed. His boasts about producing ICBMs by the dozens, “like sausages,” led to the fears of the “missile gap,” a theme with which the Democratic Party ousted the Republicans in a squeaker election in November 1960.

Meanwhile, many people in the West sought excuses for their lag. Some blamed it all on Army-Navy rivalries, or on bad schools and materialistic values, or on politicians, industrialists,

intellectuals, whomever. Some complained, "We got the wrong Germans," a misconception even Eisenhower nourished when he announced it was "German scientists captured at the end of the Second World War [who] doubtless played a big part in the Soviet achievement." (One self-styled expert even claimed that *sputnik* was really a German word, *sputt-nicht,* a farewell wish to the rocket to "sputter not"!) America's cosmic humiliations continued, with bigger and better Sputniks circling over the burning wreckage of American "flopniks" and "pfftniks."

Amid the near hysteria, some voices called out for calm, claiming that the effects of the Soviet, space shots had been exaggerated. Senator William Fulbright, for example, wrote: "What about the prestige that Sputnik gave the USSR? It does not feed their people. It was a trick, a kind of gambit. It does not convert anyone to communism. So far as real prestige goes, it is nothing." The world, however, did not seem to operate in such intellectual terms: Sputnik made a big impact, at least according to surveys made by the U.S. Information Agency; In one report, "World Reaction to the United States and Soviet Space Programs" (done in mid-1960), the USIA wrote that most of the West believed that Moscow was ahead and would still be ahead after ten years.

In countries such as England, France, Germany, Italy and Norway, space activities were reported in the context of a race between Russia and America. The report continued: "Within this rivalry, space achievements are viewed as particularly significant because of the strong tendency for the popular mind to view space achievements as an index of the scientific and technological aspects of the rival systems, and to link space capabilities with military, especially missile, capabilities."

The "missile gap," meanwhile, was a product of Khrushchev's boasts and American panic. Korolev's R-7 was an inefficient ICBM (and he had never intended anything different): it was too large to disperse into the countryside and had to be installed on rail spurs off the Trans-Siberian Railroad; it took hours to fuel and launch and could thus be caught on the ground by a sneak air attack; it required ground guidance stations, which could easily be bombed or sabotaged; with the smallest possible nuclear warhead, the operational version could barely reach targets in the northeastern United States.

After the success of the Sputnik, Korolev lined up a whole series of new space shots, and Khrushchev -- satisfied with the results of the first launches and delighted with the consternation such accomplishments were having in the West -- promised complete support A series of larger satellites with genuine scientific value were prepared: first a dog was sent up, to demonstrate that a living creature could survive days of weightlessness; then an even heavier geophysical probe was put into orbit (after the first of what would be a long series of satellite launch failures). Even the moon became a realistic target, theoretically brought within range by the addition of an upper stage to the *semyorka* -- but it took a series of launch failures starting in June 1958 to perfect the improved booster, and it was not until January 1959 (after the United States had had four launch opportunities of its own and missed all four times) that success was achieved. An even bigger upper stage was designed, and Korolev set his sights on Mars and Venus; the proven moon-rocket version was redirected toward an equally spectacular goal, manned flight into orbit -- and back.

It was at this point, in 1959-1960, that the Khrushchev-Korolev alliance began showing the first signs of strain. The problem was that Khrushchev had a very precise idea of what he was spending money on space shots for: to create the image, both at home and abroad, of a powerful Soviet technology and of a progressive and efficient Khrushchev regime.

Space research as such did not interest him. Although one defector remarked that “he adored fireworks of all kinds,” he never seems to have actually attended a space launch. Following the success of each project, Khrushchev ordered the cancellation of follow-on launchings of the same type, which, while promising to be more scientifically productive, would only appear to be “repetitious” and would not result in new gasps of shock and fear around the world.

At first Khrushchev timed his own political power plays to follow close on the heels of space spcctaculars, but as time passed, he began scheduling his diplomatic moves in advance, while demanding that Korolev conform his own space-launch schedule to meet Khrushchev’s convenience. In the three years which followed the launching of Sputnik-1, these policies led to a greater and greater divergence of goals -- and since

Khrushchev controlled the purse strings, it was Korolev who accommodated himself to the political demands.

One additional demand of Khrushchev's must have infuriated Korolev: the space-program chief designer, although no longer a condemned prisoner, was enveloped in even more effective chains. His identity was kept secret and he was forbidden not just to travel abroad (his political reliability was never trusted), but also to even correspond with foreign space experts. One case in particular must have frustrated Korolev, when Dr. Hermann Oberth of Germany, an old colleague of Tsiolkovskiy's and a space pioneer in his own right, asked to meet with him -- and Khrushchev forbade it. Wrote Oberth: "I am old, and at one time I lost hope that I would live to see the space era. And then a Russian Sputnik was orbiting the Earth . . . Unfortunately, I am not personally acquainted with another man I respect, the one who constructed the powerful rocket. Probably if my colleague Mr. Tsiolkovskiy were alive -- your esteemed fellow countryman with whom I corresponded -- then he and I, on meeting the wonderful designer, would exclaim 'Bravo! Bravo! You have realized the dream which nourished our minds for many years and for whose accomplishments we did our best.' Mankind is grateful to this man for his achievement." But neither Oberth nor anyone else was ever able to greet Korolev personally.

Khrushchev refused to share the glory with anyone, even Korolev himself. "It was important," wrote the defector Vladimirov in 1969, "that Khrushchev maintain the impression that the Sputniks were being launched by the 'Soviet people' under Khrushchev's leadership." Khrushchev justified the enforced anonymity by using it as an excuse to whip up spy mania and xenophobia among the Soviet population: "For those who created the rockets and artificial satellites," he promised, "we will raise an obelisk and inscribe their names on it in gold so they will be known to future generations" -- but he then blamed the West for their present anonymity: "We value and respect these people highly and assure their security from enemy agents who might be sent to destroy these outstanding people, our valuable cadres." And so Korolev the top space engineer was still Korolev the prisoner, although his physical horizons had widened slightly; his mental horizons, of course,

had never been restricted, even in the depths of his Siberian and *sharashka* exiles.

Korolev had moved into a new type of imprisonment -- with genuine rewards, to be sure, but with new types of punishments as well. One of these punishments was that in order to meet Khrushchev's demands, Korolev was compelled by the Soviet military missile hierarchy (personified by Field Marshal Nedelin) to gamble with other people's lives. On the night of October 23-24, 1960, one such gamble would be disastrously lost -- and dozens of Korolev's people would die horribly. Compared to the torture of these deaths, his memories of the Kolyma death camps must have paled.

[2007: The so-called 'Nedelin catastrophe' turned out to have been the responsibility of a competing team of missile builders and Korolev was not involved, although many of the military rocket officers who had helped launch Sputnik were indeed also on duty at the other launch pad three years later, and they died there. But that's another story – JEO]

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