THE HISTORY OF REUSABLE ROCKETS AND REUSABLE SPACEPORTS. THE SPECIAL ROLE OF THE V-2 AND «FERRY ROCKET»

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Abstract. The history of the creation of disposable and reusable rocket systems – rockets and spaceports are considered. In 1920, Lenin, after a conversation with Zander, appointed Dzerzhinsky as the curator of cosmonautics in Soviet Russia. Dzerzhinsky, at Lenin's suggestion, headed *the Society for the Study of Interplanetary Communications*. Tsiolkovsky was given a scientific pension by the Council of People's Commissars.

In Germany, Oberth creatively developed Tsiolkovsky's ideas. In 1926, he received his book from Tsiolkovsky: "Exploration of World Spaces by jet devices."

Oberth's pupil was Werner von Braun. Developed by Brown in 1939-1944, *the classic "V-2" rocket became the classic basic model of all disposable rocket systems in the world*. Brown's development in 1952 of the 6,400-ton "*Ferry Rocket*" three-stage rocket with the 48-meter wingspan *became the classic basic model of all reusable rocket systems in the world.*

In 2026, we proposed the formation of two global (planetary) space complexes: Western and Eastern, which will provide all types of space launches in the era of space industrialization.

In 2024, the U.S. spaceports at Cape Canaveral began implementing a 50-year U.S. plan for the development of reusable spaceports by private investors (for the period from 2024 to 2074).

Large-scale infrastructure modernization is underway (including at the Cape Canaveral seaport) to ensure the higher expected frequency of launches and the creation of landing sites for spacecraft. and new reusable generation rockets.

The basis of space navigation will be a single reference lunar standard time ("*galactic time*"), which synchronizes the operation of the Western and Eastern space complexes.

Keywords. Lenin; Zander; Dzerzhinsky; Tsiolkovsky; Obert; Werner von Braun; Goddard; disposable and reusable rocket systems and spaceports; Western and Eastern global (planetary) space complexes; unified reference lunar Standard Time ("galactic time"); the new space socio-economic formation [SEF] named after Tsiolkovsky.

I. THE FOUNDERS OF WORLD COSMONAUTICS

Socio-economic formation [SEF] Tsiolkovsky began to develop spontaneously on Earth. It is just being formed. We are not yet fully aware of this

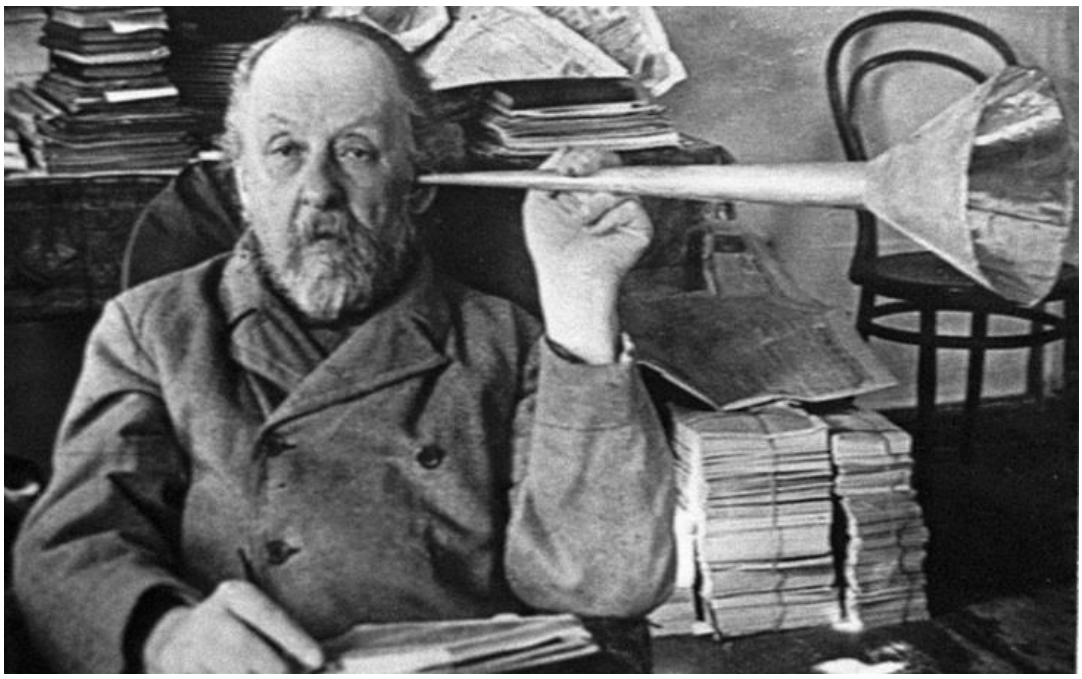
historical process. But real existence quickly determines our social and social consciousness. This is a normal trial and error process.

In December 1920, Lenin personally met with Tsander, a student of Tsiolkovsky, and with Dzerzhinsky. Dzerzhinsky became the first curator of cosmonautics in Soviet Russia.

At Lenin's suggestion, he headed the "*Society for the Study of Interplanetary Communications*." Tsiolkovsky was given a scientist's pension by the Council of People's Commissars.

Tsiolkovsky [1857-1935] completed the manuscript "Rocket" on May 10 according to the Julian calendar [May 22 according to the Gregorian calendar] in 1897.

He published this work in 1903 under the patronage of D. Mendeleev [1834-1907]. Robert Goddard [1882-1945] turned 21 in 1903; Hermann Oberth [1894-1989] turned 7; Wernher von Braun [1912-1977], a future student of Oberth, was not yet born. Professor Mendeleev, at the age of 69, turned out to be the most far-sighted. In 1903, he became the "midwife" of scientific cosmonautics.



Tsiolkovsky K.E. [1857-1935]

In 1926 Konstantin Eduardovich Tsiolkovsky republished his book «***The Exploration of Cosmic Space by Means of Reaction Devices***». [12,13,14,15]

Tsiolkovsky sent his monograph to everyone who was known to him as an expert on cosmonautics. He sent several copies to Oberth and Goddard personally in 1926.

This was a new edition of his 1903 work, in which the scientist outlined in detail the "work plan, starting in the near future" — the so-called "Tsiolkovsky Plan of 16 points." *zhukovskymuseum.ru; prlib.ru; element114.narod.ru.*

The book contained a theoretical justification for the possibility of achieving space speeds and creating a rocket-type aircraft for passengers. In it, Tsiolkovsky also answered questions about what pictures of the Earth, the starry sky and planets celestial travelers would observe. *zhukovskymuseum.ru*

The copy of this book was received by the Library of the Prussian Academy of Sciences — this was officially announced in 1927. *gmik.ru*

Hermann Julius Oberth [1894 — 1989]

Werner von Braun [1912-1977]

All spacecraft created in the first decades of space exploration were *disposable.* Their outstanding classical author, who de facto defined the entire

practical world trend in the development of rocket engineering, was the German engineer *Werner von Braun* [1912-1977].

Von Braun's classic dissertation "*Constructive, theoretical and experimental solution to the problem of a liquid rocket" (defended on April 16, 1934) was classified by the German army and was not published until 1960*.

Brown's consultant was the American Robert Goddard (1882-1945), whose liquid–fueled rocket, the "*Nell"*, successfully launched on March 16, 1926 in Massachusetts for the first time in the world. She climbed to a height of 12.5 m in 2.5 seconds.

By the end of 1934, Brown's group had launched several liquid-fueled rockets, two of which successfully climbed to an altitude of 2.2 km and 3.5 km (1.4 and 2.2 miles), respectively.

The first Soviet liquid-fueled rocket, GIRD-09, flew *on August 17, 1933*, it rose to an altitude of 400 meters in 18 seconds.

The practical implementation of Tikhonravov's GIRD-09 rocket project was personally led by S.P. Korolev, Deputy Head of the RSRI [Reactive Scientific Research Institute].

Tikhonravov M.K., an employee of the RSRI [Reactive Scientific Research Institute] and Tsiolkovsky K.E. [February 17, 1934]. Meeting after the launch of the first Soviet GIRD-09 rocket, designed by Tikhonravov. Korolev and Glushko were also invited by Tsiolkovsky to this meeting, but failed to attend.

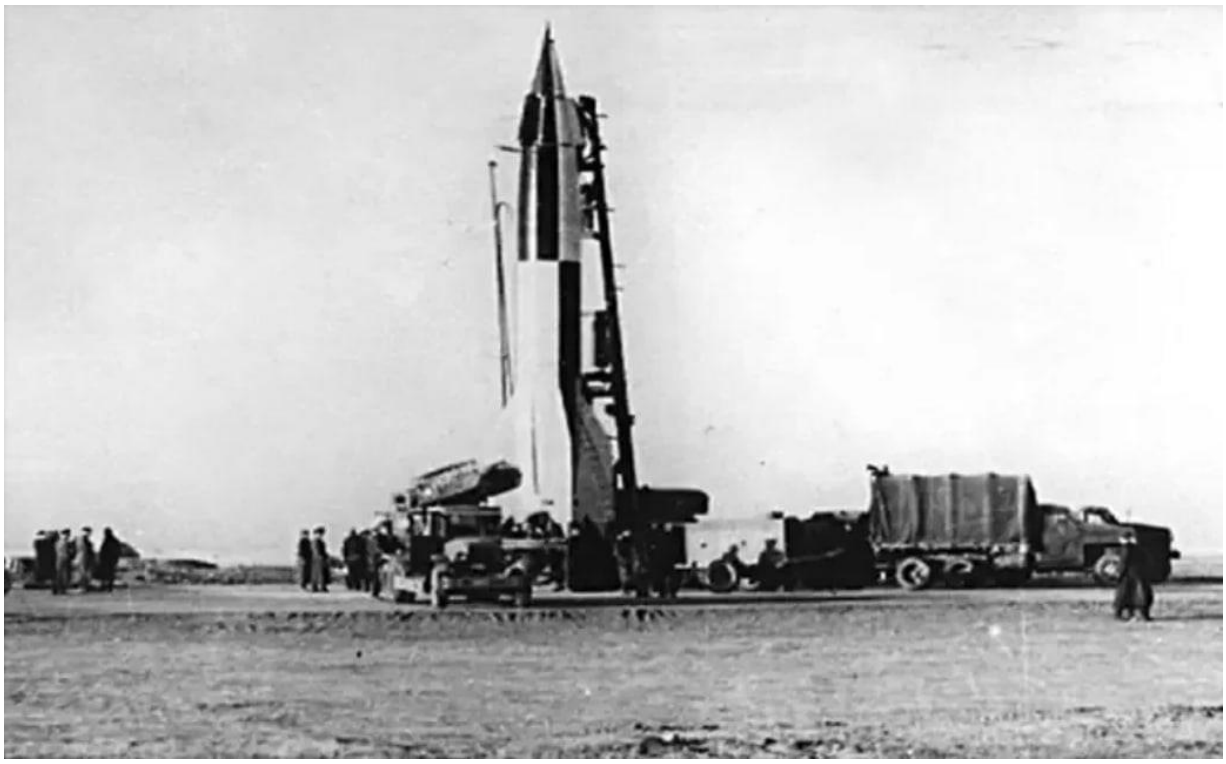
Kleimenov, the Head of the RSRI [Reactive Scientific Research Institute], and Tsiolkovsky [on February 17, 1934] met after the launch of the first Soviet GIRD-09 rocket. On Kleimenov's initiative, Tsiolkovsky was involved in the scientific developments of the institute, and he was elected an honorary member of the Institute's Academic Council [1933]. *keldysh-space.ru; warheroes.ru; zhukovskymuseum.ru*

The design and construction of the German A-4 rocket were ordered by the Wehrmacht in 1938-39. In 1939, Adolf Hitler was shown rocket engine tests, but he was not impressed by this sight.

However, already in 1944, Hitler regretted his mistake. He gave the highest priority to the project of building combat missiles in Peenemunde in the German armament program, saying:

"*Why couldn't I believe in the success of your work in 1939? If we had had these missiles in 1939, this war would not have happened* [World War II] ..."

Mobile version of the V-2 (1944)



V-2 rocket on the launch pad (1944)

In 1942, a liquid-fueled V-2 rocket made the first ever successful suborbital flight, crossing the Pocket line, theoretically separating the Earth's atmosphere from outer space at an altitude of 80 km.

This historic first successful test flight took place on October 3, 1942, and the rocket rose to an altitude of 84.5 kilometers (52.5 miles). On that day, Walter Dornberger declared at a meeting in Peenemunde:

"*The third day of October 1942 marked the beginning of a new era in the field of transportation — it is the beginning of the era of space travel*."

The V-2 reached its highest altitude on June 20, 1944 in the first flight of 174.6 km (108.5 miles), and in the second flight – 188 km.

Unlike the V-1, an airplane-type pulse-powered cruise missile, the speed and trajectory of the V-2 ballistic missile made it virtually invulnerable to anti-aircraft guns and fighter jets. The maximum speed reached 5,760 km/h (3,580 mph).

When colliding with the Earth's surface - up to 2,880 km/h (1,790 mph). It was the first kinetic weapon in the world. The V-2 fell to the Earth's surface from a height of 100-110 km (62-68 miles) with a suborbital flight speed of at least three times the speed of sound at sea level [Mach 3] of approximately 3,550 km/h (2,206 mph).

The rocket could be stealthily launched from almost anywhere, especially from roads running through forests. It was possible to launch up to 350 V-2 missiles per week, that is, 100 missiles per day. The V-2 left the crater 20 meters (66 ft) wide and 8 meters (26 ft) deep, spewing about 3,000 tons of soil into the air.

The V-2 did not have time to influence the outcome of the war, but led to the development of Cold War-era intercontinental ballistic missiles, which were actively used to colonize space.

After the defeat of the Nazis in World War II, German engineers were transported from defeated Germany to the USA, USSR, France and Great Britain, where they continued to develop the V-2 rocket for military and civilian purposes of the victorious states. *The V-2 rocket laid the foundation for the production of all modern liquid-fueled rockets and space launch vehicles that were used later*.

Three hundred railroad cars with V-2 missiles and their parts were captured and shipped to the United States alone. 126 leading designers, including Werner von Braun and Walter Dornberger, were captured by the Americans.

Von Braun, his brother Magnus von Braun and seven others decided to surrender to the American military (Operation Paperclip) in order not to be captured by the advancing Soviet troops and, most importantly, not to be shot by the Nazis themselves, which they were obliged to do to them on Hitler's orders in order to avoid their capture by the victorious Allies.

After moving to the United States, Werner von Braun began developing *reusable* space systems. Among the first, the most significant and well-technically developed, his *1952* project should be noted.

He designed the *Ferry Rocket*, which weighs about 6,400 tons and has a wingspan of 48 meters.

The first stage was supposed to return to Earth using a steel mesh parachute, and on approach to the surface of the Earth, additional engines were turned on for a soft landing in the ocean.

The second stage returned in the same way as the first, and the third landed on the airfield like a regular airplane [this is the principle of the ***Space Shuttle-Ferry***]. *bcs-express.ru; siriusmag.ru*

All subsequent developments of reusable rockets in Russia became a repetition of this model in different versions [1,2,3,6]. *Werner von Braun became the founder of all modern reusable rocket space systems.*

In 1990, the USSR successfully launched 61 rockets, or every second rocket on the planet [*50%*]. Globally, successful space launches in 2024 increased to 255, or 43 units (+21%). The increase was almost entirely due to Elon Musk's SpaceX (+38 launches). The Russian Federation's share in global launches dropped to an average of *2.35%.*

The number of military launches decreased. In 2022, the Russian Federation sent 12 rockets with satellites into space for defense needs, in 2023 – 7, and in 2024 – 6 [*2.35%*] although the Ministry of Defense planned 18 launches. [10]

Missile launches in Russia have become unprofitable by 2026. Why? The life of civilization on Earth changed all at once in 2017. This year, the Moon Colonization Program was adopted by Trump, the 45th President of the United

States, who issued Decree No. 1 on the colonization of the Moon by Americans on December 11, 2017. This Decree de facto launched the modern process of total industrialization of space.

Today, there are already about *9,000 tons* of artificial Earth satellites in space. And this process is progressing rapidly.

The first manned flyby of the Moon in the 21st century in 2026 as part of the Artemis II mission was an important step taken by the United States in the colonization of outer space. The next step should be the landing of American astronauts on the Moon as part of the Artemis IV mission.

"NASA aims to return to the Moon before the end of Trump's second term, build a lunar base, ensure a permanent presence and do everything necessary to ensure American leadership in space," said NASA billionaire astronaut *Jared Isaacman*.[11]

The United States refused to participate in a joint project with the European Space Agency for the construction of the Gateway space station. Instead, they will make a habitable base on the Moon right away, of course, not right now, but in the near future. The construction of habitable modules and various infrastructure has been scheduled for the 2030s.

By the way, this is not at all as fantastic as it seems at first glance. Large reserves of ice have been discovered at the poles of the Moon, which means that drinking and industrial water can be extracted directly on the Moon.

This is much easier and cheaper than shipping it from Earth, where it costs 0.5-1.2 million dollars to deliver one liter of water. So one of the main problems associated with the colonization of the Earth's satellite is definitely solved, one might say, on the spot.

The primacy in exploiting the resources of any space object, be it a planet or an asteroid, will remain with the country (or even a private company) that will be the first to begin manned colonization. For this reason, Americans only want to be the first.

Then they will get the best places on the surface of the planet, and the rest will have to negotiate with them and explore worse places: too sunny or, conversely, constantly dark, with radio communication problems, difficult terrain and other problems.

The whole world is switching to new space technology. There is a spontaneous transition from single-use rockets and single-use continental spaceports to reusable rockets and reusable spaceports.

The world is moving to a new space navigation that will be tied to the Moon, not the Earth. It will be a new "*galactic*" time of human civilization.

Russia has lagged behind in new space technologies. Most importantly, it cannot develop them without a critical base – without a system of reusable *offshore spaceports.*

In 2024, the U.S. Cape Canaveral spaceports launched a 50-year U.S. plan for the development of reusable spaceports by private investors (for the period from 2024 to 2074).

Large-scale infrastructure modernization is underway (including at the Cape Canaveral seaport) to ensure a higher expected frequency of launches and the creation of landing sites for spacecraft. vehicles and rockets of the new reusable generation.

Reusable rockets need automatic offshore platforms, on which all rocket stages that have been used in space automatically land. They are restored and then launched into space again with minimal operating costs.

The profitability of such missiles in relation to disposable ones is significant. All of today's Russian single-use cosmonautics has historically been built on purely continental single-use spaceports, and therefore it is unprofitable today. Russia has fundamentally lagged behind the advanced space powers, especially the United States, and continues to lag behind.

At the same time, Russia has a unique natural chance to occupy one of the leading positions in *the new space socio-economic formation named after K.E. Tsiolkovsky.*

On March 30, 2026, an absolute record for reusable space launches was set in the United States. A few minutes after launch, the first stage, the absolute leader of the SpaceX fleet, *made an accurate landing on the Just Read the Instructions marine unmanned platform ship in the Atlantic*.

It was the 34th flight of the same accelerator in just over five years of operation. The 33rd flight took place about a month ago. The company continues to increase the life of boosters: the goal is to bring them up to 40 or more flights.

The revolutionary shift from single-use spaceports and rockets to reusable ones has consequences. The limited number of reusable spaceports in the United States threatens the country with congestion in terms of launches, according to *The Wall Street Journal.* [4]

Almost all US launches are carried out today only from three eco-friendly reusable spaceports located in Cape Canaveral, Florida, due to strict environmental restrictions.[4]

In search of a solution, the space industry has turned its attention to alternative sites, including the northernmost spaceport on Earth on Kodiak Island in Alaska, right on the border with Russia.

Currently, the American Kodiak cosmodrome in Alaska is undergoing a permit procedure for up to 25 launches per year, which may partially relieve existing spaceports in the United States and provide new opportunities for small space companies.

The Vostochny cosmodrome in Russia is designed for about 10 one-time launches per year. [4]

It can be assumed that NASA can significantly expand the capacity of its unique modern reusable spaceports by opening its branch in Cuba. Logistically, this is an ideal location for the sea transportation of large rockets from factories in Texas and California (via the Panama Canal in the latter case).

We are talking about a reusable spaceport project in Cuba in the Western Hemisphere of the Earth. In a geopolitical sense, the middle and southern parts of Cuba's territory may be convenient for equipping the latest reusable spaceports and launch pads.

In addition to the three existing reusable spaceports at Cape Canaveral, NASA can easily add up to 50 new spaceports and launch sites in Cuba.

The strategic and commercial interest here is obvious. Cuba is closer to the equator than Florida, and is more convenient in terms of logistics for sea and air transportation. In Cuba, it is convenient to use mobile sea-based landing platforms for precisely refloated reusable rocket stages.

Today, according to The Wall Street Journal, there is a worldwide shortage of reusable eco-friendly spaceports due to the sharply increased demand of the new era of space industrialization.[4]

In the United States, only two giant factories of Elon Musk intend to produce up to 10,000 rockets per year and launch up to 1,000 rockets per month into space to the Moon alone. Thus, up to 200 rockets per day will have to be launched per launch window [for comparison, the Vostochny cosmodrome in Russia is designed for about 10 launches per year].

In May 2025, the head of the ballistics department of RSC Energia, *Rafail Murtazin*, publicly pointed out in an interview with MK that reusable flights from the Vostochny cosmodrome were objectively impossible under existing conditions. [5]

"Our rockets, when launched from the Vostochny cosmodrome, fly over mountains and gorges at almost all inclinations. And where there are no mountains, there is a frozen, uninhabited tundra. In the case of disposable rockets, it doesn't matter what kind of terrain is underneath."

"Since there was no program to create reusable launch vehicles in 1993, no one took this circumstance into account when choosing the location of the Vostochny cosmodrome. And even if there was such a program, no one offered any other place for the cosmodrome except Vostochny." "Roscosmos planned to carry the return stage after landing on the world's largest Mi-26 helicopter.

And there are no guarantees that such an operation will take place without damage to the stage or helicopter. In short, there may be no economic effect in our conditions. "The use of mobile sea-based landing platforms on land is, of course, impossible.

Is the Vostochny cosmodrome today an expensive technological dead end for all of Russia's disposable cosmonautics, which fundamentally cannot be reusable

without modernization either at the Vostochny cosmodrome or at all other remaining 5 cosmodromes in Russia?

Russia has 6 one-time spaceports on its southern geographical arc.:

1). Plesetsk;

2). Kapustin Yar;

3). Yasny;

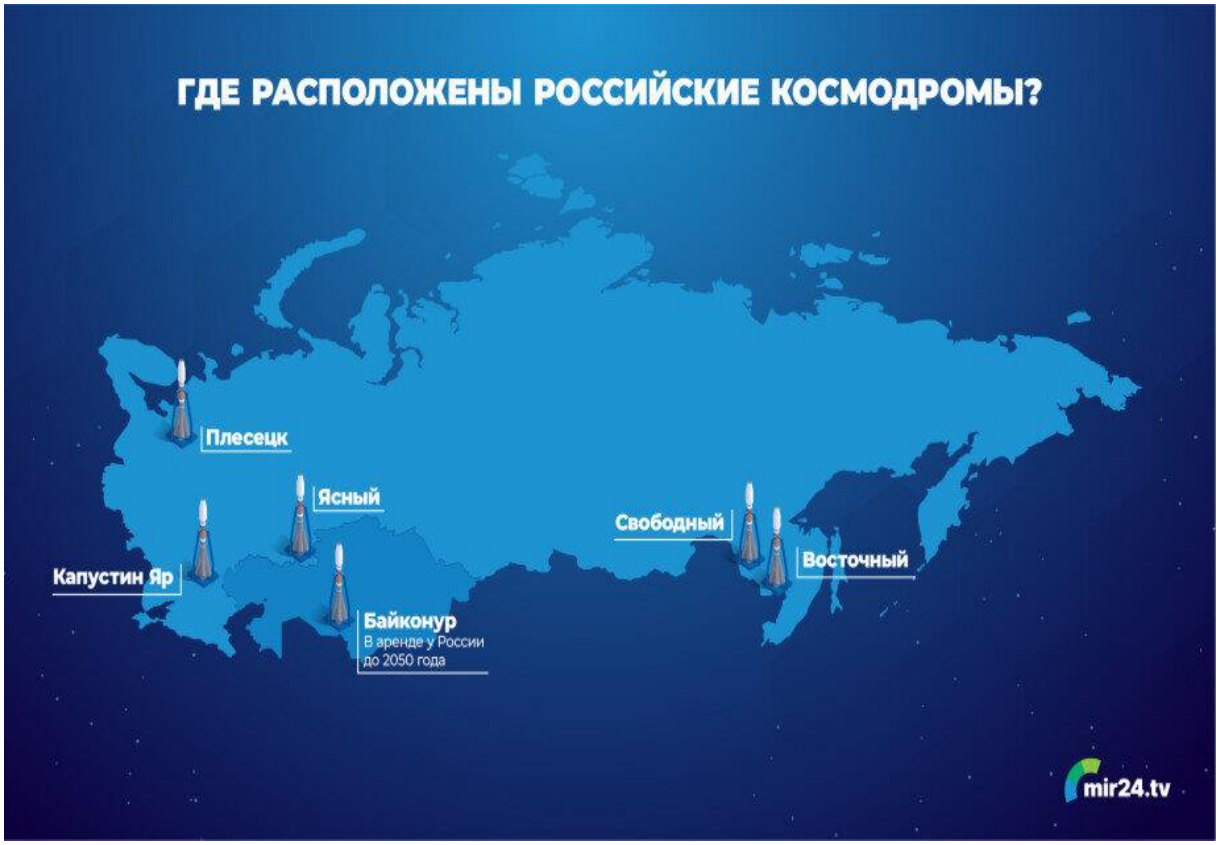
4). Baikonur;

5). Free;

6). Vostochny

All of them were planned from the very beginning for disposable missile systems. Therefore, even if Russia acquires or manufactures reusable missile systems itself, it will not be able to physically use them.

"Instead of placing production on site, somewhere in Komsomolsk-on-Amur, space technology is transported across the country by rail, which has restrictions on the weight of cargo and its dimensions." It is very expensive. These are objective limitations for all Soyuz-5 series missiles and Angara series missiles.



> This one-time spaceport problem, along with the 1966 [Soyuz] and 1965 [heptyl Proton] disposable rockets themselves It is a negative birthmark of the former USSR, which has been inherited by modern Russian cosmonautics. [5]

If Russia wants to stay in the trend of space industrialization, it must build new reusable spaceports for the use of reusable rocket systems. The "conclusion" on

the entire "disposable space" in the USSR and in Russia, as a technologically backward dead end, was made by *Rafail Murtazin*, head of the ballistics department of RSC Energia.

In this regard, it makes sense to consider the possibility of creating the strategic Russian Far Eastern Reusable Space Complex [FESC] on the Magellanic date change line - the Russian Eastern Spaceport for reusable rocket systems on the Kuril Islands, as a continuation to the North of the Japanese cosmodrome line.

This project should probably receive the status of a priority national project in Russia for the next 50 years, as it has already been done in the United States. Why?

This option technically solves the issue of overcoming the impasse of the impossibility of using reusable rockets of any mass at 6 old Soviet obsolete disposable spaceports.

In the FESC, missile systems will be mostly reusable. Russia will have a continuous powerful missile defense [MD] and air defense [AD] system along the entire northern arc from Murmansk to Vladivostok and protection along the entire length of the Northern Sea Route from Alaska to the North Sea.

During the Great Patriotic War, German submarines operated in Norway, in the Soviet Arctic along the entire Northern Sea Route. *vk.com; svpressa.ru*

I.D. Papanin, head of the Main Northern Sea Route in 1939-1946, led the fight against them. During the Second World War, German submarines had secret bases in the mouths of Siberian rivers flowing into the Arctic Ocean, and repeatedly reached Japan and back to Germany with secret military supplies and technologies. *Therefore, we have proposed to build*:

I. The Russian Far Eastern Reusable Space Complex (RSC) on the Kuril Islands, as well as to participate in the creation

of II. reusable spaceport in Cuba. Technically, the two projects are very similar.

1). The FESC center should preferably be located on Sakhalin. Sakhalin will become a kind of "capital" of the state national program of space industrialization. Rocket factories for the production of the entire range of missiles should be located there.

This approach will fully resolve the issue of Russia's national space security. Convenient logistics will reduce the cost of missile production several times.

2). Cooperation with Far Eastern shipbuilders should be ensured for the production of multi-tonnage special vessels for the transportation of large-sized parts of reusable heavy and superheavy rocket systems from production sites to places of operation at spaceports.

It will be a cascade of 20-50 reusable, full-fledged, environmentally friendly spaceports and launch pads at the world ecological level.

Most of the space activity on Earth will be concentrated here. Sakhalin should become one of the industrial capitals of the highly developed space industry in the world.

The entire Far Eastern scientific complex will be involved in the structure of space industrialization. The cost of creating and launching rockets will decrease several times. Almost all of them will be reusable.

3). The Kuril Islands are a chain of 56 islands of volcanic origin located between the Russian Kamchatka Peninsula and the Japanese island of Hokkaido. The archipelago of islands stretches for 1,200 km and separates the waters of the Sea of Okhotsk and the Pacific Ocean.

Today, 20,842 people live permanently on the four islands. If the FESC is created, up to a million people will eventually live in it.

For many years, three cosmodromes and one launch complex have been successfully operating in such difficult seismic conditions [7,8]:

I). the Kodiak Cosmodrome in the USA in Alaska; as well as two spaceports and one launch complex in Japan:

II). Uchinoura,

III). Tanegashima, and one launch complex

IV). Yoshinobu at the Tanegashima Cosmodrome.

The Uchinoura Cosmodrome (Uchinoura Space Center) was founded in February 1962. Construction of the complex, designed for experimental launches of large rockets, began in 1961.

Until 2003, when the Japan Aerospace Exploration Agency (JAXA) was formed, the Uchinoura cosmodrome belonged to the Institute of Space and Astronautics (ISAS) and was designated as the Kagoshima Space Center.

Tanegashima was founded in 1969 and is operated by JAXA. It is located on the southeastern coast of Tanegashima Island, in the south of Kagoshima Prefecture, 115 km south of Kyushu Island.

The heaviest Japanese H-IIA and H-IIB launch vehicles, which are now the main rockets launching from this cosmodrome, as well as small rockets designed for suborbital scientific launches, are launched from the cosmodrome.

Spacecraft launches are possible with an orbital inclination of up to 99° to the equator plane. According to JAXA, this spaceport is the most beautiful and picturesque launch pad in the world.

II. THE CASCADE OF REUSABLE SPACEPORTS ON THE KURIL ISLANDS IS A KEY STRUCTURE OF THE FAR EASTERN REUSABLE SPACE COMPLEX [FESC] - THE CONTINUATION OF THE JAPANESE COSMODROME LINE FROM SOUTH TO NORTH

4). It is proposed to build a cascade of 20-50 state-of-the-art reusable eco-cosmodromes and world-class launch pads for various purposes on the Kuril Islands. Today, there are no more than 10-11 units per the entire globe [out of about 60 available]. FESC will become one of the global centers of progress in the era of space industrialization.

5). The location of the FESC space complex is unique in its environmental safety. It is an environmentally safe place to launch reusable rockets of any capacity [power], including the largest and super-large, without any restrictions in their number and frequency of launches and *orbital inclinations* in combination with the Western Spaceport in Cuba.

The use of offshore platforms for landing reusable rocket stages, as well as mobile ocean launch platforms, will be very effective.

6). Connect the islands with each other through underwater tunnels, starting with tunnels to Sakhalin from the mainland and ending with Kamchatka.

It is possible to connect businesses of the Japanese island of Hokkaido to the structure of the FESC.

7). The developed underground and underwater infrastructure should become the backbone of the entire space system of FESC.

8). The energy sector of the FESC will be represented by powerful gas and oil power plants on Sakhalin itself, as well as tidal power plants on Penzhinskaya Bay, nuclear, wind and geothermal power plants, which will be optimally distributed throughout the territory of the FESC.

III. ECONOMIC CRITERIA OF FESC

9). FESC, having an excess of cheap electricity, will build hydrogen production plants and use hydrogen as the main environmentally friendly fuel for rockets.

The strategy for the development of the Russian energy sector today assumes an increase in exports of hydrogen fuel to *2 million tons* by 2035.

10). Based on this plan, it can be assumed that by the middle of this century, the export of environmental raw materials should replenish the Russian budget by *$100 million* annually. The project has the potential to invest in its own development.

11). This perspective will allow the Russian Federation to move away from dependence on the export of non-renewable resources and dictate conditions in the new energy market, as well as earn money by providing global services in the field of launching spacecraft from its new FESC.

The need for reusable eco- launching spacecraft and space launch sites will only increase worldwide. [4]

12). Russia will be able not only to become a leader in hydrogen production and make super profits, but also to influence the political balance in the status of an energy, scientific and space world superpower.

IV. PRODUCTION STRUCTURE OF FESC

Will be built:
13). geothermal power plants powered by volcanic and underground heat;
14). nuclear power plants. Will be:
15). an aviation plant in Komsomolsk-on-Amur has been involved.
16). A robot design and production center has been established.
17). The Space Financial Center of the FESC has been established.
18). The FESC will provide a continuous dome of air defense and missile defense protection over the whole of Russia.
19). The colonization of the Moon and all Russian space developments will be created in the FESC. Close international cooperation with the DPRK, the People's Republic of China, the Republic of South Korea, the United States and Japan is embedded in this FESC project.

V. UNIFIED GLOBAL SPACE NAVIGATION

The proposed Western reusable spaceport in Cuba is located geopolitically in the Western Hemisphere of the Earth.

The proposed Eastern reusable spaceport is located geopolitically in the Eastern Hemisphere of the Earth.

But functionally, it is the same planetary space system, dialectically interconnected through the Panama Canal.

Global space industrialization will physically develop through the construction and interaction between these two spaceports.

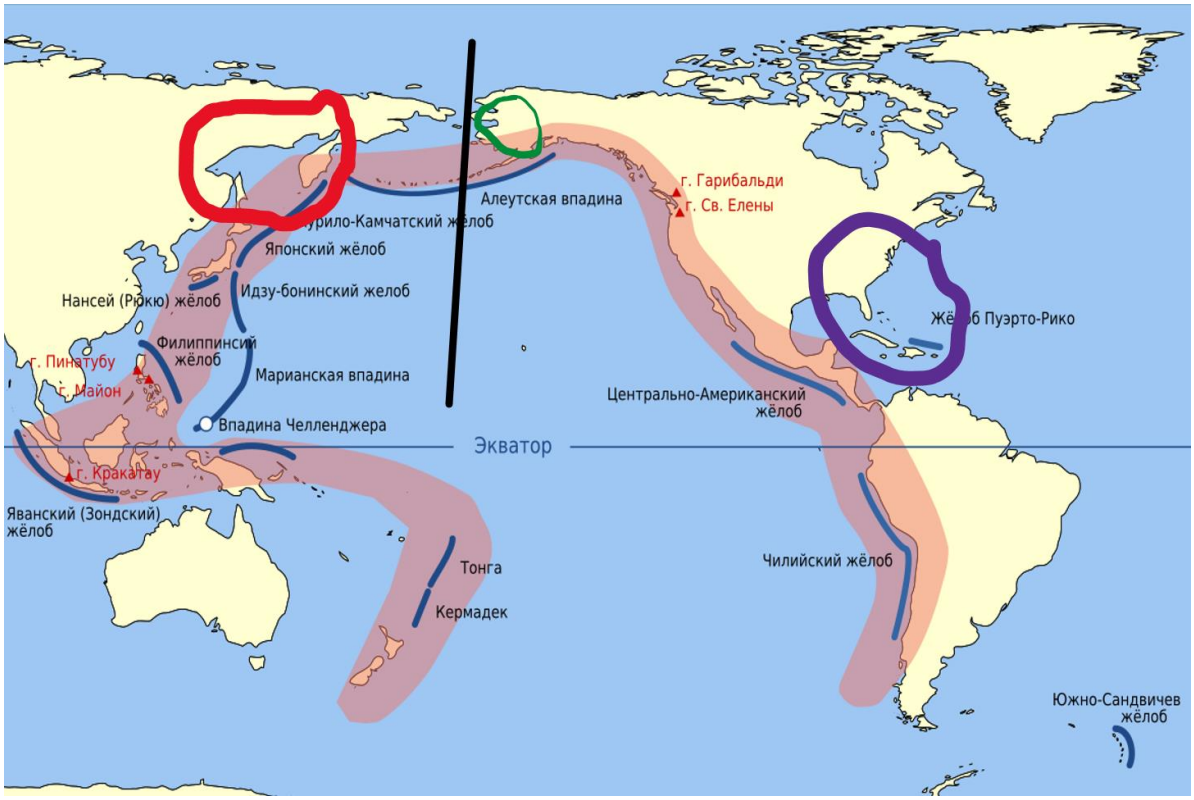
Figuratively speaking, these will be the key objects of K.E. Tsiolkovsky's sixth space socio-economic formation [SEF], which will unified for civilization.

The unified linear reference standard of lunar coordinated time - the unified 25th lunar time zone - is considered in this context as the unified, universal, absolute, global time of the world civilization in space - "*galactic time*".[9]

It is objectively the basis for unified space and terrestrial navigation and time synchronization between the Eastern and Western spaceports. Both global spaceports [East and West] will complement each other perfectly logically through the Panama Canal.

These two spaceports will be a key economic foundation in the formation of the new Tsiolkovsky space socio-economic formation [SEF], which will eventually become the main form of human civilization.

After the launch of these two global projects, up to 80% of all space launches will take place through them. These two convenient spaceports represent the future of world space exploration in the 21st century.



The geopolitical alignment of the Eastern and Western world spaceports of the "Japan-Kuril-Sakhalin" Pacific seismic belt

[the territory of the proposed Far Eastern Space Complex [FESC – red circle] has been allocated –the Eastern Reusable Spaceport on the Kuril Islands; the US Kodiak Cosmodrome in Alaska [green circle]; the US spaceports at Cape Canaveral in Florida [purple circle] – and the Western Reusable Spaceport in Cuba]

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