

## Russia's Other Cosmodrome – Plesetsk

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Plesetsk is Russia's "other cosmodrome" north of Moscow. Operated by the Strategic Rocket Forces (and later the 'Space Forces') as a military space base, Plesetsk has been the mainstay of routine space launchings in Russia for more than forty years. But its role in the future of the much-reduced Russian space program remains uncertain, mainly because so little is known about the base and its background.

Of Russia's two main cosmodromes, Baykonur is by far the better known. Located in now-independent Kazakhstan, on a vast desert east of the Aral Sea, Baykonur is where Sputnik and Lunik and Vostok were launched fifty years ago. It is where the cosmonauts are launched from, where lunar and planetary probes blast off, where Western newsmen and tourists visit. It is the Russian "Cape Canaveral".

But 850 km north of Moscow, deep in the Russian 'taiga' (the ancient pine and birch forests) is another rocket launch site, called Plesetsk. Even the name, derived from an old Slavonic word for a bend in a river, is difficult for foreign tongues to say. Studying this secret installation has been even more tortuous than trying to pronounce it.

If Baykonur is in a foreign land, surrounded by very un-Russian geographical and cultural features, Plesetsk is deeply rooted in the true Russian historical experience and culture. And while Baykonur's future remains fragile, this foundation appears to give Plesetsk a solid basis for continued and even expanded space operations.

A few centuries ago, the town of Plesetsk was a small settlement on the Yemtsa River, a stop along the ten-day couch ride from Moscow to Arkhangelsk, Russia's first ocean port. Rail connection was established only in 1890, and the town expanded to house railway and lumber mill workers.

Following the Bolshevik coup in 1917, anti-communist "White" forces rallied in Arkhangelsk, supported by several thousand British, French, and American troops under the English general Ironside. Between September 1918 and August 1919, these soldiers pushed the Red Army back south as far as the Plesetsk railway station. Bitter fighting along the Yemtsa River, in the region of the future cosmodrome, killed several hundred of the "interventionist" soldiers, many of whose bodies remain buried around Plesetsk. With the subsequent withdrawal of these foreign troops, the 'White' forces collapsed.

Twenty years later, Plesetsk was the administration center of the vast "Oneglag" network of slave labor camps, where hundreds of thousands of prisoners (including 'special regime' camps for women and for Russians of German ancestry) laid rail lines, cut lumber, and dredged rivers for bauxite. Tens of thousands died, to be buried in unmarked graves in the forests.

The 1950s saw a brief respite in activity around Plesetsk, as the camps were shut down. But in January 1957, Plesetsk was picked for another special mission: be the point of the "nuclear spear" that Soviet missile engineers were developing. It was chosen as the launch site for the Intercontinental Ballistic Missiles which had not even begun flight testing at Baykonur.

The reasons were geographical. Plesetsk was in that part of Russia closest to population centers in North America, the planned targets for the "R-7" ICBM being built by Sergey Korolyov's team. From the northwest corner of Russia, such rockets were just able to reach Boston, New York, and Washington. Plesetsk was also on a major rail line (and was at the center of an existing network of smaller roads and railways), but was located in a region where the people were accustomed to military secrecy.

When Colonel Sergey Byleyev's construction brigade arrived at the Plesetsk railway station, winter still held the region in its grip. He found a village with 56 private homes, a small machine repair workshop, a sawmill, and a turpentine factory. The population was about to increase ten-fold.

Swarms of special troops followed. There were railway workers to build the sidings to process several hundred rail cars per day. Construction troops built storage areas and roads, and one special team started immediately on an airport. A 100-km long perimeter was fenced and patrolled, and anti-aircraft guns and missiles were installed to ward against American spy planes. And at the "polygon" itself -- the launch area, code name 'Angara' -- specialists began building the pads right on the steep banks of the Yemtsa. Nearby were the support buildings for the missiles and their warheads.

The amount of dirt to be moved (a million cubic meters) and the volume of concrete (30,000 cubic meters) were equivalent to that needed for a medium-sized hydroelectric power dam. And this had to take place either while the ground was frozen or while it was soaking wet, with pumps constantly fighting groundwater seepage. The roads crossed peat bogs five meters thick; a hundred new bridges had to be thrown up and kept up against natural and usage stresses.

The first builders later told tales of hardship. In winter, your moustache would freeze to the pillow at night, if you were lucky enough to have a pillow. With temperatures hovering below minus 35-40 C and only a few hours of dim daylight, mechanical equipment crumbled and died and couldn't be repaired. Snows -- especially during the first winter -- were dry and powdery, and even snowshoes and skis had difficulty.

In springtime, the rivers flooded, washing away foundations and redepositing dirt removed so laborously in previous months. Giant bubbles of natural gas oozed to the thawing surface, and machines and people often sank out of sight. During the cool, brief summer, clouds of midges devoured all exposed flesh, especially eyes.

After a year and half of effort, with the polygon only 70% complete, the project was so late and so over budget that Khrushchev ordered it scrapped entirely. But his rocket experts argued him out of the cancellation. Defense Minister Dmitriy Ustinov himself began flying to Plesetsk every Saturday to oversee progress.

Other forms of oversight were deliberately avoided. To elude detection by American spy planes, the launch pads were covered in roll-away plastic "grass carpets" and fake trees. Buildings were nestled deep within pine forests. Roads were lined with trees whose branches were tied together overhead. With the Finnish border only 500 km away, Soviet missile commanders feared that they could be attacked during the several hours it took to roll the missiles out of their hangars to be launched.

After almost three years of construction, in late 1959, the base received its first operational R-7 missile and thermonuclear warhead. It was officially "on line". And on April 9, 1960, after the normal winter cloud cover had dissipated, a U-2 overflight caught photographic evidence of the operational missile. Gary Powers' cross-country spy flight on May 1 was supposed to gather additional information on Plesetsk but he was shot down over the Urals and U-2 overflights were terminated. It wasn't until August 1961 that a 'Corona' spy satellite was able to take new photographs.

American analysts soon realized that the feared "missile gap" was another empty Khrushchev boast. There were only four R-7 launch pads at Plesetsk (and two more test pads at Baykonur). Fears that Plesetsk might harbor dozens of missiles were dispelled.

And as American concern over Plesetsk faded, so did Soviet interest in maintaining it. New generations of longer-range military ICBMs were deployed elsewhere in the USSR in the early 1960s, making the Plesetsk's lumbering R-7's and expensive support facilities obsolete. Once again Plesetsk faced termination, but in May 1964, Khrushchev agreed to convert the ICBM pads into satellite launch sites, and Plesetsk found a new mission.

The first R-7-launched military satellite from Plesetsk reached orbit on March 17, 1966 (a launch attempt the previous autumn had failed). Official Soviet press releases talked only about a routine "Kosmos" scientific satellite, #112 in a series, and there was no hint about any new launch site.

But American space trackers immediately recognized the new site. As the North American Aerospace Defense Command published unclassified orbital data about Kosmos-112 and its subsequent space siblings, there were subtle hints in the numerical tables that were first recognized by Geoffrey Perry and his student space trackers at the Kettering Grammar School in England. The "orbital elements" which described each satellite's motion through space also included the "revolution number" for each pass around Earth, starting from the first. When Perry's team performed calculations on the data they noticed that the first orbital pass had a ground track far to the northwest of Baykonur. A new launch site had to be located somewhere along that track. And after several different launchings at different azimuths, into orbits with different 'inclinations',

the "Kettering Group" was able to find the point of intersection of the different trajectories for each 'first orbit'.

It was then only a matter of looking up the latitude and longitude on a map -- where the village of "Plesetsk" was found. Perry published an article about the discovery soon afterwards, and the myth grew (despite Perry's protests) that his team of student's had been the first Westerners to 'discover' the base ahead of "professional spies". Actually, of course, the US military intelligence agencies had done so long before, and their published data was what allowed Perry to recognize the implications and draw the lines on a map -- a praiseworthy piece of analysis all its own.

Although in later years some Soviet spokesmen claimed falsely that the base had originally been built in the far north to make it easier to launch polar-orbit satellites (which actually can be launched with equal ease from anywhere on Earth), there was one amazingly lucky geographical coincidence about Plesetsk that makes one special type of space launching more efficient. Spacecraft in the elongated 12-hour 'Molniya' orbits used by generations of Soviet communications satellites must keep their high point over the northern hemisphere, even though irregularities in Earth's gravitational field tend to cause the high point to advance along the orbit over time. If not compensated for, this could quickly shift communications satellites into orbits with useless high points over the South Pacific. But the perturbing forces balance out for orbits inclined about 63.5 degrees to the equator, a figure determined by Earth's actual shape. Since Plesetsk just happened to be at a latitude of 62.5 degrees north, this meant that launch vehicles blasting off almost due eastwards -- getting maximum bonus from Earth's eastward spin -- would be in the perfect orbital plane for this type of orbit. The precise moment when one Russian space orbitologist realized this is probably a great "Eureka!" in the story of Plesetsk, but so far it remains lost to history.

With routine orbital launches now assigned to Plesetsk, Baykonur concentrated on advanced projects such as the doomed N-1 moon rocket, the Salyut space stations, and later the Energiya booster and Buran shuttle. By 1970, Plesetsk's annual launch rate exceeded Baykonur's, and by the early 1970's it was launching more than sixty orbital missions a year, half of all satellites in the world.

But the existence of the base remained a military secret, and this led to some very amusing public relations problems which eventually indirectly forced the end of the secrecy. It's obvious that while you can hide a rocket on the ground, it's difficult to camouflage it once it's been launched. But for fifteen years, that's exactly what Soviet military censors tried to do.

Within a few months of inauguration of orbital launchings, public reports of bizarre lights in the sky began pouring in to Soviet journalists in Moscow and elsewhere. During a brief period in 1967, amateur Russian "UFO experts" were allowed to publish their data, and Soviet officials must have been horrified to realize that most of their "best" cases of "alien visitors" were based on eyewitness accounts (from the ground, from aircraft, even

from ships) of rocket launchings from Plesetsk. The precise reports on timing and motion and other features of the flights threatened to give Western spies a unique window on super-secret Soviet space activities, so the private UFO experts were shut down, their access to the Soviet media cut off. [In UFO circles to this day this is interpreted to mean that Moscow was concealing the 'truth' about the existence of UFOs, but the opposite turned out to be true – they were concealing only the truth about what 'UFOs' in Russia actually WERE]

Yet the reports continued to be circulated privately. The most spectacular sighting in September 1978 (the pre-dawn launching of Kosmos-955) was seen by terrified witnesses in the city of Petrozavodsk and neighboring regions, including Finland, where amateur skywatchers had long been enjoying the light shows (which they knew to be space launches) and the official Russian attempts at camouflage. The Petrozavodsk apparition, in the form of a bright cloud dangling tentacles (exhaust trails of the multiple strap-on boosters), came to be known as the "medusa", or "jellyfish", and even top Soviet scientists accepted it as the "smoking gun" proof of alien visitations to Earth. Whether Soviet security organizations encouraged such delusions by planting 'supportive rumors', or merely sat back to exploit the misidentifications, is still not clear, but during all the years that ordinary Russians were seeing flying saucers over the northwestern USSR, the secret of Plesetsk was 'safe'.

However, while Soviet news controllers were prepared for verbal hostility from Western journalists, they were unprepared -- and vulnerable to -- what happened next. Publication in British and American newspapers and magazines about the silly Soviet charade of disguising secret rockets as "spaceships from Mars" led to widespread laughter and ridicule. Embarrassed, some Soviet journalists pushed their own secrecy limits and began mentioning the officially non-existent base in 1983.

Pravda's Vladimir Gubarev was the first to really break the ice over the existence of the Plesetsk cosmodrome. In a long, candid article about his difficulty in explaining UFO sightings to pilots, astronomers, and other witnesses who obediently refused to believe there was a massive space center only a few hundred kilometers north of Moscow, Gubarev provided a decade-old first-person account of one of the launchings he had been allowed to witness (but not report on):

"The road ran through a forest. It was getting dark rapidly, and the light from the headlights was snatching from the darkness the trunks of the fir trees that were interweaving their branchy paws. There was a lot of snow that year, and it lay on the branches, causing me to feel that the fir trees were giants carrying whimsical white scarves...

"A breeze sometimes blew, flicking the snow away from the firs, and it whirled over the launching area a long time, turning silver in the beams of the searchlights that were illuminating the rocket...

"Launch! And immediately a bright, fiery ball that had appeared at the base of the rocket illuminated the forest around us. Waves of light were reflected repeatedly, little sparks of snow flashed, and an artificial sun was born in this snow-white bowl. It tore itself from the Earth and started climbing above us slowly, turning night into day. The rocket rose, saluting us with multicolored rings that appeared around it, optical effects...."

That was the launch of Interkosmos-8 aboard a 'Soyuz' booster on November 30, 1972. Gubarev was finally able to publish his account eleven years later.

But while the existence of the base had at last been acknowledged in the Soviet press, little additional information reached the public for many years more, until the collapse of the Soviet Union in 1991. At that time, a new torrent of historical details emerged, providing Western observers with new surprises.

The most sensational story dealt with an R-7 booster explosion during pre-launch preparations on March 18, 1980. It had killed fifty space workers on the launch pad. All of Russia's top space experts were involved in the investigation, but so tight was the Plesetsk secrecy that not a single rumor leaked out of the Soviet Union (when 80 men were killed in a pad explosion of an ICBM at Baykonur's "Area 41" in 1960, stories hit the Western press within days).

In the post-Soviet era, detailed and sympathetic accounts of the tragedy appeared in many Russian newspapers. The base commander, 44-year-old General Vladimir Ivanov (later head of all Russian military space forces), permitted the families of the victims to visit the launch pad where they were briefed on the super-secret work their relatives had been performing, and on the technical details of the disaster (improper materials in a propellant feed line had led to a runaway chemical reaction and consequent fiery explosion). A tasteful memorial obelisk and 'eternal flame' had been set up outside of the space workers' residential city (originally called 'Lesniy', or 'Forest', it now bears the name 'Mirniy', or 'Peaceful') north of the original village of Plesetsk.

As years passed, this disaster continued to fester because of an on-going legal battle over liability and compensation for family members. The corporation which had built the launch site, led by a legendary construction engineer named Barmin (and later by his son), refused to accept responsibility for the design flaw. Their own version of the disaster blamed it on "operator error", which was impossible to prove because the equipment and all witnesses had been lost in the fire. Bitter recriminations and accusations bubbled up in the post-Soviet news media for decades.

In the early 1990s, as Plesetsk's neighbors became better informed about the real activities at the base, some serious tensions arose. Residents in towns and villages surrounding the base began accusing the cosmodrome of poisoning their lands with chemicals and of rendering the area dangerous with sharp shards of rocket fragments. When fish began dying in nearby Lake Varshinsky, residents blamed Plesetsk. Farmers demanded a halt to launchings during the growing season. When many children were born in one area with

yellow skin, local leaders accused Plesetsk. In the Vinogradskiy Region, people collected hunks of unburned solid-fuel from an off-course military training launch that had exploded over their heads in 1991 (another nearly-fully-fuelled rocket had fallen near some houses in 1985). Hunters reported vast numbers of wildlife killed or crippled by contact with razor-sharp rocket stages on forest trails.

Cosmodrome officials, unaccustomed to defending and explaining their activities to ordinary people, valiantly tried to put their operations in perspective, compared to other sources of pollution. Grandiose government promises to recover downrange debris by helicopter collapsed when money quickly ran out. Tensions remain high, and Plesetsk workers may be forgiven their nostalgia for a time when the outside world thought that the rockets were flying saucers from somewhere else.

By the end of the 1990's, Plesetsk had nine operational launch pads for boosters of the 'Soyuz/'Molniya' class, the 'Kosmos' class, and the 'Tsiklon' family. There were also military missile pads for developmental flight tests and troop training exercises. Because so much of the operations are routine and automated, Plesetsk gets by on about a third as much personnel as at Baykonur. The 'Zenit' pads, begun in 1990 but soon mothballed when the money ran out, may actually be completed in a few years for the new 'Angara' booster project.

Assuming enough funds can be found, Plesetsk officials hope to be able to launch both improved versions of existing vehicles (such as the upgraded Kosmos-3M, called "V'zlyot", and the upgraded 'Soyuz-2', or "Rus") and totally new vehicles ranging from the small "Rokot" launcher to the proposed heavy "Angara" series. Those bigger boosters, along with innovative trajectories involving lunar fly-by, may allow Plesetsk to compete with -- and ultimately fully replace -- the Proton launchings at Baykonur.

Plesetsk, deeply rooted in Russia's sad and brutal history, already has come to symbolize the conversion of instrumentalities of destruction into productive, beneficial activities. With luck and with government and commercial support, the cosmodrome could become a gateway to a better future for its workers, for its customers, for Russia, and for the world.