

# **History of Rocketry and Astronautics**

**Proceedings of the Twenty-Eighth and Twenty-Ninth History  
Symposia of the International Academy of Astronautics**

**Jerusalem, Israel, 1994**

**Oslo, Norway, 1995**

**Donald C. Elder and Christophe Rothmund,  
Volume Editors**

**Donald C. Elder, Series Editor**

**AAS History Series, Volume 23**

**A Supplement to Advances in the Astronautical Sciences**

**IAA History Symposia, Volume 15**

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**AAS Publications Office  
P.O. Box 28130  
San Diego, California 92198**

**Affiliated with the American Association for the Advancement of Science  
Member of the International Astronautical Federation**

*First Printing 2001*

**ISSN 0730-3564**

**ISBN 0-87703-477-X (Hard Cover)  
ISBN 0-87703-478-8 (Soft Cover)**

**Published for the American Astronautical Society  
by Univelt, Incorporated, P.O. Box 28130, San Diego, California 92198**

**Printed and Bound in the U.S.A.**

## Chapter 18

# Dniepropetrovsk Space Rocket Complex in the 1970s and 1980s\*

V. F. Prisniakov,<sup>†</sup> V. P. Gorbulin<sup>‡</sup> and F. P. Sanin<sup>†</sup>

Great contributions to the progress of space rocket technology were made by the Ukrainians, by natives of Ukraine and by specialists working on Ukrainian soil: A. D. Zasiadko, N. I. Kibalchich, Yu. V. Kondratyuk (A. I. Shargei), I. I. Gvai, L. R. Gonor, V. P. Glushko, S. P. Korolyov. The founders of the Soviet rocket guard, designers M. K. Yangel, V. S. Budnik, V. F. Utkin, N. F. Gerasyuta, V. M. Kovtunenکو, I. I. Ivanov, B. I. Gubanov, V. V. Grachiov, Yu. A. Smetanin, M. I. Galas, L. D. Kuchma, and S. N. Konyukhov, and production workers L. V. Smirnov, A. M. Makarov, L. L. Yagdzhiyev, G. G. Komanov, V. S. Sokolov, and others, were among them.

A powerful space rocket complex forming part of the design bureau “Yuzhnoe” (D.B. “Yu”) and the experimental serial “Yuzhny” Machine-Building works, was established in Dniepropetrovsk in the 1950s. It became the largest space complex, not only in Europe, but in the whole world.

In 1954 Mikhail Kuzmich Yangel, a 43 year-old man, who by that time had already gained great work experience in the field of aviation and rocket technology, took over the leadership of D.B. “Yu.” Vasiliy Sergeyevich Budnik, the former D.B. “Yu” chief designer, became his deputy.

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\* Presented at the Twenty-Ninth History Symposium of the International Academy of Astronautics, Oslo, Norway, 1995.

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After reprofiling the “Yuzhny” Machine-Building Works for rocket production, a talented organizer, Leonid Vasiliyevich Smirnov, became its director for about a ten-year period. Alexander Maximovich Makarov, one of the most experienced production leaders, became its engineer-in-chief and then the director of the Works up to 1986.

Yangel’s personality, and his talent as a scientist-designer, and organizer, and a constructive group founder, became legendary. Articles have been published, books have been issued, and talks have been given about him, including reports at international symposia.

Recently many publications have also appeared about V. S. Budnik. Academician M. K. Yangel died on his 60th birthday, 25 October 1971. At the same time V. S. Budnik took up other work at the Ukrainian Academy of Sciences.

Two generations of strategic missiles, created by design Bureau “Yuzhnoe,” equipped the Soviet Army. As the arms race went on, the state needed new, more perfect missiles. So the design bureau had to solve new problems.

Vladimir Fiodorovich Utkin became M. K. Yangel’s successor at the post of chief designer. His close assistants were B. I. Gubanov, N. F. Gerasyuta, V. V. Grachiov, I. I. Ivanov, P. I. Nikitin, M. I. Galas, Yu. A. Smetanin, and other experts, who worked hard to keep up the reputation of Yangel’s firm.

The achievements of D.B. “Yuzhnoe” in the 1970s and 1980s were mainly determined by a proper processing strategy as well as by the skillful supervision of the chief, and later grand designer, V. F. Utkin.

Those were the ways of finding an alternative scientific and technical solution to problems at minimal expenditure in response to the development of corresponding kinds of armament by potential enemies and maximum employment of all scientific and engineering developments for the good of science and the national economy.

V. F. Utkin was born on 17 October 1893 in the Ryazan Region. He took part in the Great Patriotic War from the very first day to the last one. In 1952, after graduating from the Leningrad Institute of Military Mechanics, he was directed to work at D.B. “Yuzhnoe,” where under Yangel’s supervision he passed the path from engineer to deputy chief designer. Since 1971 he was the chief, and later, general designer and an academician. In 1991 V. F. Utkin was appointed to the post of director of the Central Research Institute of Engineering in Russia. He is twice a Hero of Socialist Labor, Lenin and the USSR State Prize winner, and a deputy of the Supreme Soviet of the USSR during many sessions. While working at the Defense and State Security Committee during the last years of the USSR’s existence, he strived to implement the law on planning and ensuring conversion, and on aid to working people who had lost their jobs in this process.

He had high personal qualities: a sense of duty and responsibility, a desire to know the matter deeply and comprehensively, exceptional intellectual curiosity, adherence to principle, extraordinary diligence, and a care for people. These

all helped the chief designer to apply his gift as an engineer and scientist, of a prominent expert and organizer, as he headed Yangel's firm. Due to him it made great progress in rocket production and space technology.

The second person in D.B. "Yuzhnoe" after M. K. Yangel's death and V. S. Budnik's departure was Boris Ivanovich Gubanov, who had been working at D.B. "Yu" for a long time after graduating from Kazan Institute of Aviation and who had coped with all the stages of a career.

At one time B. I. Gubanov was the Party organizer of D.B. "Yu." But he did not make a standard ideologist; he proved to be a sympathetic person, helping people in their work and in everyday life, who used his great power and influence humanely and creatively. M. K. Yangel had the greatest respect for Gubanov and appreciated him. B. I. Gubanov supervised the development of Unit E, one of the units of the N-I-L3 Moon rocket. It was a tremendous "Moon project," which was not to be realized, although D.B. "Yu" had coped with all of its tasks. In 1982 B. I. Gubanov became the chief designer of the "Energy-Buran" system.

Among M. K. Yangel's close comrades-in-arms, we want to point out one more glorious name. It is Nikolay Fiodorovich Gerasyuta. He was born in 1919 in the town of Alexandriya in the Ukraine. In 1941 he graduated from Odessa University and went to the front as a sapper. He saw action from Stalingrad to Berlin. In 1947 he threw his lot in with space rocket technology. In 1952 he defended his thesis for a scientific candidate's degree, and was invited to work at Yangel's D.B. There he headed the development of ballistics, aerodynamics, and guidance systems, and was both the deputy chief designer and the deputy general designer. It was his independent nature, inexhaustible Ukrainian humor, and, most of all, his scientific and engineering expertise that attracted people to him.

The ideology of control system building regarding the main functional possibilities was determined by the specialists and cooperators under the leadership of N. F. Gerasyuta, the Corresponding Member of the Ukrainian Academy of Science, and professor at Dniepropetrovsk University. A. A. Negoda, the general manager of the National Space Academy of the Ukraine, and many directors and candidates of the sciences, are among his pupils. The scientific school of N. F. Gerasyuta became one of the leading schools in the Ukraine. Eight years later, his life, full of creative plans, was cut short.

In 1971, after the sudden death of Yangel, it was very important for the country to see how the matters of the bureau would develop.

The work on second generation missile construction involved the creation of the SS-7 heavy rocket, and the SS-15 light rocket. Orbital and separated head parts for the SS-9 missile were designed. A missile with an orbital head had a greater possibility of overcoming an anti-missile defense, and the method of approach to the devices from any direction had no comparison in the world of

rocket production. That's why its liquidation was one of the conditions of the signing of the Strategic Defense Armament Agreement.

The third generation missile complexes were designed without M. K. Yangel. The mining base of the launchers really defined the revolutionary solutions involved in creating the SS-17 rocket. The idea of multi-rail rocket launcher liquid-fueled missiles shot from a transport launch container was not appreciated by some specialists, and the application of the control system on the basis of board figure calculating machines (BFCMs) as the only system providing for the creation of multi-element separating head parts (SHPs) showed a realization of the need for flexible systems in utilizing the complexes. The new SS-17 missiles were of the heavy class, and came in two modifications. The light class missiles also had two modifications, and were added to the armory of the Soviet Army in 1975.

The fourth generation of missile complexes to come out of the designer office "Yuzhnoe" included the highly effective SS-24 solid-fuel missile and the SS-18 heavy liquid-fuel missile. These represented brilliant achievements of military engineering, and provided missile launch invulnerability from nuclear explosions; the vitality of the SS-24 was due to its mobility and non-fixed launching position.

These missile complexes and their modifications created by the design bureau "Yuzhnoe" established the basis for the strength of the rocket forces. This allowed the Soviet Union to achieve strategic parity, and created the basis for the disarmament process. In the 1960s, during the lifetime of Yangel, the design bureau "Yuzhnoe" constructed and worked with the rocket booster "Cosmos," and then the rocket booster "Cyclone" was built on the basis of the SS-9 missile. These works became important in perspective, but as a matter of fact they were conversions.

In the 1980s, work on the rocket booster "Zenith" began, the tenth anniversary of which was celebrated by the Dnepropetrovsk rocket builders in April 1995. It's a missile of the 21st century. The main features of "Zenith" are the complete automation of the prestart preparation, its pure fuel (liquid oxygen and kerosene), and its perfection in terms of its construction and technological engineering.

This rocket booster can put into outer space a twelve-ton load, including piloted vehicles. Its first stage is used as a lateral accelerator in the rocket system "Energia-Buran" (power-Storm) of the Glushko-Semyonov Bureau.

From the beginning of the 1960s the families of space vehicles have been designated simultaneously with the construction of missiles and rocket boosters. At first there were "Space" and "Interspace" vehicles. Then came "Halo" ("Oreal-1") together with the French specialists, and "Ariabata" and "Bhaskara" with Indian ones. In 1962, the special design bureau for developing these missiles, with V. M. Kovtunenکو at the head (nowadays he is the general designer of the bureau named after Lavochkin in Russia), was formed. In the following

years the space design bureau was headed by B. E. Khmyrov, a doctor of Physics and Mathematics, S. V. Konyukhov, nowadays the general designer of the design bureau “Yuzhnoe,” and an academician, Doctor of Science V. A. Dranovsky.

Vyatcheslav Mikhaylovich Kovtunenکو was born in the town of Engels, in the Saratov region. He graduated from Leningrad State University, and was a participant of the Great Patriotic War, where he became an invalid. On V. S. Budnik’s invitation he had come to the design bureau “Yuzhnoe,” where he became the head of the main body of the design office. V. M. Kovtunenکو’s outstanding merits in the creation and formation of a new direction in missile design came from his work on the combustible components of fuel and an autonomous construction system. His works were highly praised in 1959 after producing the R-12 missile for armament. He was honored with the Lenin Prize. After that a new principal work was begun in the design bureau: the creation of the Artificial Satellites of the Earth.

On 16 March 1962 the first artificial satellite from this series was launched. The tasks of this series were different. From 1962 to 1980, 1,225 satellites were put into orbit. On 14 October 1969 the satellite “Interspace-1,” which opened a wide program of space research in cooperation with scientists from Bulgaria, Hungary, the GDR, Poland, Romania, and Czechoslovakia, was launched. France, India, and Sweden joined the investigations on this new stage. On 27 December 1971 the artificial satellite “Halo” (“Oreol”), for investigating physical phenomena in the higher latitudes of the Earth’s upper atmosphere and studying the nature of polar light, was launched. The scientific equipment and the program of experiments were designed by Soviet and French specialists within the framework of the joint project “Arkad.” In two years the experiment was repeated with the launching of the “Halo-2” (“Oreol-2”) artificial satellite.

Soviet-Indian cooperation was also very successful. On 19 April 1975 the satellite “Ariabata” was launched to investigate in the fields of X-ray astronomy, the neutron and gamma radiation of the Sun, and the ionosphere. On 7 June 1979 “Bhaskara,” the second Indian satellite, was launched to investigate the Earth’s natural resources with the help of TV equipment and microwave radiometers. The head of these projects was V. M. Kovtunenکو. Since 1969, the first ASE (Artificial Satellites of the Earth) “Meteor” was put into orbit. The design bureau “Yuzhnoe” took an active part in this work.

The satellite “Interkosmos-15” started the epoch of AUOS (Automatic Universal Orbital Stations).

The story of using the satellite “Cosmos-1500” to save both a ship convoy ice-bound in the East Siberian Sea and the diesel-electric ship *Somov* near the coast of Antarctica have become known world-wide. The ASE “Cosmos-1500” became the ancestor of the navigational satellites of the oceanographic space system of the “Ocean” series. At the present time, based on the experiences of

the “Ocean” system, the “Sich” space system, with unique possibilities for controlling the environment, using nature, and mapping, is being created.

The direction for the creation of Earth artificial satellites, begun during M. K. Yangel’s lifetime, has now become one of the main trends in the workings of D.B. “Yuzhnoe.”

In speaking about the creation of rocket complexes of all generations, it is necessary to emphasize not only the strong relations between Ukrainian companies and those of the former Soviet Union, but also the tremendous possibilities of D.B. “Yuzhnoe” itself, with its industrial research base and the industrial potential of the South (“Yuzhny”) Machine-Building Works. In speaking about the technical solutions which provided for the further development of rockets, it would only be proper to talk about the people who have created them.

The personality of Ivan Ivanovich Ivanov modestly stands among the leading rocket makers of the 1950s. I. I. Ivanov, invited by V. S. Budnik, came into the serial D.B. of the rocket plant to take into his own hands all the questions of rocket engine-building once and for all. All the complex tasks of launching and steering the rockets of all generations, the choice of fuel components, the perfection of engine construction, the problems of thermodynamics, and launching from the stands in all sorts of flying conditions—all of these questions were successfully decided by the D.B. staff, which was led by I. I. Ivanov, along with the glorious cooperative enterprise of V. P. Glushko, A. D. Konnopatov, and L. P. Babakin. I. I. Ivanov, an Associated Member of the Ukrainian Academy of Sciences, promoted the growth of outstanding Ukrainian engine-building scientists, such as Academicians V. V. Pilipenko and V. F. Prisniakov, and Doctors of Science N. D. Kovalenko and A. V. Klimov, who made a great contribution to the development of space rocket technology in the Ukraine.

When in the 1950s the D.B. “Yuzhnoe” began working on the R-12, the first ballistic missile to operate with high boiling temperature fuel components and an autonomous operations system, Victor Vasilyevich Grachov became its leading constructor. Born in 1923, in the Moscow Region, he graduated from Moscow Higher Technical School in 1951. World War II had interrupted his studies at M.H.T.S. He had joined the army at that time and served in the Zapolyare (North Pole) region with an anti-aircraft unit. From 1945 until 1951 he studied, then joined the Ukrainian rocket D.B. He helped work out successful flight-construction tests of the R-12 and other rockets, and because of this he became an assistant to the Main Constructor working with experimental rockets.

The personality of V. V. Grachov predetermined the permanent successes of the F.S.T. Of course, there were wrecks and failures. But high levels of responsibility, competence, wisdom, confidence, and the skill to work calmly with people in the stressful atmosphere present at the firing grounds always stabilized the situation.

After V. I. Gubanov’s retirement in 1982, Leonid Danilovich Kuchma became the first assistant of the general contractor. He was born in 1938, in the



village of Chaikino in the Chernigov Region, and in 1960, after graduating from Dnepropetrovsk State University he began to work at D.B. "Yuzhnoe." Soon Komsomol members elected him to be a Komsomol Committee Secretary. It should be noted that in those years almost all engineers in the D.B. "Yuzhnoe" were Komsomol members, so the secretary was not only holding a finger on the pulse of the D.B.'s Komsomol, but also actively influenced the work, energized it, and looked for the weak points, and, along with the Komsomol members, was solving many problems. L. D. Kuchma had become the main constructor when he proceeded to produce the rocket-booster "Cyclone," among others. A knowledge of project construction work, the technology of manufacturing, and testing, along with his organizational abilities, permitted L. D. Kuchma to become the first assistant at D.B. "Yuzhnoe." He was general constructor at first, then the director of the South "Yuzhny" Machine-Building Works in 1986. Under the conditions of severe political and industrial crises, the general director continued to create systems displaying the newest space-rocket technology.

Conversion has finally come. The idea of mastering new types of applications far from the production of rockets belongs to the director: battery operated equipment for cleaning the environment, equipment for the meat industry, etc. L. D. Kuchma is a master of the sciences, and has developed a number of scientific works. He was the chief of the production technology branch at Dnepropetrovsk State University, and a professor there.

In 1986, Stanislave Nikolayevich Konyuhov became the first assistant of V. F. Utkin and since 1991 he has been the general constructor and an academician. He was born 12 April 1937 in the Vologda region, and in 1959 he graduated from Dnepropetrovsk State University. At D.B. "Yuzhnoe" he covered a long path from engineer to the main constructor at the facility.

The Ukraine has become a non-nuclear country, and it doesn't need strategic rockets, but the projects of the space-rocket program which are done at D.B. "Yuzhnoe" keep it in the position of a world-level leading company. According to the Ukrainian National Space Program, until the year 2000 D.B. "Yuzhnoe" will continue to work out the means for putting into orbit space apparatus, supervise the "Svityaz" aircraft space-rocket complex, elaborate the "Lyibid" national satellite system to provide for telecommunication, develop the "Sich" program to use nature and enhance ecological control, and create a means for the provision of "Suzirya" technology and biotechnology.

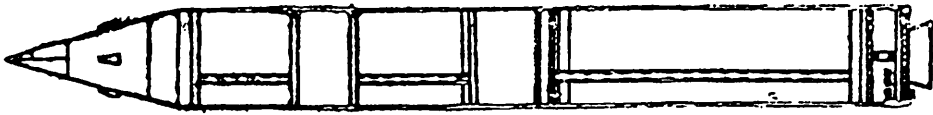
D.B. "Yuzhnoe" is also involved in a joint Russian-Ukrainian program to work out a three-step variant of the "Zenith," using the rocket-booster "Zenith-2" as a transport means for providing an international manned station which will replace "Mir."

In this short report we most certainly did not say everything about everybody.

D.B. "Yuzhnoe" is looking forward with optimism and confidence, the guarantee of which is the creative potential of its glorious staff, created by M. K. Yangel and V. F. Utkin, and sustained at a high level by their pupils.

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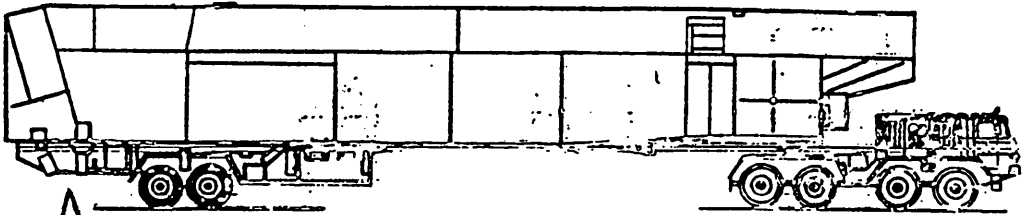
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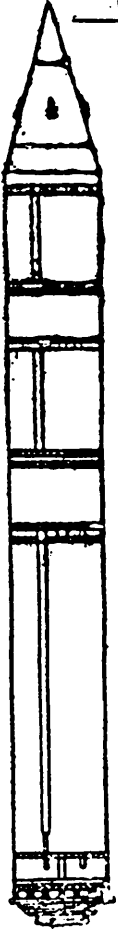
МБР РС-22 (SS-24) для ШПУ.



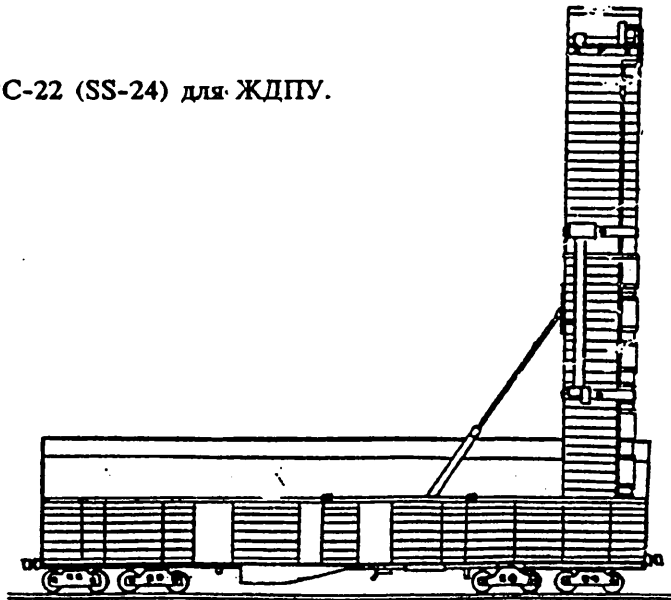
МБР РС-22 для ШПУ в пусковом контейнере (SS-24).



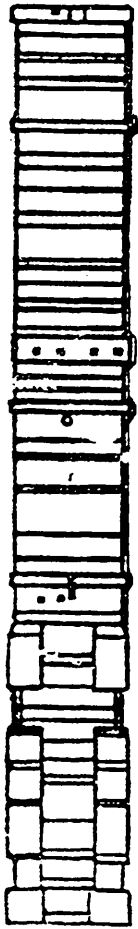
Установщик МБР РС-22.



МБР РС-22 (SS-24) для ЖДПУ.



Железнодорожная мобильная ПУ ракет РС-22 (SS-24).



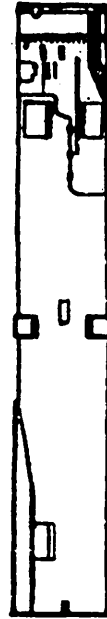
МБР РС-20 (SS-18) в пусковом контейнере.



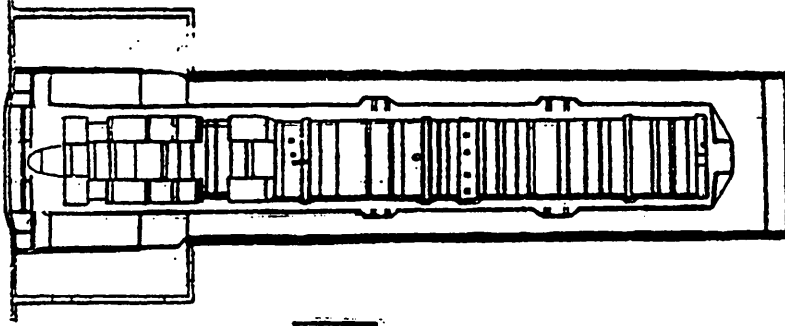
МБР РС-20 (SS-18).



МБР УР-100Н (РС-18).



МБР РС-18 в пусковом контейнере.



ШПУ ракетного комплекса РС-20 (SS-11)