Building a Rocket Base in the Taiga:
The Early Years of the Plesetsk Launch Site (1955-1969) – Part 2

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10. Plesetsk Becomes a Space Launch Site

As had been the case at Angara, construction work at the site north of Il'ea was assigned to the Ministry of Defence’s 57th Directorate of Engineering Works under the leadership of Nikolai Stepanchenko. However, as construction of RT-2 silos and supporting infrastructure (roads, railways, housing facilities) got underway, it gradually became clear that this particular location was not ideal. Further analysis showed there would be range safety problems for both missile and space launches and it also turned out the area was very swampy, which especially posed a problem for the construction of the RT-2 silos. All this raises the question if the commission headed by Alpaidze hadn’t done a proper job. Stepanchenko voiced his concerns in a meeting with the Minister of Defence’s Deputy for Construction Work Aleksandr Komarovskiy and reportedly also in a letter to the Central Committee of the Communist Party and the Council of Ministers, proposing to move the facilities to Angara, where a lot of supporting infrastructure was already in place and several housing areas were completely unoccupied [72].

The option of moving the RT-2 silos and space launch facilities planned for the Il'ea site to Angara became even more attractive as growing support emerged for adapting the R-7 pads at Angara for space launches. There were several reasons for this. First of all, several Earth-imaging satellites launched by R-7 based rockets from Tyura-Tam would benefit from the higher inclinations afforded by the Angara site, allowing them to see larger portions of the Earth’s surface. This was particularly the case for the Zenit-2 and Zenit-4 spy satellites (both based on the Vostok design) and the Meteor weather satellites. Moreover, after the transfer of the Meteor weather satellite project from Yangel’s bureau to VNIIEM in 1962, the design of the satellite was changed such that it had to switch from the 11K65 to an R-7 type launch vehicle.

In addition to that, the two R-7(A) pads at NIIP-5 were felt to be insufficient to satisfy space launch needs. As a matter of fact, only the original R-7 pad at NIIP-5 (“Object 135”, popularly known as the “Gagarin pad”) was initially available for both R-7 missile and space launches, while the second pad (“Object 353”) in Area 31 was on permanent stand-by for R-7A missile launches only. Construction of the second pad had begun in December 1958, with the first R-7A launch having taken place on 14 January 1961 [73]. On 10 July 1963 the Gagarin pad was severely damaged when a Vostok-2 rocket with a Zenit-2 spy satellite fell back on the pad just 1.9 seconds after liftoff because of an engine failure in one of the strap-on boosters. This left the Russians without the capability to launch critical spy satellites from NIIP-5 for more than three months (the first mission to fly from the pad after the accident was Kosmos-20 on 18 October 1963). Although the government had officially given the go-ahead for adapting the second pad for space launches on 3 July 1962 (decree nr. 702-295) (probably in the wake of another Vostok-2/Zenit-2 on-the-pad failure on 1 June 1962), that work doesn’t seem to have begun in earnest until after the July 1963 accident [74]. The first space launch from the second pad was Kosmos-28 on 4 April 1964.

As Alpaidze later recalled, the initiative to turn the Angara R-7(A) pads into space launch facilities came from Korolyov, who first took up the matter with him in late 1962. This was around the same time that Alpaidze presented the results of his commission’s work on the northern launch base to Strategic Rocket Forces Commander-in-Chief Biryuzov. However, when reporting to Biryuzov, Alpaidze did not mention Angara as a possible location for the launch site simply because his commission had not been asked to explore that possibility. Apparently, the Strategic Rocket Forces had not been very enthusiastic about modifying the R-7A pads for space launches. This probably explains why Alpaidze and Korolyov decided to bypass the Strategic Rocket Forces and instead present the idea to Sergei Zverev, the First Deputy Chairman of the State Committee for Defence Technology (GKOT), a ministry whose 7th Directorate oversaw most space and missile design bureaus and production facilities at the time. This was in late 1962, even as the government decree approving the construction of the site near Il'ea
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was being drawn up. During the meeting with Zverev, Korolyov not only called for using the R-7(A) pads at Angara for space launches, but also for moving the facilities planned for the Il'ea site to Angara. After all, it would be a costly affair to build downrange tracking facilities for two northern launch sites.

Zverev expressed his support for the idea and in the first half of 1963, no doubt after Korolyov had pulled some more strings, Deputy Defence Minister Andrei Grechko set up a new commission to study the feasibility of using the Plesetsk area as a test site for the RT-2 missile and as a space launch site. This indicates that the plan was also supported by Defence Minister Rodion Malinovsky and was likely to be approved unless the commission found some unexpected problems. The commission was headed by the head of the Operations Directorate of the General Staff Aleksandr Popov, with Alpaidze serving as his deputy. Among the issues the commission looked at were the location of downrange tracking facilities and impact zones for rocket stages. One account suggests the commission members spent only three days in the Plesetsk area, roaming the taiga in three amphibious crawlers. Alpaidze claims the commission also studied an area west of Plesetsk.

In the end, the commission concluded that using Angara as a test site and cosmodrome presented no insurmountable problems and would provide major cost savings. By this time, opposition within the Strategic Rocket Forces against adapting the R-7(A) pads for space launches had also faded. With the massive deployment across the country of the more effective R-16 ICBMs, the strategic importance of the R-7(A) was quickly diminishing.

On 16 September 1963 the government issued a decree (nr. 999-347) authorizing the use of Plesetsk for space launches and test flights of solid-fuel ICBMs. 3 UAP, as the launch site had been officially known since 1959, now got the name of the cancelled site near Il'ea (NIIP-53, with the Military Unit number changing from 26176 to 13991), although it would continue to perform its former role of an operational ICBM site. Construction and launch teams stationed at the Il'ea site were relocated to Plesetsk and supporting infrastructure already built there was “turned over to the local economy”. Galaktion Alpaidze was named commander of the site, taking over from 3 UAP commander Stepan Shtanko, who had run the base from 8 May 1962 until 17 December 1963 (having taken over from the original commander Mikhail Grigoryev) [75] (Figs. 21 & 22).

11. Organizational Changes

The expansion of activities at Plesetsk required some
teams operating R-7A pads nr. 2, 3 and 4 and all the R-16 and R-9 teams.

• 2<sup>nd</sup> Test Directorate (2IU): Directorate for Testing Space Objects and Rocket Carriers (Military Unit 07376) (commander Veniamin Eibshits); this was responsible for launching satellites using the R-7A, R-12 and R-14 based launch vehicles and test flights of the RT-2 solid-fuel missiles and R-14 missiles (the latter as part of the Aidan anti-missile test programme). It included the teams operating R-7A pad nr. 1 (the only of the four R-7 pads that was initially converted for space launches) and the R-14 teams transferred from the site near Ileza [76].

• 3<sup>rd</sup> Test Directorate (3IU): Directorate of Measuring Systems and Computing (Military Unit 07378) (commander Nikolai Borisov); this was responsible for building and operating a network of downrange tracking facilities that would monitor both space launches and missile test launches, carrying out trajectory measurements and receiving telemetry. Five tracking stations were built in 1964-1965, two of them at the cosmodrome itself (sites “Dobryanka” and “Klyuchevoye”) and three more in Zheleznodorozhnyy (later renamed Yemva, in the Komi autonomous Soviet republic), Naryan-Mar (close to the Barents Sea) and on Novaya Zemlya island. Also subordinate to the 3<sup>rd</sup> Directorate were three teams in charge of flying out to rocket stage impact zones. One was stationed at the launch site, a second in Shoina and a third in Nizhnyaya Pyosha [77].

Commander Alpaidze found that the combat launch teams of 3 UAP were overstaffed and transferred many of the people involved in R-7A, R-9A and R-16 ICBM work to the 2<sup>nd</sup> and 3<sup>rd</sup> Directorates [78].

There were several more changes the following years. The teams in charge of the RT-2 test flights were transferred to a new 4<sup>th</sup> Test Directorate (Military Unit 12445), set up on 18 March 1966 and headed by Pyotr Shcherbakov [79]. The teams operating R-7A pads 3 and 4 (Military Unit 14056) were transferred from the 1<sup>st</sup> to the 2<sup>nd</sup> Directorate on 14 March 1968 as these pads were being converted for space launches [80].

12. The First R-7 Launches from Plesetsk

The first R-7 pad to be modified for space launches was the original pad nr. 1 (Fig. 23). The team in charge of that pad (Military Unit 13973) was temporarily relieved from combat duty from 20 March until 31 October 1965 as the modifications were carried out. Construction also began of a new assembly building in the immediate vicinity of the pad, although it wouldn’t be finished until 1969. Before the first satellite launch two training launches of the R-7A were planned to see if the pad was ready for its new role and to give the launch teams some much-needed practice. Although all the R-7A launch teams had gained hands-on experience with launch operations at NIIP-5, Plesetsk, being an operational ICBM site, hadn’t seen a single R-7 launch since the four pads had been commissioned in 1959-1961. The first ever R-7A launch from Plesetsk took place from pad 1 on 14 December 1965, followed by a second launch from the same pad on 21 December 1965. Both rockets flew in the direction of the Kamchatka peninsula. The first launch was conducted by Military Unit 13973 and the second by Military Unit 14056, which was actually in charge of pads nr. 3 and 4 [81].

The stage was now set for the first space launch from the northern cosmodrome, which involved an 8A92 (“Vostok”) rocket and a Zenit-2 spy satellite (serial number 37). Since not all the satellite preparation facilities were ready, some improvisation was needed to get the early satellites ready for launch. For instance, there was no fuelling station to load the Zenit satellites with the toxic propellants needed for their manoeuvring systems. Instead, this hazardous work was conducted in tents erected not far from the assembly building, where temperatures dropped to as low as -25°C in wintertime.

By an order of cosmodrome commander Alpaidze of 21 February 1966 the rocket and satellite were to be ready for launch on 3 March, but the preparations took about two weeks longer than expected as the inexperienced launch teams struggled with various minor technical issues. Finally, on 15 March 1966 the rocket and payload were installed on pad 1. Liftoff was set for 12h19m43s (Moscow time) on 17 March, but eventually took place at 13h28m42s because of problems with the rocket’s inertial guidance system. Several minutes later the Zenit-2 spy satellite was successfully inserted into a
207x545 km orbit inclined 72° to the equator, the highest inclination ever reached by a Soviet satellite. In a routine launch statement, the TASS news agency announced the satellite as Kosmos-112, giving no indication whatsoever that the launch had taken place from a new launch site. Less than a month later, on 6 April 1966, pad nr. 1 hosted its second space launch, with the 11A57 ("Voskhod") version of the R-7 placing into orbit a Zenit-4 spy satellite announced as Kosmos-114 [82].

R-7 pad nr. 2 was probably also supposed to be turned into a space launch facility, but those plans were thwarted by a major accident at NIIP-5 on 14 December 1966. On that day a 11A511 ("Soyuz") version of the R-7 carrying the second unmanned Soyuz test vehicle exploded on the launch pad in Area 31 after its emergency escape system had been accidentally activated. The accident put the pad out of service for several months, forcing a transfer of all R-7 type launches to the "Gagarin" launch pad. In order to speed up the repair work, it was decided to largely dismantle R-7 pad nr. 2 at Plesetsk in January-February 1967 and ship the parts to NIIP-5. Launches from Area 31 were resumed in July 1967. The team in charge of pad nr. 2 (Military Unit 14003) was removed from combat duty in January and disbanded in June 1967, not having conducted a single launch from Plesetsk. The pad wasn’t rebuilt until the late 1970s and eventually saw its first launch on 19 February 1981 (Kosmos-1247), more than twenty years after it was first commissioned [83].

Conversion of the “twin pads” nr. 3 and 4 for space launches began in 1968 based on an order of the Military Industrial Commission dated 20 December 1967 (Fig. 24). Before that only pad 4 had been used for an R-7A training launch (on 25 July 1967) [84]. On 28 March 1968 the Military Unit (14056) operating the two pads was removed from combat duty and as of 20 July 1968 pads nr. 1, 3 and 4 officially were no longer on combat alert, ending the ICBM career of the R-7 [85]. The first space launch from pad 4 took place on 3 December 1969 (Kosmos-313). Two practice launches were planned from pad 3 in September 1969 as part of an operation called “Berkut” ("Golden Eagle"), but were cancelled [86]. Pad nr. 3 was inaugurated with the launch of Kosmos-396 on 18 February 1971.

The payloads most frequently launched from Plesetsk with R-7 based rockets before 1970 were the Zenit-2 and Zenit-4 reconnaissance satellites, which had first flown from NIIP-5/Tyura-Tam in April 1962 and November 1963 respectively (Fig. 25). Two further modifications of the Zenit satellites (Zenit-2M and Zenit-4MK) first flew from Plesetsk in 1969, after having made their debut from NIIP-5 in 1968. The first six Zenit-2 satellites used the 8A92 version of the R-7 (retrospectively named “Vostok”), but all the others were orbited using the 11A57 ("Voskhod") version (Fig. 26). Many Zenit satellites launched from Plesetsk had orbital inclinations of 73° and 81°, but a significant portion also flew in the same 65° inclination orbits that were routinely used by Zenit satellites orbited from Tyura-Tam. This indicates that besides the ability to reach higher inclinations, the use of Plesetsk was also simply seen as a way of increasing the annual launch rate.

Fig. 25 The Zenit-2 reconnaissance satellite. (RKK Energiya)
The only other satellites launched by R-7 derived rockets from Plesetsk before the end of the 1960s were the Meteor weather satellites (Fig. 27). The first five experimental Meteors (all given “Kosmos” designations) had been launched into 65° inclination orbits from NIIP-5 between August 1964 and June 1966, but beginning with Kosmos-144 on 28 February 1967 the satellites flew from Plesetsk, reaching 81° inclination orbits. Although the switch from NIIP-5 to Plesetsk for Meteor had almost certainly been decided on earlier, it was apparently sped up by the 14 December 1966 Soyuz explosion that heavily damaged the pad in Area 31 [87]. All the five initial Meteor satellites had flown from that pad, which possibly had something to do with the fact that they were placed into orbit with a modernized version of the “Vostok” rocket called 8A92M. For unclear reasons, the Meteor satellites were prepared for launch at Plesetsk by Military Unit 63551, whose main responsibility was to launch the unrelated 11K63 and 11K65M boosters [88].

In the US weather and reconnaissance satellites launched from Vandenberg were inserted into polar orbits. Plesetsk also provided that opportunity, but such launches would carry the satellites over US territory shortly after orbit insertion and could therefore be misinterpreted as Soviet missile attacks. Clearly, any such launches would have to be preceded by diplomatic agreements between the USSR and US, something which the tense relations between the two superpowers made impossible. The first known proposal to fly Sun-synchronous missions from Plesetsk (with the Tsiklon-3 rocket) was not put forward until 1977. Although supported by the military community, it was reportedly rejected by Soviet leader Leonid Brezhnev because of the overflight issue. Actually, the first Soviet Sun-synchronous missions were launched from Tyura-Tam (beginning in 1977), but they passed over countries such as Afghanistan and Pakistan and were rarely flown. In the end, Plesetsk did not see its first Sun-synchronous launch until 2000, albeit only at the request of foreign customers with piggyback payloads [89].

In the late 1960s plans also circulated for flying piloted missions from the Plesetsk R-7A pads. In 1967-1968 the TsKBEM design bureau (the former Korolyov bureau) began working on small space stations called Sovyuz-VI (VI standing for “military research”) that would mainly be used for military reconnaissance. Cosmonauts would fly to the station in a modernized version of the Soyuz spacecraft known as 7K-S (which later evolved into the Soyuz-T space station ferry). The original requirement was for the stations to be launched into 51.6° inclination orbits from Tyura-Tam [90]. However, it is known that in 1968 plans were drawn up to adapt Plesetsk R-7 pad nr. 1 and its associated assembly building for launches in the Soyuz-VI programme by the first quarter of 1971. Preliminary schedules called for conducting the first four launches from Plesetsk between January and October 1971 [91]. Unfortunately, in 1970 the Soyuz-VI programme was cancelled as TsKBEM switched its attention to a larger space station (DOS) that eventually became known as Salyut. In 1977 Plesetsk commander Yurl Yashin made another attempt to bring piloted space operations to Plesetsk. Although his initiative was supported by the country’s military space forces (then called GUKOS), it
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was not approved, with one of the opponents reportedly being Vladimir Utkin, the chief of the Yangel design bureau [92].

R-7 pad nr. 1 witnessed its last launch in 1989 and was completely dismantled by the end of the 1990s. The other three pads remain operational today.

### 13. 11K63 and 11K65M Rockets

In January 1964 construction began of launch pads for two lightweight boosters of the Yangel design bureau, the 11K63 (based on the R-12; retrospectively called "Kosmos" or "Kosmos-2") and 11K65M (based on the R-14; retrospectively called "Kosmos-3M"). Presumably, all of these were originally supposed to be built at the site near Ileza before it was decided to relocate the northern cosmodrome to Plesetsk. The pads were built in an area known as "Lesnoye" (Areas 132 and 133), just to the east of R-9A pads 14 and 15. The 11K63 pad was known as "Raduga" (also 11P863) and the 11K65M pads as "Voskhod" (also 11P865) (Fig. 28). An overview of the pads is given in Table 6. A single assembly building serving all three pads was constructed in an area called "Polyarnoe" (Area 141). Unlike other assembly buildings at Plesetsk, which were very close to the pads, this one was located several kilometres from the pads just north of the town of Mirnyy so that people had to spend less time commuting to work [93].

The original idea was to build a pair of pads for both boosters, but while this plan was accomplished for the 11K65M, only one pad was eventually built for the 11K63. The pads were the first dedicated space launch facilities built in the Soviet Union, all the others having been modified from their original role as missile launch pads or silos. Attempts were made to use common elements in the 11K63 and 11K65M facilities, but the different roots of the boosters made this difficult. A feature they did share was a mobile gantry that fully enclosed the rocket during pre-launch preparations, among other things because neither of them could withstand high wind loads (the first stages having been built to operate from silos). The pad design also allowed payloads to be changed out on the pad, without the rocket having to return to the assembly building. Despite the use of hazardous hypergolic propellants on both rockets, launch preparations were very labour-intensive, with a lot of personnel required on the pad to get them ready for launch. This experience was taken into account in the construction of launch pads for later Yangel bureau boosters (Tsiklon and Zenit), which were highly automated [94].

Both rockets had already flown from converted missile silos and pads at either Kapustin Yar or Tyura-Tam before they were introduced at Plesetsk. Development of an initial batch of 11K63 boosters had been authorized by the government in August 1960. After two failures in late 1961, the rocket made its first successful flights from an experimental R-12 silo ("Mayak-2") at Kapustin Yar on 16 March 1962, placing into orbit the DS-2 satellite (officially named Kosmos-1). Beginning in December 1964 (Kosmos-51), launches were transferred to another type of R-12 silo ("Dvina") and a second identical silo entered service on 26 December 1967 (Kosmos-197). The second stage of the rocket protruded from the silo (which had been built for the single-stage R-12) and was surrounded by a mobile service tower, which was rolled back 15 minutes before launch. The final 11K63 launch from Kapustin Yar was carried out on 19 April 1973 (Interkosmos-9).

It looks like the construction of 11K63 rockets for launch from Plesetsk ran into serious delays. For instance, it is known that by mid-1965 none of the eight rockets that were to have been delivered in the fourth quarter of 1964 were available [95]. Launch teams practiced the roll-out and pad operations with a mock-up of the rocket. The first launch (Kosmos-148/DS-P1-I) took place on 16 March 1967, on the 5th anniversary of the rocket's first successful launch, and was reportedly timed such that it occurred in between passes of American reconnaissance satellites [96]. The final 11K63 launch from Plesetsk occurred on 18 June 1977 (Kosmos-919). Afterwards the Raduga pad was converted into a Voskhod
pad for 11K65M launches, which in turn was adapted for launches of the Rokot launch vehicle in the late 1990s (Fig. 29).

All but one of the payloads launched by the 11K63 from Plesetsk before the end of the 1960s were small satellites of the Yangel bureau designed to calibrate radars used by Soviet anti-ballistic missile systems. The type most often flown was the DS-P1-Yu satellite (Fig. 30). The first five of these were launched into 49° inclination orbits from Kapustin Yar between July 1964 and July 1966 and the first to go up from Plesetsk was Kosmos-152 on 25 March 1967 (inclination 71°). All the following satellites except three also departed from Plesetsk. The other series, known as DS-P1-I, was introduced with a launch from Kapustin Yar (Kosmos-106/48° inclination orbit) in January 1966, but all subsequent satellites were placed into 71° inclination orbits from the northern cosmodrome.

The only other type of satellite launched by the 11K63 before 1970 was Kosmos-261 in December 1968. This was a DS-U2-GK satellite for studies of the aurora during the solar maximum, making it the first scientific satellite to fly from Plesetsk. It was also the first Soviet mission to involve participation from other East Bloc nations under the Interkosmos programme. Interestingly, the next satellite flown under that programme about a year later (launched from Kapustin Yar) was officially named Interkosmos-1, while the following one (launched from Plesetsk in 1970) was again given a Kosmos designator (Kosmos-348). It has been speculated that this was done so as not to draw unwarranted attention to the secret launch site [97]. However, unlike the satellites given Interkosmos labels, Kosmos-321 and 348 did not actually carry equipment built by the Soviet Union's East Bloc neighbours, whose role was limited to ground-based

### TABLE 6: 11K63 and 11K65M Pads at Plesetsk.

<table>
<thead>
<tr>
<th>Pad nr.</th>
<th>Type</th>
<th>Area nr./name</th>
<th>Launch vehicle</th>
<th>First launch</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Raduga (11P863)</td>
<td>133 (Lesnoye)</td>
<td>11K63</td>
<td>16 Mar 1967 (Kosmos-148)</td>
</tr>
<tr>
<td>1</td>
<td>Voskhod (11P865)</td>
<td>132 (Lesnoye)</td>
<td>11K65M</td>
<td>15 May 1967 (Kosmos-158)</td>
</tr>
</tbody>
</table>

Fig. 29 Twin 11K65M (“Kosmos-3M”) launch pads.  
(Soglasliye Publishers)

Fig. 30 The DS-P1-Yu radar calibration satellite.  
(KB Yuzhnoye).
measurements of ionospheric parameters and data analysis. Later joint Soviet-East Bloc scientific missions launched from Plesetsk did get Interkosmos designators (beginning with Interkosmos-8 in December 1972) [98].

The 11K65 rocket had begun test flights from Tyuratam on 18 August 1964, flying from the same site where an R-16 had exploded in October 1960. About a dozen launches were conducted from that pad until August 1968. The construction of the first Plesetsk pad for the rocket (a slightly modified version called 11K65M) was finished by June 1966, but it would take until 15 May 1967 for the first launch to take place. Unfortunately, the nosecone failed to separate from the rocket, rendering the satellite (Kosmos-158) useless [99]. The next two launches in June and September 1967 were complete failures. One of the rockets fell back onto the pad and exploded right after lift-off but the repair work does not seem to have taken very long [100]. The second pad saw its first launch on 21 October 1969 (Kosmos-304) [101]. An identical pad was constructed at Kapustin Yar and inaugurated in January 1973, making the 11K65M the only launch vehicle to fly from all three Soviet cosmodromes (Fig. 31).

Four types of satellites were launched by the 11K65M from Plesetsk before the end of the 1960s. The first was the Tsiklon navigation satellite built by Reshetnyov’s OKB-10 in Krasnoyarsk. This was used to determine the coordinates of Soviet submarines equipped with ballistic missiles so as to increase their firing accuracy. They also carried an additional communications payload for the Soviet Navy. The second type was the Tselina-O area-survey electronic intelligence satellite developed by the Yangel bureau, which was intended to provide a rough estimate of the location of enemy radar systems. The third type was the Sfera geodetic satellite of OKB-10, intended for military topographical research to improve accuracy of long-range weapons. All these satellites were launched exclusively from Plesetsk into 74° inclination orbits. Just days before the turn of the decade the 11K65M made a failed attempt to launch a scientific satellite for ionospheric studies (“Ionosfernaya stantsiya” or “Ionospheric station”).

Various statistics for space launch vehicles and satellites flown from Plesetsk between March 1966 and December 1969 are given in Tables 7, 8, 9 and 10. Figure 32 shows the location of launch facilities at Plesetsk at the end of the 1960s.

14. Missile Test Programmes

Besides serving as a cosmodrome, Plesetsk also became a test site for new solid-fuel long-range missiles. On 25 February 1965 Military Unit 01349 was set up to conduct test flights of the new missiles. Headed by Yuriy Yashin from 1965 to 1967 and Veniamin Shabarov from 1967 to 1970, it was initially subordinate to the 2nd Test Directorate and was then transferred to the newly formed 4th Test Directorate in 1966.

In January 1964 a commission headed by NIIP-53 commander Alpaidze undertook a search for suitable launch areas for the RT-2 ICBM and recommended to build twin silos separated by 250 to 300 m, a storage facility for the missiles and a single command post located 6 to 15 km from the pad. The commission also advised to survey areas for the construction of eight to ten additional silos later on. The two first silos (1-1 and 1-2) were built in an area known as Zarya (Fig. 33). A government decree on 29 December 1965 (nr. 1138-381) approved the construction of an additional seven RT-2 silos (built in areas known as Yasnyoe, Ozerki, Loshchina, Gornaya, Ozormaya, Losinoe, Lazurnaya) for long-duration storage tests of the RT-2 missiles. The RT-2 silos were built east of the Mekhrenga river, several dozens of kilometres from the space launch facilities.

The first test flights of the RT-2 were staged from Kapustin Yar from a modified R-14 silo between February and July 1966 (the first successful one on 26 February 1966). All seven missiles were fired in the direction of Lake Balkhash and six of the tests were considered a success.

As part of the final launch preparations, a mock-up

<table>
<thead>
<tr>
<th>Rocket</th>
<th>Number of launches in 1966</th>
<th>Number of launches in 1967</th>
<th>Number of launches in 1968</th>
<th>Number of launches in 1969</th>
<th>TOTAL</th>
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<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>6</td>
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<td>(&quot;Vostok&quot;)</td>
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<tr>
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<td>19</td>
<td>50</td>
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<td>2</td>
<td>3</td>
<td>8</td>
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<td>8</td>
<td>11</td>
<td>25</td>
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<th>Satellite</th>
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<th>Launch vehicle</th>
<th>First launch attempt from NIIP-53</th>
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<td>Zenit-2</td>
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<td>8A92/11A57</td>
<td>17 Mar 66 (K-112)</td>
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<td>(11F61)</td>
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</tr>
<tr>
<td>(11F69)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zenit-2M</td>
<td>photographic reconnaissance</td>
<td>11A57</td>
<td>3 Dec 69 (K-313)</td>
</tr>
<tr>
<td>(11F690)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zenit-4MK</td>
<td>photographic reconnaissance</td>
<td>11A57</td>
<td>23 Dec 69 (K-317)</td>
</tr>
<tr>
<td>(11F692)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meteor</td>
<td>meteorology</td>
<td>8A92M</td>
<td>28 Feb 67 (K-144)</td>
</tr>
<tr>
<td>(11F614)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>DS-P1-I</td>
<td>radar calibration</td>
<td>11K63</td>
<td>16 Mar 67 (K-148)</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>DS-P1-Yu</td>
<td>radar calibration</td>
<td>11K63</td>
<td>25 Mar 67 (K-152)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DS-U2-GK</td>
<td>aurora studies</td>
<td>11K63</td>
<td>19 Dec 68 (K-261)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tsiklon</td>
<td>military navigation</td>
<td>11K65M</td>
<td>15 May 67 (K-158)</td>
</tr>
<tr>
<td>(11F617)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tselina-O</td>
<td>electronic intelligence</td>
<td>11K65M</td>
<td>30 Oct 67 (K-189)</td>
</tr>
<tr>
<td>(11F616)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sfera</td>
<td>military geodesy</td>
<td>11K65M</td>
<td>20 Feb 68 (K-203)</td>
</tr>
<tr>
<td>(11F621)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ionosfernaya stantsiya</td>
<td>ionosphere studies</td>
<td>11K65M</td>
<td>27 Dec 69 (failure)</td>
</tr>
</tbody>
</table>

of an RT-2 missile was installed in Zarya silo 1-1 in October 1966. The first RT-2 launch from Plesetsk was conducted on 4 November 1966, marking the first experimental missile launch from the northern launch site. A total of 25 test flights were flown between then and 3 October 1968. Twenty-one were flown over intermediate range distances in the direction of the Kamchatka peninsula and four were flown over full range in the direction of the Pacific. Sixteen of the tests were successful and nine ended in total or partial failure. The relatively high failure rate was due to the fact that the missiles arrived at the test range in relatively "raw" form, having undergone little pre-flight testing. The test programme included a salvo launch (the first in the history of the Strategic Rocket Forces) of three RT-2 missiles on 24 August 1966 from the two silos at Zarya and the Yasnoye silo [103]. After the completion of the test flight programme, serially produced RT-2 missiles were regularly test-fired from Plesetsk to check the quality of particular batches and also to see if missiles that had been in storage longer than planned still functioned normally.
TABLE 9: Number of Satellite Launches from Plesetsk in 1966-1969.

<table>
<thead>
<tr>
<th>Satellite</th>
<th>Number of launches in 1966 (Kosmos numbers)</th>
<th>Number of launches in 1967 (Kosmos numbers)</th>
<th>Number of launches in 1968 (Kosmos numbers)</th>
<th>Number of launches in 1969 (Kosmos numbers)</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zenit-2M</td>
<td></td>
<td></td>
<td></td>
<td>1 (313)</td>
<td>1</td>
</tr>
<tr>
<td>Zenit-4MK</td>
<td></td>
<td></td>
<td></td>
<td>1 (317)</td>
<td>1</td>
</tr>
<tr>
<td>Meteor</td>
<td>3 (144-156-184)</td>
<td>2 (206-226)</td>
<td>3 (F-Meteor-1-1-Meteor-1-2***).</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>DS-P1-I</td>
<td>1 (148)</td>
<td>2 (204-242)</td>
<td>2 (275-308)</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>DS-U2-GK</td>
<td></td>
<td></td>
<td></td>
<td>1 (268)</td>
<td>1</td>
</tr>
<tr>
<td>Tsiklon</td>
<td>3 (158-F-192)</td>
<td>1 (220)</td>
<td>2 (292-304)</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Tselina-O</td>
<td>2 (F-189)</td>
<td>2 (200-250)</td>
<td>2 (269-315)</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Sfera</td>
<td>3 (203-F-256)</td>
<td></td>
<td>2 (272-312)</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Ionosfernaya stantsiya</td>
<td>1 (F)</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>6</td>
<td>30</td>
<td>31</td>
<td>40</td>
<td>107</td>
</tr>
</tbody>
</table>

*F = launch failure
**Kosmos-199 failed to separate from the rocket’s upper stage [102]
***Beginning in 1969, all first-generation Meteor satellites were officially announced simply as "Meteor" without any digits. In Western launch tables these are usually designated Meteor-1-1, Meteor 1-2 etc. for the sake of clarity.


<table>
<thead>
<tr>
<th>Date</th>
<th>Launch vehicle</th>
<th>Payload</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 Jun 67</td>
<td>11A57</td>
<td>Zenit-4</td>
</tr>
<tr>
<td>26 Jun 67</td>
<td>11K65M</td>
<td>Tselina-O</td>
</tr>
<tr>
<td>1 Sep 67</td>
<td>11A57</td>
<td>Zenit-2</td>
</tr>
<tr>
<td>27 Sep 67</td>
<td>11K65M</td>
<td>Tsiklon</td>
</tr>
<tr>
<td>4 Jun 68</td>
<td>11K65M</td>
<td>Sfera</td>
</tr>
<tr>
<td>1 Feb 69</td>
<td>8A92M</td>
<td>Meteor</td>
</tr>
<tr>
<td>23 Jul 69</td>
<td>11K63</td>
<td>DS-P1-Yu</td>
</tr>
<tr>
<td>27 Dec 69</td>
<td>11K65M</td>
<td>Ionosfernaya stantsiya</td>
</tr>
</tbody>
</table>
On 18 December 1968 the RT-2 missile was officially declared operational. By 1971 a total of 60 RT-2 silos were on combat duty at a Strategic Rocket Forces base near Yoshkar-Ola, the only site where the missile was operationally deployed. In fact, the RT-2 never played a significant role in the Soviet Union’s strategic missile arsenal. It was inferior in performance to Chelomei’s UR-100 class liquid-fuel missiles and also to America’s Minuteman-2 solid-fuel missile, which had a similar launch mass but carried nuclear warheads that were twice as powerful. By 1977 all RT-2 missiles at Yoshkar-Ola were replaced by the improved RT-2P, which had begun test flights from Plesetsk in January 1970 [104].

Another missile tested from Plesetsk in the late 1960s was the RT-20P (8K99) mobile ICBM, developed by the Yangel design bureau. Design work on this missile had begun as early as 1961, with the original goal being to develop a small-size solid-fuel ICBM with a launch mass of around 25 tons. Eventually, this goal turned out to be unrealistic, forcing Yangel’s designers to come up with a “hybrid” rocket, burning solid fuel in the first stage and liquid propellants in the second stage. It was fired from an automotive launcher created on the basis of the heavy T-10 tank (Fig. 34).

Two sites were prepared for test launches of the RT-20P. Called Areas 157 (Tsvetochnaya) and 158 (Tokovishche), these neighbouring facilities were situated just north of the RT-2 silos. A comprehensive test programme numbering 35 launches was planned. The first two rockets were shipped to the launch site in the spring of 1967 and were only used for ground tests. The first launch attempt on 27 September 1967 was aborted and subsequent attempts on 24 October and 1 November ended in first-stage failures. Seven more missiles were flown between February and October 1968, but only three were considered marginally successful. In January 1969 production of the rockets was cancelled but several more tests with existing missiles were approved to test systems that could be used in future rockets. Three more
rockets were successfully launched in July-August 1969 from Kapustin Yar, but the RT-20P project was definitively terminated on 6 October 1969. Not only had the test flights given little confidence in the reliability of the rocket, there was also opposition in the Strategic Missile Forces against using liquid propellants on a mobile ICBM. Moreover, a more capable mobile ICBM using only solid propellant (the Temp-2S of the Nadiradze design bureau) was already under development [105].

In the late 1960s and early 1970s Plesetsk also served as the launch site for R-14U missiles flown in the framework of the A-35 anti-missile programme, designed to protect Moscow and its surrounding areas against nuclear attack. An experimental version of the ABM system called Aldan was set up at the Sary Shagan test range (10 GNIIP) near Lake Balkhash in the late 1960s. It included two launch pads for A-350 interceptors, three radar systems and a command post. The final objective of the test programme was to use A-350 missiles to intercept R-12 missiles launched from Kapustin Yar and R-14U missiles fired from Plesetsk.

The area chosen for the R-14U launches was known as Medvezhi Gory and was presumably located a few kilometres to the west of the 11K63/11K65M pads. Construction work started in 1963 and was finished in January 1965. US reconnaissance satellite photographs made at the time showed two pads [106]. The R-14U facilities were very basic and had little in common with the 11K65M pads in the nearby Lesnoye area (Fig. 35). They included simple ground-based pads and a small building to mate the rocket with its head section. No rail lines were built to the facility and the rockets were transported by road. Things were probably kept simple because the test programme would be limited. The facilities were operated by the same team that was in charge of the 11K63 and 11K65M pads (Military Unit 63551).

The first launch attempt in July 1969 failed when one of the two engines in the first stage did not ignite, causing the rocket to crash back to the ground only several dozen metres from a major command post at Plesetsk. All five subsequent launches were successful. The test programme was finished in June 1970, although the Sary Shagan Aldan complex continued to be used in the 1970s for practice launches by A-35 teams based around Moscow [107].

15. Spying on Plesetsk

Although the existence of the Plesetsk launch site was a closely guarded state secret, it didn’t take very long for US intelligence to pick up signs of ICBM-related activity in the area. The CIA estimated that the R-7 had a range of 5,000 nautical miles (9,200 km), which meant that missiles launched from Tyura-Tam would not be able to reach significant portions of US territory. The logical conclusion was that operational sites would have to be deployed in northern Russia. Based on photographs of Tyura-Tam obtained by the U-2 spyplane in 1957, it was known that the ICBM system relied on the rail network, leading analysts to conclude that any operational sites in the northwest would also be located in the vicinity of railways.

The first evidence for the existence of a missile base near Plesetsk is believed to have been obtained via signals intelligence (SIGINT). On 23 April 1958, about a year after construction of Object Angara had begun, the National Security Agency intercepted the first of a small number of messages involving a special Russian military construction unit located at an undetermined point along the Vologda-Arkhangelsk railway line [108]. By August 1958 Plesetsk had become an area of interest [109].

It was also around this time that the northwestern railways were reportedly first placed on the target list for the U-2 (Fig. 36). A group of intelligence experts met with
President Dwight Eisenhower at the end of August 1958 and recommended that he approve “a northern operation” by the U-2. The flight would enter Soviet airspace from the Barents Sea and search for ICBM bases along the railways of the northern USSR. After the President’s approval, two U-2s were sent to a Norwegian Air Force base at Bodo (the closest “friendly” launch base for such a mission), where they remained on stand-by in September-November. However, consistent cloud cover over the target area eventually led to the cancellation of the mission, which was known as “Operation BABY FACE” [110]. Although it has been speculated that Plesetsk was among the targets for the “northern operation”, this now seems unlikely [111]. In a top-secret CIA National Intelligence Estimate disseminated on 24 October 1958 the only suspected operational ICBM site mentioned is Polyarnyy Ural. This is Russian for the “Polar Urals” region and is also the name of a village situated along the Kotlas-Vorkuta-Salekhard railway line. It is in this same general area that construction is known to have begun in early 1957 of “Object Volga”, the other R-7 base that was approved by the Soviet government in January 1957 besides “Object Angara”. In all likelihood, SIGINT evidence for the Polyarnyy Ural site was more convincing than that for Plesetsk. As the report noted:

“There is limited information concerning a possible Soviet ICBM launching site … Fragmentary [classified word] data concerning unidentified activity in the Polar Urals region suggests that establishment of an ICBM launching site might be underway. The available information, however, reveals only that a military construction project of undetermined scope and character was underway in the latter part of 1957 and is probably still continuing. [Several lines classified]. Railway construction battalions have also been active in the area” [112].

Plesetsk is not mentioned either in declassified documents from the Eisenhower Archives dated 31 March 1959 which contain recommendations for further U-2 overflights of the Soviet Union. The suspected operational ICBM sites included here were Verkhnyaya Salda in the Urals (which would become the first operational R-16 base) and the Polyarnyy Ural area. It was believed that rail lines in northern Russia could provide “mobile rail launch against the United States” or “direct rail support for ICBM hardstands at Polyarnyy Ural”. In one of three proposed U-2 flights, the U-2 would take off from Bodo, Norway, enter Soviet airspace over the west of Novaya Zemlya island, follow the rail line running from Salekhard to Kotlas and then turn north again, following the Severnaya Dvina river. It would leave the Soviet landmass over Severodvinsk (called Molotovsk until 1957), where construction of guided missile or atomic powered submarines was believed to be underway. The flight path would have taken the U-2 roughly 200 km east of Plesetsk [113]. All this would suggest that while signals intelligence had identified Plesetsk as a possible ICBM base by mid-1958, it was not as high on the priority list as the Polyarnyy Ural site or the exact location of the construction site was not yet known. Of course, no one knew at the time that the Soviet government had ordered to terminate work on the Polyarnyy Ural base in July 1958.

The U-2 planes hadn’t flown over Soviet territory since March 1958, mainly because President Eisenhower feared they could be shot down by the Russians. However, there was increasing pressure to settle the question if there really was a “missile gap” between the USSR and the US. The missile gap controversy had been provoked by the initial R-7 test flights and Sputnik launches and an extensive Soviet propaganda campaign that claimed a substantial Soviet lead in developing and deploying ICBMs. Because of the lack of photographic coverage of the Soviet Union, the CIA was almost completely in the dark about the number and nature of operational R-7 launch sites, not knowing whether they were fixed or mobile, “soft” (i.e. ground-based) or “hard”
U-2 overflights of the Soviet Union resumed with missions in July 1959 and December 1959, but those did not spot any operational ICBM sites. By early 1960, the Air Force claimed that the Soviet Union had deployed about 100 ICBMs, but the Army, Navy and CIA doubted that any had been deployed because none could be found.

It was not until after two more U-2 missions in February and April 1960 that the northern railway lines were again placed on the target list. Two missions were proposed. One, called Operation TIME STEP, would take off from the USAF base in Thule, Greenland, fly over Novaya Zemlya island and then follow the railway lines from the Polar Urals to Kotlas before returning back to its home base (pretty much the same flight path proposed in March 1959). The other, dubbed Operation GRAND SLAM, would be the first U-2 mission to transit the entire Soviet Union border-to-border, taking off from Peshawar, Pakistan and landing in Bodo, Norway. Among its targets would be Tyura-Tam, nuclear production facilities around Sverdlovsk in the Urals, and Plesetsk. In the end, preference was given to GRAND SLAM because it offered the best chance of photographing suspected ICBM installations. One advantage of approaching Plesetsk from the south was that the U-2 was less likely to be detected by Soviet air defence radar systems, most of which were pointed north to the US. It was also felt that TIME STEP was more likely to run into bad weather because it would remain above 60° northern latitude.

Plesetsk was formally added to the target list on 14 April 1960. In the preceding months evidence had continued to mount that some kind of unidentified ballistic missile activity was taking place there. In September 1959 the CIA’s Ad-Hoc Requirements Committee (ARC) had identified the area around Plesetsk as a potential target for future U-2 overflights on the basis of fragmentary SIGINT data. Between December 1959 and February 1960, Norwegian SIGINT stations had intercepted more Soviet communications traffic suggesting that ballistic missile activity was being conducted at Plesetsk.

After several delays, the U-2 (mission 4154), piloted by Francis Gary Powers, took off on 1 May 1960, but the aircraft never made it to Plesetsk. Four and a half hours into the mission, while flying near Sverdlovsk, the plane was disabled by a surface-to-air missile that detonated right behind it. Powers managed to eject from the U-2 and was captured by the Russians. He was sentenced to ten years (three years in imprisonment followed by seven years of hard labour) but was released in February 1962 in exchange for a Soviet spy who had been caught by the FBI.

Overall the U-2 had accomplished 28 missions over various parts of the USSR and Eastern Europe between mid-1956 and May 1960 and although many important missile installations (notably at Kapustin Yar and Tyura-Tam) had been observed, no photography was acquired of any operational ballistic missile deployment complex which was sufficiently far enough along in construction to be recognizable. However, this did not eliminate concerns over massive Soviet ICBM deployment. After all, the U-2 had imaged only about 15 percent of the country and deployment activity might not be distinguishable from other construction or invisible because it was concealed or mobile. For instance, it was believed that missiles and their supporting equipment would be carried on trains and moved from one pre-selected site to another, making it difficult to determine the precise location of any given missile unit on a continuing basis. Had Powers’ U-2 flown over Plesetsk, the CIA very likely would have received irrefutable evidence for the existence of four R-7 pads, two operational ones and two in the final stages of construction.

After the cancellation of U-2 flights following the May 1960 shootdown, all hopes to obtain overhead imagery of Soviet territory were pinned on the CORONA reconnaissance satellites. Officially announced with the cover name Discoverer, the satellites had begun flying in January 1959, but it was not until Discoverer 14 (CORONA mission 9009) on 18 August 1960 that the first imagery was successfully returned. Earlier that same month the Director of Central Intelligence had established the Committee on Overhead Reconnaissance (COMOR) to recommend targets for CORONA and other strategic reconnaissance systems. The same day that
Discoverer-14 flew, COMOR promulgated a “List of Highest Priority Targets” in which suspected ICBM complexes received top priority. Among the list of 32 targets were the Vologda-Arkhangelsk rail line (with Plesetsk one of three locations along the rail line to be photographed) and the Kotlas-Vorkuta-Salekhard rail line (with Polyarnyy Ural among nine sites to be imaged) [120].

The next successful CORONA mission (Discoverer-18/CORONA mission 9013), launched on 7 December 1960, was the first to photograph the ICBM complex at Plesetsk, but low Sun angle, small scale and snow cover prevented its positive identification at the time [121].

In a National Intelligence Estimate released on 7 June 1961 the CIA reported that it had still been unable to positively identify any ICBM launching facilities other than those at Tyura-Tam, but that there was substantial evidence for the existence of such sites in the northwest of the USSR:

“Some of the suspected areas are in regions best suited to the deployment of 5,000 n.m. ICBMs. Two of these are at Plesetsk and Polyarnyy Ural in northwestern USSR … There is considerably more information on these two locations than any of the other suspected sites. It includes, among other things, a reliable report of a large rail-served installation at Plesetsk, consisting of several groups of buildings and rail spur. While there is some evidence to suggest alternative explanations for the construction at Plesetsk and Polyarnyy Ural, its timing was concurrent with the development of the 5,000 nautical mile missile. We believe that these activities provide mutual cross-confirmation, and therefore estimate that Plesetsk and Polyarnyy Ural are ICBM sites which were operational as of about 1 January 1960”.

The CIA estimated that the USSR had about 10 to 15 operational ICBM complexes with a total of 50 to 100 pads, while the Air Force claimed there were at least 120 pads. On the other hand, the Army and Navy believed it unlikely that operational ICBM sites had been constructed in those areas in 1957-1959 because this would have required decisions on their design and construction to have been made prior to the first R-7 test flights from Tyura-Tam. In their view, little if any operational ICBM deployment had occurred. It was noted in the report that disadvantages of northwestern launch sites would be their vulnerability to attack by Western delivery systems and also the harsh climatic conditions, which were likely to create “severe construction, maintenance, and operational problems”. By this time, US intelligence was aware of test flights of an improved version of the first-generation ICBM with a range of 7,000 nautical missiles (later identified as the R-7A) and it was realized that the Soviets “would probably seek rail-served locations in interior regions with moderate climate and terrain, low population density, and high security from Western observation and attack” [122].

With hindsight, the CIA had been almost spot-on with its estimate that the Plesetsk pads were operational by 1 January 1960. As noted earlier, pad 1 had been declared operational on 15 December 1959 and pad 2 on 17 February 1960. However, the conclusion that Polyarnyy Ural had also reached operational status by early 1960 was completely wrong, indicating that these estimates were based on flimsy evidence.

Plesetsk was again imaged during the next two successful CORONA missions, launched on 16 June and 7 July 1961 (9017/Discoverer-25 and 9019/Discoverer-26). In a memorandum to the Director of Central Intelligence, the CIA’s Board of National Estimates assessed the June photography as “the most important breakthrough into the Soviet long range ballistic missile program since the acquisition of radar coverage of test firings and TALENT [U-2] coverage of test range installations some years ago”. However, the main accomplishment of the missions appears to have been the positive identification of operational R-16 facilities (“second-generation ICBM complexes”) near Yurya, Yoshkar-Ola and Verkhnyaya Salda [123].

In a supplementary follow-up National Intelligence Estimate disseminated on 21 September 1961, it was noted that the new photographs made in mid-1961 had been too limited to confirm or rule out Plesetsk as an ICBM deployment complex. Apparently, the strongest indications something was going on at Plesetsk came from support facilities:

“On the basis of evidence dating back to 1957 and other more recent information, we have estimated that Plesetsk is an ICBM complex with rail-served launchers designed to employ the first-generation ICBM. The installation at Plesetsk … is even larger than the Yurya complex. Although the presence of ICBM launchers has not been confirmed, there are [surface-to-air missile] sites, several large support areas, and numerous buildings, including what appears...
to be housing for some 5,000 to 15,000 persons. The photographic and other evidence is inadequate to establish the number of launchers which may be at Plesetsk. We believe that the number may be as few as two, but four or more is also possible. An ICBM complex involving this much equipment, investment, and personnel would probably have a reload of at least one missile per pad. Based on Tyura-Tam experience, we estimate the time to prepare a second salvo at about 16 hours” [124].

The report also included a map of Plesetsk, where “West Area” is the location of the R-7 pads. The area indicated as “East Area” is roughly where the construction of R-16 pads had begun in the summer of 1960, but the CORONA pictures were clearly not detailed enough yet to identify them as such. Polyarnyy Ural was no longer mentioned in the report, but it was still on CORONA’s list of suspected ICBM deployment sites as late as September 1962 [125].

The general conclusion of the September 1961 report was that the coverage of test range activities and potential ICBM deployment sites was adequate to support the judgment that only a few ICBM complexes were operational or under construction. It was believed that in about 1958 the Soviet Union had decided to deploy only a small force of first-generation ICBMs while pressing toward second-generation systems. Nevertheless, the CIA still estimated there could be 10 to 25 operational first-generation ICBM launch pads, while in actual fact there were only four. One problem in looking for operational R-7 launch sites was that US intelligence was not sure that the pads would be identical to those at Tyura-Tam. In fact, the general belief appears to have been that the operational pads would be much simpler than the prototype pads at Tyura-Tam. It took analysts some time to realize that the simpler facilities built for the R-16 at Tyura-Tam were not intended for the R-7, but for a new-generation ICBM.

Plesetsk remained a top priority target for US reconnaissance satellites for years to come. Photographic interpretation was often hampered by the frequent cloud cover over the area (which, as pointed out earlier, was exactly one of the reasons why Plesetsk had been selected). However, declassified CIA Photographic Interpretation Reports show that by February 1963 the CIA had positively identified all four R-7 pads (referred to as “Launch points I, II, III and IV”/“Type I facilities”), the three R-16 complexes (referred to as “Areas A, B and C”/Type II ground-based, Type III silo) and the two R-9A complexes (“Areas D and E’/Type IV”) (Fig. 39). It was noted that Plesetsk was unique among operational ICBM sites because it supported all three ICBM types available at the time. This led the CIA to conclude that “it may be both a deployed operational complex and a training-orientation facility” [126].

By December 1966 CIA photo analysts had spotted the launch facilities for the 11K63 and 11K65M rockets (referred to as “Launch Sites 9 and 10”) but were unaware of their purpose because they were unlike any other launch complexes identified to date (the 11K63 facilities at Kapustin Yar having been silo-based and the 11K65 facility at Tyura-Tam having been adapted from an R-16 pad). Analysts were also puzzled by the absence of a nearby assembly building, which, unknown to them at the time, was being built several kilometres south of the pads near Mirnyy. They also wrongly concluded that both sites consisted of two pads (that was only the case for the 11K65M complex) [127]. The purpose of these facilities presumably did not become clear until the first 11K63 and 11K65M launches in March and May 1967.

It is not clear if the CIA had any indications that Plesetsk was going to be used as a space launch facility before the first satellite launch took place in March 1966. The only new infrastructure known to have been built in support of the space programme prior to the 1966 launch were downrange tracking stations (also needed for test flights of the RT-2 solid-fuel missile). Another clue might have come from modifications made to the first R-7 pad, but it is questionable if those could have been recognized as being related to the space programme.
16. Kettering Group Finds Plesetsk

The distinction of "discovering" Plesetsk in the public domain fell to the famed Kettering Group. Led by physics teacher Geoffrey Perry, this was a team of enthusiasts who monitored satellite signals with shortwave radio equipment from Kettering Grammar School in Northamptonshire, England (Fig. 40). The team had specialized in monitoring week-long missions of recoverable Kosmos satellites launched from Tyura-Tam and immediately noticed various unusual features when Kosmos-112 was launched on 17 March 1966. Apart from the unusual inclination of 72°, the launch took place unusually late compared to that of spy satellites launched from Tyura-Tam and the signals received indicated it was being controlled from a more northerly station than usual. All this led Perry to believe that the satellite had been launched from a new site in the north of the USSR. Perry published his findings in the Correspondence section of the 21 April 1966 issue of *Flight International*, saying he agreed with a suggestion made to him by Swedish satellite observer Sven Grahn that “a launch from the southern tip of Novaya Zemlya (71°N, 52°E) would satisfy all the foregoing observations”. Few people took notice of Perry’s letter at the time.

Two more Kosmos satellites were launched into 72° inclination orbits in April and June 1966 (Kosmos-114 and 121) and it wasn’t until the launch of Kosmos-129 (another Zenit-2 spy satellite) on 14 October 1966 that Perry’s team was able to accurately pinpoint the location of the northern cosmodrome. The satellite had an inclination of 64.65° (slightly less than the 65° inclination used by recoverable satellites flown from Tyura-Tam), the launch took place later in the day than that of typical 65° inclination Kosmos satellites and the satellite landed after 6.75 days instead of the usual eight, leading Perry to conclude that it had also been launched from the new site. Using a computer belonging to a Kettering firm, Perry and his students plotted its orbital path and determined that its initial ground track intersected the others at 63° north latitude and 41° east longitude, a point near the town of Plesetsk some 200 km south of Arkhangelsk [128].

Perry announced the coordinates at a meeting of the British Interplanetary Society on 3 November and followed this up with another letter to *Flight International*, published on 10 November. As Perry himself later recounted: “Once again there was no initial reaction but the late Dr Charles S Sheldon II, of the Congressional Research Service of the US Library of Congress, wished to include details of the site in a report. His manuscript had been returned by the CIA with that section marked ‘Classified’. His reaction was to alert the press to what I had written in FLIGHT and on the day after we broke up for the Christmas holiday, The Times ran the story under the by-line ‘From our Washington correspondent’. My life changed from that point” [129].

Despite the fact that Plesetsk was publicly identified in the West as a cosmodrome almost as soon as the first satellite was launched, the Soviet public was kept in the dark about its existence for many more years. Unaware of what was going on, many people living under or near the rockets’ flight paths interpreted the strange lights in the sky as UFOs. In an attempt to debunk the UFO stories, the Communist Party newspaper *Pravda* finally lifted the veil of secrecy enshrouding the northern launch base in an article published on 20 June 1983 [130].

17. Conclusion

Having relinquished its original role as an operational ICBM launch site, Plesetsk soon became the Soviet Union’s and even the world’s busiest space port. At the end of 1969, less than four years after its first satellite launch, Plesetsk had already achieved a higher annual launch rate than Tyura-Tam (Table 11). By the mid-1970s Plesetsk launched almost twice as many satellites as Tyura-Tam. The high launch rate did take its toll, with two major pad accidents (one involving a Kosmos-3M rocket on 26 June 1973 and another a Vostok-2M on 18 March 1980) claiming the lives of 57 cosmodrome workers.

By the end of the 1960s Plesetsk had fielded almost all the space boosters that would allow it to achieve the spectacular launch statistics of the following decade. The only new space rocket to make its debut in the 1970s was the Tsiklon-3, which began flying from two of the former R-9A pads in 1977. In the mid-1980s construction began of launch facilities for the Ukrainian-built medium-lift Zenit rocket, but the work ground to a halt after the collapse of the Soviet Union in late 1991. As the country entered a decade of economic and financial hardship, the launch...
built for the R-7, the Kosmos-3M and Tsiklon-3 rockets are being phased out to be replaced by a new family of launch vehicles that will also fill the payload niche currently occupied by the Proton rocket, which can fly only from Tyura-Tam. Following almost two decades of frustrating delays, the new rockets should finally begin flying from Plesetsk in 2013. In a fitting tribute to the origins of the cosmodrome, the new rocket family is called Angara and should become Russia’s workhorse rocket fleet for many years to come.

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REFERENCES

78. Ibid, p.50.
80. Ibid, p.349.
82. Ibid, p.51, 311-313.
83. Ibid, p.326.
84. Ibid, p.348.
85. Ibid, pp.256-257.
86. Ibid, pp.348-349.
87. Ibid, p.70.
93. V. Favorskiy and I. Meshcheryakov, op. cit., p.99.
96. I. Chornyy, op. cit.
98. Also note that all the satellites officially announced as Interkosmos had secret design bureau designators with the letters IK (e.g. Interkosmos-1 was DS-U3-IK-1, Interkosmos-2 was DS-U1-IK-1 etc.). This was not the case for Kosmos-261 and 348 (DS-U2-GK).
100. A. Bashlakov, vol. 1, op. cit., p.211.
101. I. Chornyy, op. cit.
103. Some sources claim that the salvo launch was the last in the test flight series.
111. In an interview with C. Pocock, Bodo detachment commander Stan Beerli said that in his recollection Plesetsk was one of the targets. Author’s e-mail correspondence with C. Pocock, 20 July 2011.
115. Memorandum, Reber to Deputy Director (Plans), ARC (Ad-


123. "Intelligence Aspects of the Missile Gap", op. cit., pp.31-33.


125. "Index of COMOR targets" for KH-4 Mission 9043, published in "OAK Report", September 1962. See: J. David, "What Should Corona Photograph and How Often?", Quest, 17, p.45, 2010. It is not clear when Polyarnyy Ural was ruled out as an ICBM complex. A declassified 1968 CIA review of the missile gap controversy says it was later determined that the USSR probably started a first-generation complex at Polyarnyy Ural, but then cancelled it "some time after 1957". See: "Intelligence Aspects of the Missile Gap", op. cit., p.23.


130. V. Gubarev, "Starting Place: Plesetsk" (in Russian), Pravda, 20 June 1983. Available online at http://miger.ru/1983_23.html. (Last Accessed 30 October 2012) The article revealed little about the history of Plesetsk, saying that the cosmodrome had entered service in 1960 (which, strictly speaking, was the year it became operational as an ICBM base) and identifying it as the launch site of Interkosmos, Molniya and Meteor satellites, without mentioning its military role.