

Baikonur Cosmodrome, Kazakhstan

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Geographical position

Kyzylorda Province, Kazakhstan

Location

Latitude 45.9° N, longitude 63.3° E. Elevation 100m above mean sea level.

General description

Baikonur Cosmodrome has been the global base of operations for the Soviet, and subsequently the Russian, space programme. The first satellite, Sputnik, was launched from Baikonur, as was the first manned spacecraft in human history, Vostok 1, with Yuri Gagarin. So were several generations of cosmonauts, orbital stations, and lunar and planetary space missions.

Introduction

Science and technology heritage is a challenging new initiative involving numerous themes and issues, including specifically those relating to astronomical heritage and space exploration. We are keen to see solid progress towards understanding the principal concepts underlying such a complex topic. This, however, can only be accomplished by a gradual development of ideas. Baikonur's inclusion in this volume is an attempt to undertake the first steps in this process, but it does not constitute a full case study.

Science and innovation are regarded by UNESCO as key activities promoting sustainable development. Astronomical heritage is intrinsically related to the most important breakthroughs in space science and technology, and space exploration has established a new great milestone for human civilization. It is therefore essential to include space technology as an important category of technology heritage that has international significance in terms of humankind's relationships with the sky. Following the international conference on 'Astronomy and World Heritage: Across Time and Continents' held in Kazan, Russia in August, 2009, it became a subject of further discussion and clarification, with an important step towards the goal being taken within the first ICOMOS–IAU Thematic Study (see DeVorkin 2010; Marov 2010).

Outstanding objects of space infrastructure involving the most valuable sites and facilities must be regarded as historically important artefacts of human culture, alongside astronomical observatories and instruments. This includes instruments operating in space, themselves material artefacts of great significance (see Huntress and Marov 2011). There is a synergy between space astronomy and space technology that served to stimulate progress with astronomy and produced numerous technological spin-offs. The goal is therefore to develop a rational and coherent approach enabling us to commemorate various space instruments (e.g. space telescopes), spacecraft (e.g. planetary probes), and other man-made objects in space (e.g. orbital stations) accepted by international bodies such as the IAU, ICOMOS, and COSPAR, as heritage artefacts of global significance in relation to astronomy and space technology.

Space facilities where the most historically valuable spacecraft were designed and manufactured together with launch pads (cosmodromes) are key parts of the overall space infrastructure because they ensured the development and launch of spacecraft and thus historical achievements in space exploration and use. Examples of particular historical value are the RSC "Energia" (former OKB-1) and NPO Lavochkin in Russia; the Jet Propulsion

Laboratory (JPL) and Johnson Space Flight Center (JSFC) in the USA; the Russian Baikonur Cosmodrome and the American Kennedy Space Center, just to mention a few. These are space facilities responsible for the development and launch of the first satellite; for Yuri Gagarin's first orbital flight in the VOSTOK spaceship; for Neil Armstrong first step on the Moon from the EAGLE capsule; for the first orbital stations (Salyut, Skylab, MIR) which paved the road to the International Space Station (ISS); and for several generations of launchers including the Space Shuttle and Energiya-Buran.

Brief inventory

Baikonur cosmodrome is located at the centre of an elliptically shaped area measuring 90 km from east to west and 85 km from north to south. It comprises nine launch complexes with fourteen launch pads, thirty-four engineering complexes, three fuelling stations for space vehicles and two aerodromes. The location of the main facilities is shown schematically in Fig. 13.1. The town of Baikonur is shown as Ленинск (Leninsk)—see below.

The famous “Launch pad no. 1”, known as “Gagarinskiy Start” (Gagarin’s launch pad), is some 30 km to the north of Baikonur. The launch complex measures 250 × 100 m with a depth of 45 m. Extraordinary efforts were needed in order to create the necessary infrastructure of concrete foundations, flame duct, steel launch platform, tanks, pumps, drainage pipes etc. in the mid-1950s. The launch pad and an associated assembly building (Site 2) formed the initial facility where military and space developments took place at Baikonur.

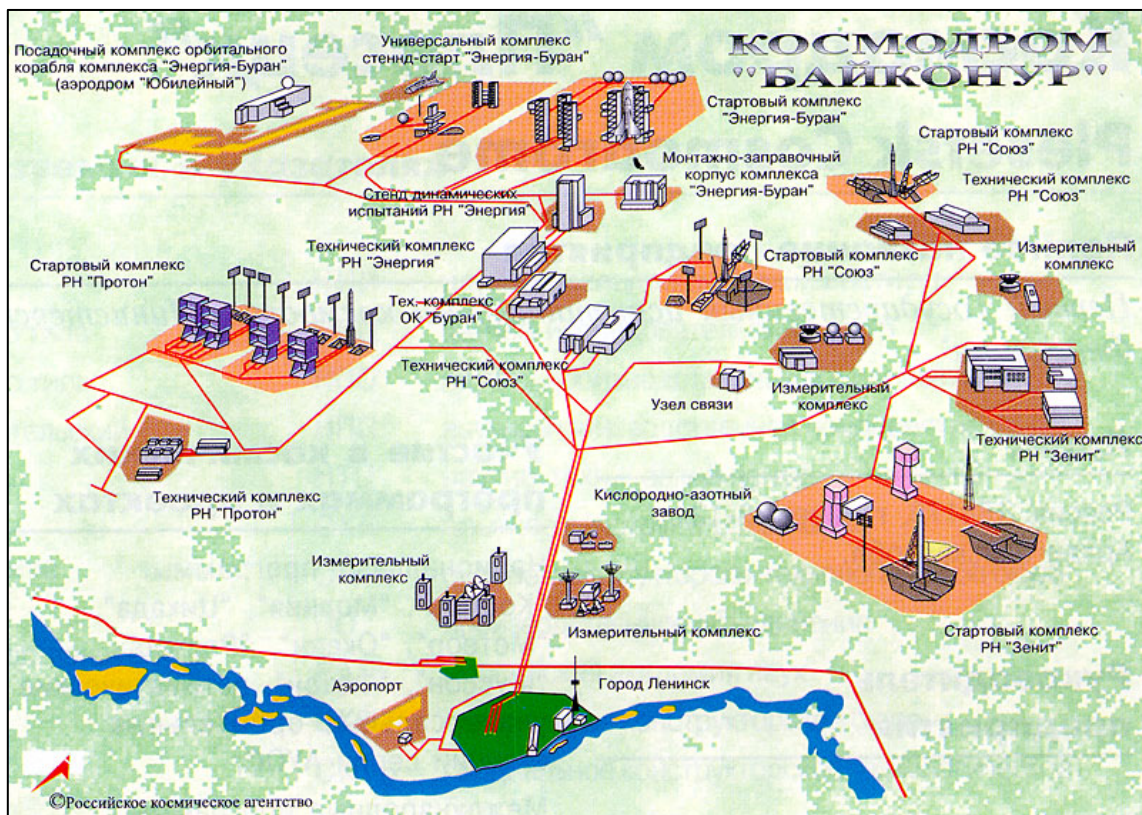


Fig. 13.1. Location of the main facilities at Baikonur Cosmodrome. Courtesy ROSCOSMOS



Fig. 13.2. The Soyuz TMA-10M spacecraft being prepared for launch in September 2013, to take a new crew to the International Space Station. Photograph: NASA/Carla Cioffi

The Энергия–Буран (Energia–Buran) general-purpose rocket launch complex is located in the center of the cosmodrome, close to Gagarin’s pad, stretching out for 15 km along the main cosmodrome road. It was constructed on the site where the N1 rocket booster, intended for manned flight to the Moon, was developed between the late 1960s and early 1970s. However four launches failed, one of which completely destroyed the launch pad.

The “left flank” portion of the cosmodrome stretches for some 20 km to the west of the Energia–Buran complex, and contains the engineering and launch facilities for the Циклон (Tsyklon/ “Cyclone”) and Протон (Proton) rockets. The latter contains four launch pads and two large “processing” (assembly-and-test) complexes, as well as a fuelling facility.

The eastern section (“right flank”) of the cosmodrome, which came into operation in 1961, was used for testing a range of ballistic missiles and rocket launchers developed by Mikhail Yangel’s Design Bureau. The more northerly of its two launching complexes has been used extensively for the launch of space vehicles, both manned and unmanned, including the extraordinarily successful Союз (Soyuz) spacecraft (see Fig 13.2). The other launch complex, 10 km to the south, was built to develop the Зенит (Zenith) launch system focused upon putting satellites into earth orbit. It comprises two launch pads, an assembly-and-test building, storage depots and other engineering facilities. A cryogenic centre is situated nearby.

Historical highlights

On Feb 12, 1955, the Soviet Council of Ministers issued a decree that Defence Ministry Research and Trials Field Station no. 5 (NIIP–5) would be sited in the heart of the Kazakh Steppe, north of the Syr Darya river and about 200 km east of the Aral Sea, near to the village of Tyuratam and its railway station. NIIP–5 was a test range for the world’s first intercontinental ballistic missile (ICBM), the R–7, which needed to be deployed well away from densely populated areas but also in a location surrounded by desert plains, so that it could receive

continuous radio signals from distant ground control stations. NIIP–5 was almost immediately expanded to include launch facilities for space flights. Construction of the first of these began on Jan 12, 1956 and was completed in under one and half years on May 5, 1957. Sergei Korolev, the Chief Designer of the R–7, went on to lead the early Soviet space programme.

According to some sources, Baikonur was a pre-existing name for the Tyuratam area. Most, however, state that the name was chosen in 1961, at the time of Gagarin's flight, in order to mislead the West about the exact location: there is a small mining town called Baikonur some 320 km to the north-east. The present city of Baikonur only came into existence in 1955, when a settlement of wooden buildings ("Ground #10 Zarya") was erected some 30 km away from the cosmodrome facilities in order to provide housing, schools and support infrastructure for employees. From 1966 until 1995 the developing city was known as Leninsk; on 20 December 1995 it was renamed Baikonur by a decree signed by Russian and Kazakh Presidents Boris Yeltsin and Nursultan Nazarbaev.

Among the notable early space missions that were launched from Baikonur are:

- Sputnik 1 (Oct 4, 1957), the first artificial satellite;
- Luna 1 (Jan 2, 1959), the first spacecraft to reach the vicinity of the Moon;
- Vostok 1 (Apr 12, 1961), the first manned spaceflight, which carried Yuri Gagarin into orbit; and
- Vostok 6 (Jun 16, 1963), which carried Valentina Tereshkova, the first woman in space.

On Oct 24, 1960 there was a major disaster when a prototype R–16 ICBM detonated on the launch pad, killing about 150 people.

Between 1978 and 1988, the "Interkosmos" program led to 14 cosmonauts from 13 nations outside the Soviet Union—countries both within and outside the Warsaw Pact (including Bulgaria, Czechoslovakia, Cuba, Vietnam, India and France)—participating in Soyuz missions launched from Baikonur. Following the collapse of the Soviet Union in 1991, Russia began joint missions to the Mir space station with the USA. This led to the development of the International Space Station, which, since the termination of the US Space Shuttle program in 2009, has been supplied solely by Soyuz manned spacecraft and "Progress" cargo transport vehicles launched from Baikonur.

Baikonur continues to be used for launching both manned and unmanned spacecraft. Numerous commercial, military and scientific missions are launched annually as part of the current Russian space programme.

Documentation and archives

Baikonur Cosmodrome has a museum which houses many artefacts, documents and photographs relating to space exploration and, more specifically, to the cosmodrome's history. A Buran shuttle orbiter, tested on a single unmanned spaceflight, has been restored and hosts an interactive presentation for visitors. The museum also includes a Soyuz descent capsule, a variety of rocket engines, early computers, various models, and numerous artefacts relating to Sergei Korolev, Valentin Glushko and Yuri Gagarin. Finally, there is a signed crew photograph for every expedition launched from Baikonur—a tradition that has been maintained without exception.

Located adjacent to the museum building are two small cottages, formerly occupied by Sergey Korolev and Yuri Gagarin, which have been carefully preserved. Their interiors nicely convey the very modest living environment and atmosphere of those few anxious nights before the historic Gagarin flight.



Fig. 13.3. The room where academician Sergey Pavlovich Korolyov, Chief Designer spent the night before Yuri Alexeyevich Gagarin's flight, the first manned spaceflight (April 11 and 12, 1961). Photograph: Alexander Mokletsov (RIA Novosti archive, image #877560)

Justification for inscription

Baikonur is one of the most advanced properties of the space era and its historically important position in human culture is without question. It could well be considered to “represent a masterpiece of human creative genius” (criterion (i)). What follows in this section is simply an attempt to preliminarily address some of the issues that could arise in the comparative analysis and in the discussion of integrity and authenticity.

The comparative analysis should most certainly consider the Kennedy Space Flight Center (KSFC) in the USA, which is arguably of similar historical value to Baikonur. Like Baikonur, it has many globally recognized achievements. Nonetheless, Baikonur holds the historical facilities that provided the launch of the world's first artificial satellite and the first man in space, Yuri Gagarin, the two key events that opened the space era.

The present-day Baikonur cosmodrome is a huge area containing numerous launch pads and facilities, as described above. It has been dramatically extended since the first Sputnik and Vostok flights. In order to satisfy integrity-authenticity requirements, careful consideration must be given to critical historical elements such as the famous “Gagarinskiy Start” (Gagarin's launch pad) and Korolev and Gagarin's cottages.

The facility containing Gagarin's launch pad is well integrated within the functional space technologies used for testing and launching manned craft: many cosmonauts and crews have been launched since the first flight of Gagarin. Nonetheless, nothing has been removed or even partially demolished since the Gagarin's time. The facility's authenticity is beyond doubt and is well documented in the available historical archives. The historical events related to the launch pad are commemorated in an inscription on the stone plate erected *in situ* beside the pad. Certainly the original launch pad and its close environment have experienced some reconstruction in order to utilise modern equipment, but there have been no significant changes that would compromise authenticity. The Gagarin and Korolev cottages have been repaired but have not been altered, and the original furniture and personal belongings have been left in place.

Management

Since the disintegration of the Soviet Union, the Baikonur cosmodrome has been leased to Russia by the Kazakh government. Under an agreement signed by Vladimir Putin and Nursultan Nazarbaev in Astana on Jan 9–10, 2004, and ratified on June 2004 to be extended until 2050 at a fixed rent of US\$ 115 million per annum, with each country holding a 50% stake, it is managed jointly by the Russian Federal Space Agency and the Russian Space Forces.

It is not believed that the protection and management of historically significant elements of the cosmodrome such as the Gagarin launch pad (Gagarin start), Baikonur museum, and other sites and facilities that could contribute to potential OUV would impose any political obstacles, despite the fact that Baikonur is under international Russia-Kazakhstan joint jurisdiction. Certainly, various mutual obligations and restrictions would be necessary in order to preserve their integrity. There would also be a need for new procedures and formats concerning continuing utilization, preservation and maintenance, minor modification (if any), and public access to the relevant zones, and these would need to be negotiated with the Roscosmos authorities. The Baikonur management team would be responsible for implementing these procedures.

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