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**Donald C. Elder and Christophe Rothmund,  
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## Chapter 14

# The History of Rocket-Space Techniques Development in the Ukraine\*

V. F. Prisnjakov and F. P. Sanin<sup>†</sup>

It is difficult to completely separate out Ukrainian roots in the whole history of rocket-space science and techniques of the USSR. But the sovereign Ukrainian state must have its own “genealogical tree.”

Among the first historians who studied rocket techniques was the academician Valentin Petrovich Glushko (the son of a Ukrainian Cossack and a Russian peasant-woman, as he said about himself). He is one of its pioneers, a founder of Soviet rocket engine construction. His article (under the pseudonym G. V. Petrovich) “At sources of Soviet rocket construction” which was converted into a monograph later on was published in “Vestnik of the USSR Academy of Sciences” N10 in 1965.

The monograph “Development of Rocket Construction and Cosmonautics in the USSR” considers the history of rocket engineering and cosmonautics beginning with the idea itself of dreams about the sky. V. P. Glushko’s approach here is similar to that of other historians of cosmonautics, notably Professors N. A. Rinin and A. A. Shternfeld.

Power rockets may be considered as the prototype of contemporary and space rockets. However, according to V. P. Glushko, the first to use rockets in Russia in military affairs were Cossacks from Zaporozhie in the battle with Fathers in 1516.

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<sup>†</sup> Dnepropetrovsk State University, Ukraine.

A great contribution to the development of the theory, construction and technology of powder rockets was made by Alexander Dmitrievich Zasiadko—a scientist in the field of rocket construction, a general-lieutenant, and participant in all military campaigns in Russia in the period of 1799-1829 (born in the village of Liutenka, in the Poltava region).

In 1815 Zasiadko began his work on designing military powder rockets. He constructed launching devices for rocket fire. He also invented an original rocket of breaking action in 1818 and elaborated tactics for the military application of rocket armament.

In 1965 the magazine “Academy of Science of the USSR Bulletin” (N10) published his article under the pseudonym G. V. Petrovich: “The first steps in the development of rocket flying apparatus for manned flight was begun in Russia by N. I. Kibalchich, the famous revolutionary, the son of Ukrainian people.”

Kibalchich Nikolay Ivanovich was born in the town of Korop in the Chernigov region (there is a memorial there). His work “The project of aeronautic apparatus” Kibalchich wrote in 1881 in prison before his execution. He suggested the use of powder as a fuel for his aeronautic apparatus.

He was a chief of the laboratory of explosives of the “Narodnaya Volya” executive community. He took part in preparing an attempt to kill Tzar Alexander II. One of the craters on the back side of the Moon was named after Kibalchich.

The scientific research materials of N. I. Kibalchich were kept in police archives up to 1917. The project of his rocket was first published in 1918 in the magazine “The Past” N4-5.

Two years after Kibalchich, in 1883, Konstantin Eduardovich Tsiolkovsky described his first space ship with an engine that used the jet principle. In 1903 his work “The investigation of world spaces with a jet apparatus” was published.

The works of Tsiolkovsky educated a lot of investigators. One of them was V. P. Glushko. In 1921 he was in correspondence with Tsiolkovsky, and published scientific and popular works during this term.

In 1916-1919 the Ukrainian gifted scientist Yuri Vasilievich Kondratjuk, independently from K. E. Tsiolkovsky, deduced the main equation of rocket motion by original method. He gave a scheme and description of a four-stage rocket using oxygen-hydrogen fuel and described the engine combustion chambers with chess and other locations of sprayers in his work “To those, who will read to build.”

In this work there are prominent scientific foresights of stages and perspectives of cosmonautic development. One of them includes the flight scheme to the bodies of the solar system by using small landing-take-off apparatus. Now it is named “Kondratjuk’s line” and has been successfully mastered by Soviet and American cosmonautics.

In 1924 Y. V. Kondratjuk finished his work with the third variant of its manuscript concerning space travel, which later received the name "About space travel." And only after that did he get acquainted with the part of K. E. Tsiolkovsky's work "The investigation of world spaces with jet apparatus."

In 1925 Y. V. Kondratjuk sent his work to Moscow to Glavnauka for publishing. The famous engineer V. P. Vetchinkin gave a very high mark to this work and recommended it for publishing. He wrote: "...engineer Y. Kondratjuk represents a great talent (as F. A. Semenov, K. E. Tsiolkovsky or A. G. Ufimsev), who was neglected in the godforsaken place...", "...and it is necessary to remove him (in case of his agreement) to Moscow, closer to the scientific centres..."

Everybody aspired to be closer to scientific centers, but actually Y. V. Kondratjuk had to escape them. His real name was Alexander Ignatievich Sharkey. He was born in 1897 in Poltava. He graduated from the gymnasium with a silver medal, and after that got his education at the Polytechnical Institute.

But the war and the revolution stopped his education and, after leaving the design school, A. Sharkey fought in the Caucasus. During the revolution he joined the White Army. His relatives worried about his destiny and they persuaded him to take the name and documents of a dead person, Yuri Vasilievich Kondratjuk, who was born in 1900.

Alexander Sharkey survived, doing inspired and creative work. Theoretical cosmonautics was his favorite child, and he devoted all his spare time to it. But he was off the main way: he built elevators, dealt with wind-energetics, and everywhere he was a success.

In 1929 in Novosibirsk Y. Kondratjuk published the book "Conquest of interplanetary spaces" at his own expense (this book was reprinted in 1947 by Oboronisdat).

A prominent scientist, the doctor of philosophy A. K. Sukhotin, wrote about Y. Kondratjuk: "It is necessary to point out that Y. Kondratjuk wins more attention from people. His name is in the shadow of the giant Tsiolkovsky, but investigators, who deal with rocket engineering and space programs agree that they work "according to Tsiolkovsky and Kondratjuk."

The curator of the rare books department of the Tomsk University Science Library, V. Lobanov, said that when the first man, who visited the Moon, American Professor Neil Armstrong, was in Novosibirsk, he was interested if there was a monument to Y. Kondratjuk. Having learnt that there was not one, he was sorry and explained that when "Apollo" landed on the Moon, the "cosmonauts used one of Kondratjuk's formulas."

At the beginning of the 1930s Sergey Pavlovich Korolev began to work in the field of rocket-space engineering. He was from the Ukraine. Korolev was born in 1906 in Zhitomir. He graduated from the gymnasium in Nezhin and got his education in Odessa, Kiev, built gliders, and was their pilot in the Crimean sky.

When he was a third-year student of Kiev Polytechnical College he moved to the High Moscow Technical College, "closer to scientific centers," as Vetchinkin said.

In autumn 1931 S. P. Korolev headed the Group of Jet Movement, that was organized and attached to Osoaviahim in Moscow. That year was the first for the same groups in Leningrad and Kharkov too. It was in Kharkov where members of the Moscow group "obtained" a heat-resistant cover for a combustion chamber and a nozzle for the first rocket.

Another famous scientist and rocket constructor, Vladimir Nickolayevich Chelomey, was born in the Ukraine. He graduated from the Kiev Aircraft Institute and worked as a teacher there. Then he worked in the Central Institute of Engine-building under the name of V. I. Baranov in Moscow.

There he created a pulsate air-jet engine (1942); since 1959 he had been working in the field of rocket engineering. He was a constant competitor of the M. K. Yangel firm; he was the elaborator of the rockets "Proton," "Poljot," and orbit station "Saljut-3-5."

One of the elaborators of jet weapons, "Katyusha" Ivan Isidorovich Gvay, lived and was educated in Dniepropetrovsk. The first "Stalin" chief constructor, L. R. Gonor, was from the Ukraine, too.

The list of Ukrainian scientists, engineers, and constructors can be continued. They devoted themselves to rocket and space engineering and worked in the "scientific centres" in Moscow, Leningrad and near Moscow; their paths crossed and they became associates or opponents.

Since 1950 the city of metallurgists, Dniepropetrovsk, has become the most important rocket-space center of the USSR. According to a government decision the type of plant that manufactured lorries, trucks, cranes, amphibians, and loaders, was changed.

The chief of the Ukrainian National Space Agency, V. P. Gorbulin, said: "Whether one likes this or not, but the rocket shield of the USSR was forged in Dniepropetrovsk, at the rocket plant."

In 1950 series production of ballistic rockets began. They were elaborated by Korolev's bureau. The Serial Design Bureau (SDB) was founded at this plant and Vasily Sergejevich Budnik became its chief.

V. S. Budnik was born in the Chernigov region. He graduated from Moscow Aircraft Institute. Together with S. P. Korolev, V. P. Glushko, and G. A. Pobedonostsev, he studied trophy FAU in Germany. He was S. P. Korolev's assistant and designed the first soviet rockets R-1, R-2, and R-5.

It was V. S. Budnik who, together with D. F. Ustinov, came to the decision to create a rocket giant in Dniepropetrovsk, and a Ukrainian rocket-space region in the whole.

The SDB in the Dniepropetrovsk rocket plant ("Yuzhny Mashinostroitelny Zavod"), besides keeping technical documents and elaboration of units and ag-

gregates of Korolev's rockets, began to search for new independent ways of rocket technique development.

A group of specialists became the main creative body of the SDB. They were moved to this new enterprise from Moscow organizations. It was formed by the now famous Viatcheslav Michaylovich Kovtunenکو, the chief constructor of the firm, a fellow-correspondent of the Russian Academy of Sciences.

He studied at Dniepropetrovsk University and defended his candidate dissertation. He was the chief of design department, and later on, the chief of the construction bureau of space research.

Nikolay Fedorovich Gerasjuta began his way to working on rockets in Germany, studying trophy FAU. He was a famous specialist in ballistics, a fellow correspondent of the Ukrainian Academy of Sciences. He was born in Alexandria in the Kirovograd region and was buried in Dniepropetrovsk.

Ivan Ivanovich Ivanov was an engine specialist, a fellow-correspondent of the Ukrainian Academy of Sciences, and Pavel Ivanovich Nikitin was a specialist on strength, and a fellow-correspondent of the Ukrainian Academy of Sciences.

Young specialists, graduates of the technical (mainly aircraft) high establishments of Moscow, Leningrad, Kazan, and Kharkov, were engaged in creative work. Among them there were: Lev Abramovich Berlin, who became one of the assistants of the chief constructor and died in an accident on October 24, 1960; and Vladimir Fedorovich Utkin, who headed all design works in DB. An assistant of Yangel, he headed CB "Yuzhnoje" after Yangel's death and was its chief for 20 years.

He did a lot for the Ukrainian rocket-space engineering development, and he is an academician of the Russian Academy of Sciences. Now he is a director of the Scientific-Research Institute on Rocket Technology near Moscow.

In 1952 the physics-technology department of DSU was organized. In fact, it was an institute, which began preparing unique specialists in all directions of rocket-space engineering. They combined theory and practice in large rocket plants and DB.

The prominent Ukrainian scientists were the first teachers of this department. Prof. N. I. Varich and F. I. Kolomojtsev were among them. The N. I. Shnjakin, N. F. Gerasjuta, V. M. Kovtunenکو, Professors M. A. Akhmetshin, M. I. Galas, I. M. Igdalov, F. P. Sanin, N. I. Urjev, and V. S. Fomenko (now the director of "Yuzhcosmos" firm) joined this teaching staff. Professor M. I. Duplishchev wrote the first monograph on rocket engineering.

The rector of Dniepropetrovsk State University, academician Vladimir Fedorovich Prisnjakov, chief constructor of CB "Yushnoje acad. Stanislav Nikolayevich Konjukhov, president of Ukraine Leonid Danilovich Kuchma, secretary of National Security Council Vladimir Pavlovich Gorbulin, and others were the students of the physics and technology department of Dniepropetrovsk State University.

Workers of DB “Yuzhnoje” taught and scientists of the university were scientific consultants of DB elaborations: V. F. Prisnjakov, V. I. Mossakovsky (academician of Ukrainian Academy of Sciences, ex-rector of the university), professors I. M. Beliajev, L. V. Andrejev and others.

In 1953 the government of the USSR and the Central Committee of the CPSU approved the initiative of the V. S. Budnik SDB in project elaboration of a new rocket P-12 with the application of high-boiling fuel components and an autonomous system of control. But there were problems for about a year with financing and staff. Creative efforts were supported by Minister of Defense Industry D. F. Ustinov.

V. S. Budnik wrote him in October 1954: “Not having permission for experimental department staffing I had to organize a small group of designers and calculators from the staff of SDB. It works not only on serial manufacturing of rockets R-1, R-2, R-5, but for new rockets as well.”

On April 10, 1954 a new design-constructional bureau ODB-DB “Yuzhnoje” was organized. Michael Kuzmich Yangel was appointed chief-constructor. He had great experience in the sphere of aircraft and rocket engineering.

The biography of this prominent constructor of rocket techniques is famous. Due to the fact that information about rockets was classified it was forbidden to write about M. K. Yangel’s works and CB “Yuzhnoje,” but in spite of some “writers” fantasy M. Yangel was not of German origin. His grandfather, Lavrenty Yangel, was from Chernigov and was exiled to Siberia at the end of the 19<sup>th</sup> century.

M. K. Yangel was not only a good constructor, but a very good organizer too. Together with V. S. Budnik, who became his first assistant, they created, in a short time, an efficient group of like-minded persons, an experimental base, and were involved in the elaboration of scientific staffs in the Ukraine and Russia. They organized a system of adjacent organization of designers, which worked as a whole organism.

On June 22, 1957 flight tests of the rocket R-12 began. They approved the appropriateness of the chosen project parameters and constructive decisions. The Soviet Army was armed with that kind of rocket. Their creators were awarded with high government rewards.

Every year DB “Yuzhnoje” suggested new elaborations to the government. As a rule, these suggestions were accepted and financed; new, more perfect rockets were created, and they were the subject of pride for Soviet rocket engineering and made the “rocket shield” of the country.

A great contribution was made by constant co-operators: one of the pioneers of rocket engineering of the USSR, the main co-operator of DB “Yuzhnoje,” the designer of many engines Valentin Petrovich Glushko (construction bureau “Energomash”); the designers of control systems Nikolay Alexejevich Pilugin and Vladimir Grigorievich Sergejev (construction bureau “Khartron,” Kharkov); the designer of sight systems and chief constructor of the legendary



plan "Arsenal" Serafim Platonovich Parnjakov; the designer of land equipment Vladimir Petrovich Barmin; and customer representatives Marshal Mitrofan Ivanovich Nedelin, Generals Andrey Illarionovich Sokolov, Mikhail Grigorievich Grigoriev, Vasily Ivanovich Voznjuk (he was a chief of the Kapustin Yar proving ground), Georgy Alexeyevich Mrykin, and Nikolay Nikolayevich Smirnitsky (who was born and educated in Odessa, and worked in Kiev).

In 1957 on the basis of created and existing ammunition rockets the CB designed a booster-rocket. This direction of work became a basis of modern conversion and was constantly developing.

The first generation of the rockets R-12, R-14, and R-16, of DB "Yuzhnoje" ensured the security of our country for that period. The appearance of new demands for fighting equipment and the constant armaments race demanded the creation of new rockets. CB "Yuzhnoje" fulfilled these tasks, constantly modernizing its projects. Four generations of rockets—this is the production of DB "Yuzhnoje."

Now Dnepropetrovsk is the largest center of machine-building in Europe. The main task of the sovereign Ukraine is not to lose this powerful scientific and industrial potential, and to use it in new conditions.

The second direction of DB "Yuzhnoje" works is the elaboration of artificial Earth satellites. On the 16<sup>th</sup> of March, 1962, the first Dnepropetrovsk satellite of the "Kosmos" type was launched. Since 1966 international co-operation on the programs "Kosmos," "Interkosmos," "Ariabata," "Arkad," and "Bhaskara" has begun.

The ancestors of space directions of DB works were: M. K. Yangel, V. M. Kovtunenکو, N. A. Zharikov, and V. N. Pappo-Korystin. The chiefs of this CB "Yuzhnoje" were: V. M. Kovtunenکو, B. E. Khmyrov, and S. H. Konjukhov; now V. I. Dranovsky is. There was created a new co-operation in rocket-space organizations of the country: the artificial Earth satellites are launched today for scientific and economic purposes.

The designers of booster-rockets were: L. D. Kuchma, V. G. Komanov, N. V. Tsurkan, and V. P. Gorbulin. The Russian and Ukrainian press wrote: "In Dnepropetrovsk the DB "Yuzhnoje" and "Yuzhny Mashinostroitelny Zavod" association manufactured the space satellite "Kosmos-3242."

Together with booster-rockets the "Cyclon" space apparatus were launched to near-earth orbit from the space-vehicle launching site Plesetsk, in the Arkhangelsk region.

This new apparatus fulfils radio-technique prospecting for Russia and the Ukraine. Financing was organized by the Russian side. There is one month between the launching of this and the previous satellite with the NPO "Yuzhnoje" mark. This is almost the same regime, in which satellites manufactured in Ukraine were launched in the former USSR.

In 1992 five space apparatus were launched to near-earth orbit by the booster-rockets "Zenit" and "Cyclon." These boosters were designed by DB

“Yuzhnoje,” and the launching was made from Baikonur. Co-operation with CIS countries is developing. International links for the rocket-space Ukraine are widening.

At the beginning of 1992 a National Space Agency was founded in the Ukraine. The first chief of the National Space Agency, V. P. Gorbulin, said, that Ukraine shares with France the 3<sup>rd</sup>-4<sup>th</sup> places in the world according to the capacity of its rocket-space complex. In 1992 the group of space specialists from the USA visited DB “Yuzhnoje” and “Yuzhny Mashinostroitelny Zavod.” They were: vice-director of NASA, D. Goldwin, vice-director on foreign relations of National Space Council, E. Prestrige, officials of NASA, D. Raug and A. Aldridge, vice-minister of the Air Force M. Fadah, and others.

The American astronaut T. Stafford was a member of this delegation. With great interest the guests watched the films about the strategic rocket SS-18, (R-18) that is called “Satan” by western specialists (in accordance with the SNV-2 agreement it will be liquidated in a determined period).

The guests visited an assembly shop where “Zenit” units were assembled. The common impression was voiced by T. Stafford: “Colossal.” A lot of calls about cooperation between the USA and the Ukraine were heard at the meeting.

At present time there are state contracts of the National Space Agency of Ukraine, CB, “Yushnoje,” and the Russian Space Agency for financing work on the international projects “Koronas-I,” “Koronas-F,” and “Foton”—a complex orbit observation of solar activity.

DB “Yuzhnoje” and the Southern Machine-building Plant designed and manufactured the space apparatus AUOS-SM-KI. Launching will be fulfilled by the rocket-bearer “Cyclon” this year.

Rocket-space science and technology in the Ukraine are developing now in a sovereign state. It is necessary to have not only a scientific conception of their development and financing, but perspective elaborations as well.

Progress can't be stopped, but it is possible to restrain artificially the branch developing (history knows the examples: genetics, cybernetics, etc.).

The young Ukrainian state must be proud not only of Zaporazhskaya Seach, Petrikovskaya painting and embroidery, but also of world-class rockets and artificial Earth satellites.