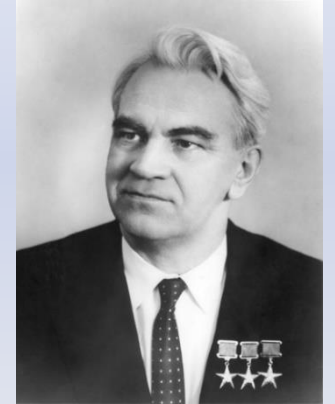


**60 years of Yuri Gagarin's flight.
The founders of the USSR
practical cosmonautics - S. P.
Korolev and M. V. Keldysh**



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Introduction

- In the jubilee year of Gagarin's flight, **we pay tribute to the numerous teams of people** who contributed to space science and technology and made the flight possible.
- The utmost respect and gratitude we address to the great personalities, the **founders of practical cosmonautics and the actual space leaders** **S.P. Korolev and M.V. Keldysh.**
- Academicians Keldysh and Korolev belonged to the **outstanding scientists** who created the glory of national science and technology.
- They were known as leaders of the largest state projects, representatives of **the famous "three K" (Kurchatov, Korolev, Keldysh)**, who created the nuclear shield of the country.
- They were called **Chief Designer and Chief Theorist of Cosmonautics**, who laid foundations of the practical cosmonautics, who **advanced the ideas and theoretical prerequisites** of space flights developed by K.E. Tsiolkovsky, Yu.V. Kondratyuk, and F.A. Tsander, and thus **pioneered space age of the mankind.**

Cosmonautics: Some Historical Roots

- Soviet practical cosmonautics is rooted several teams of enthusiastic people started design and testing the first generation of rockets back to 1930-th.
- In 1946 **OKB-1** headed by **S. P. Korolev** was set up targeted to the development of liquid-fueled missiles (R-1 – R-5) resulted eventually to the creation of multi-stage intercontinental ballistic missile R-7 with atomic charge, capable to reach a potential enemy overseas.
- **The R-7 rocket made it possible to launch an artificial body into low-Earth orbit.**
- Also in 1946, **M. V. Keldysh** headed the former **Rocket Institute - Research Institute N-1.**
- Important **complex studies** of various types of rocket engines, theories of physical gas dynamics, combustion, hypersonic aerodynamics, multistage rocket stability, heat transfer in vacuum, etc. were carried out under his leadership.
- The results of these studies were utilized in particular in the intercontinental supersonic cruise missile with a nuclear charge (**project “Burya”**) and completed with its successful flight test.

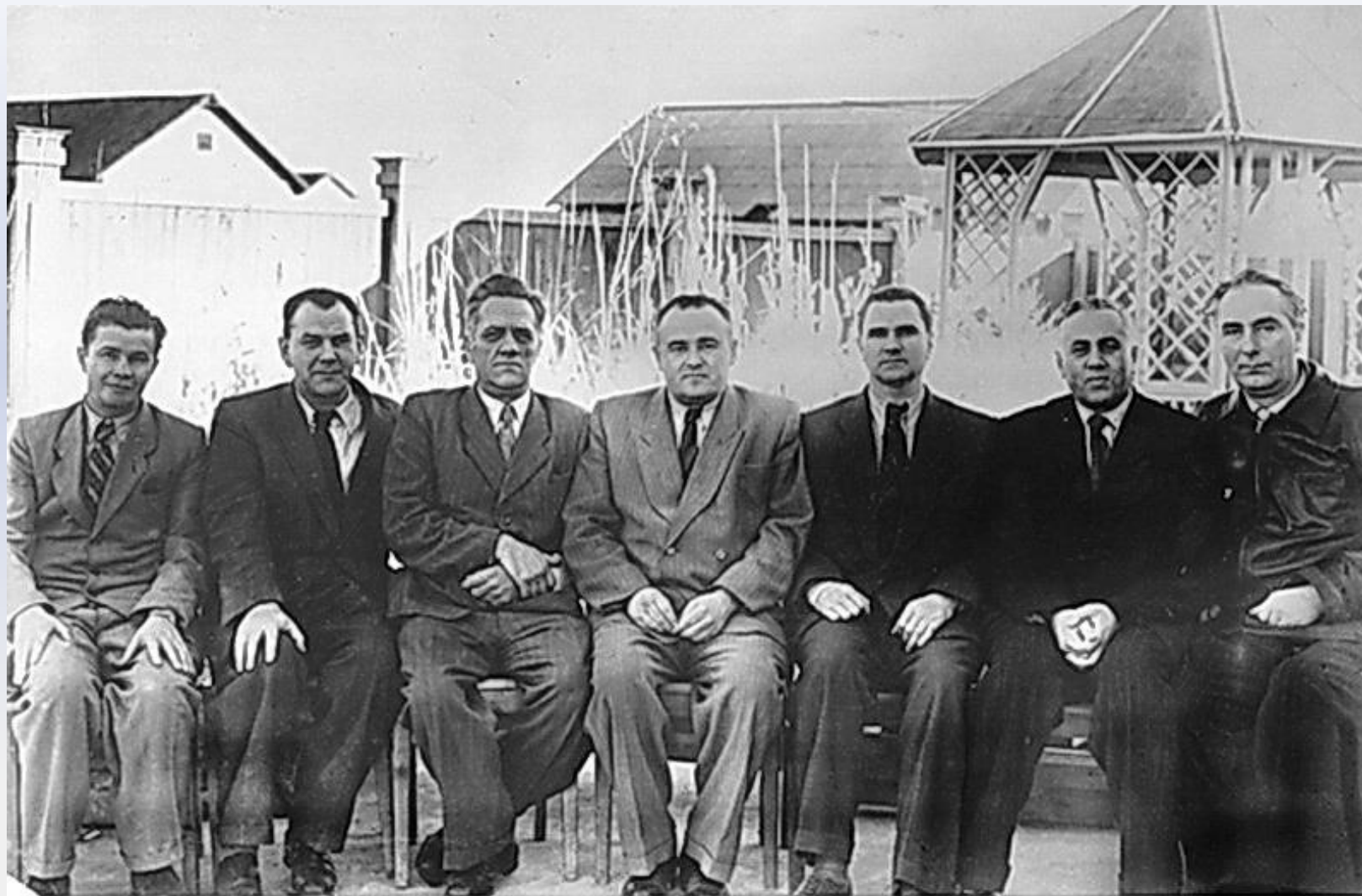
Prelude to the First Satellite Launch

- In the middle of 1950-th the multiyear creative cooperation and friendship of **designer-practitioner Korolev and ideologist-theorist Keldysh** has began and promoted the beginning of cosmonautics.
- In OKB-1 under leadership of S. P. Korolev the first versions of artificial Earth's satellite were designed.
- Korolev headed the legendary **Council of Chief Designers** (V. P. Glushko, V. P. Barmin, N. P. Pilyugin, M. S. Ryazansky, V. I. Kuznetsov) responsible for space-rocketry development.
- In Mathematical Institute after Steklov of the USSR Academy of Sciences M. V. Keldysh headed the study of **theoretical problems of space flights** including Earth's orbit, the Moon and planets of the Solar system.
- M. V. Keldysh headed the Commission on launch of the first satellite – predecessor the **Scientific and Technical Council for Space Research** responsible for the development and coordination of scientific and applied programs in the USSR.
- Both Korolev's and Keldysh's Councils played extremely important role in the Soviet cosmonautics advancement.



M.V. Keldysh and S.P. С.П. Korolev

Korolev's Council of the Chief Designers



Главные конструкторы.

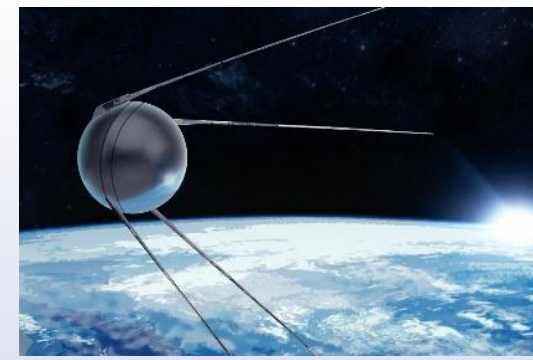
**Слева направо: А.Ф. Богомолов, М.С. Рязанский, Н.А. Пилюгин,
С.П. Королев, В.П. Глушко, В.П. Бармин, В.И. Кузнецов.**

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Keldysh and Korolev at the launch pad

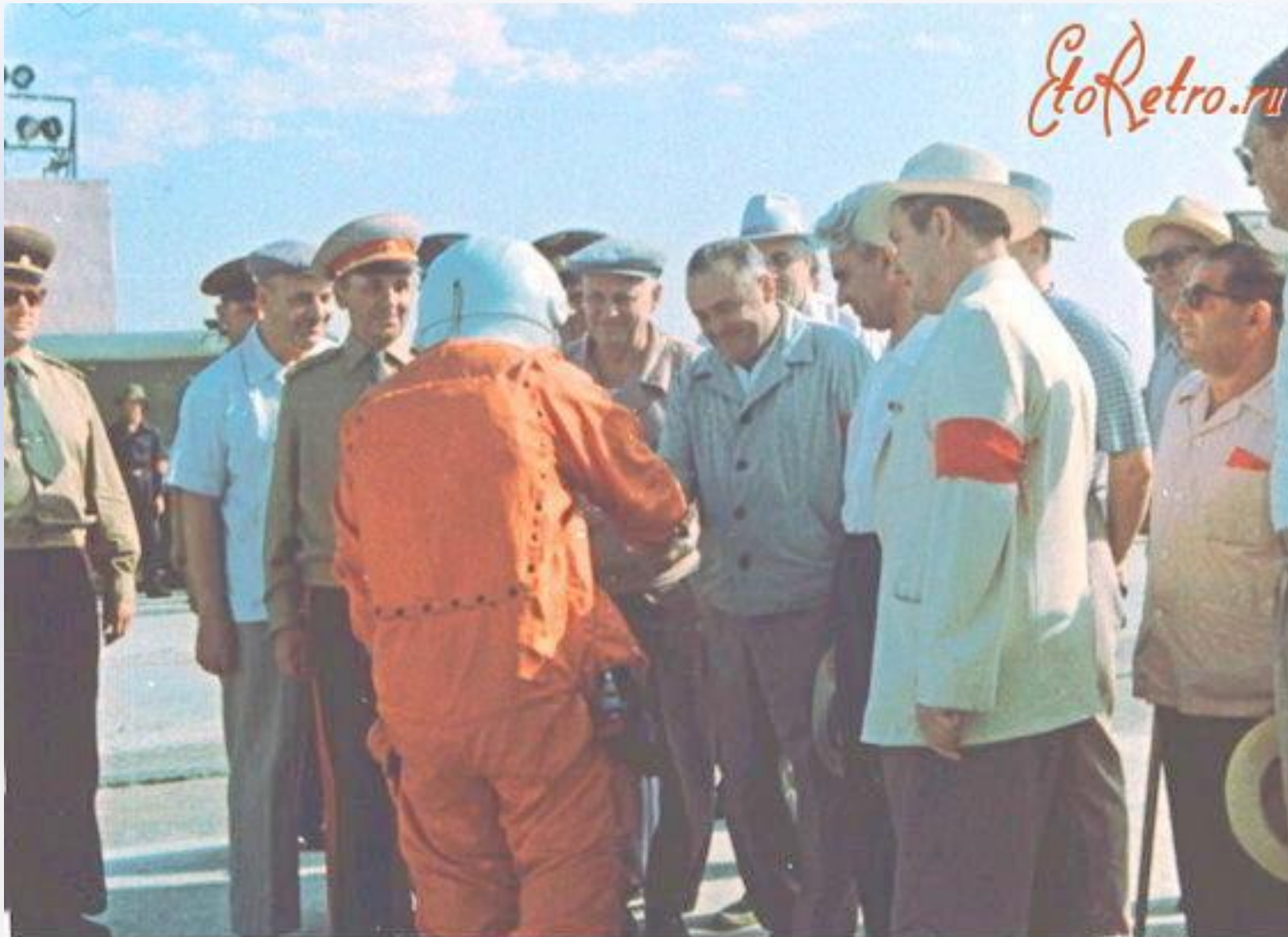
The First Satellite Launch



- The launch of the world's first Soviet artificial Earth satellite on October 4, 1957 was **an epochal event in the history of human civilization.**
- **"We ourselves did not immediately realize the importance of what happened,"** recalled M. V. Keldysh.
- In his lecture at the Royal Society in London in 1965, he said:

"I think we can rightly say that the launch of the first artificial Earth satellite by the Soviet Union opened the first of many new pages of the science of the universe that man has just begun to turn over. This success was achieved thanks to the high level of development of rocket technology, which, I allow myself to express the hope, will increasingly serve the development of science and useful purposes for humanity. It is probably unnecessary to say that the creation of space flight facilities requires a high level of industrial organization, the work of many design organizations, and the research of many scientific problems."

The First Manned Flight to Space



С.П. Королев, М.В. Келдыш, Л.В. Смирнов, К.С. Москаленко на стартовой площадке прощаются с Ю.А. Гагариным перед его посадкой в корабль. Байконур, 12 апреля 1961 г.



Yuri Gagarin after flight completion

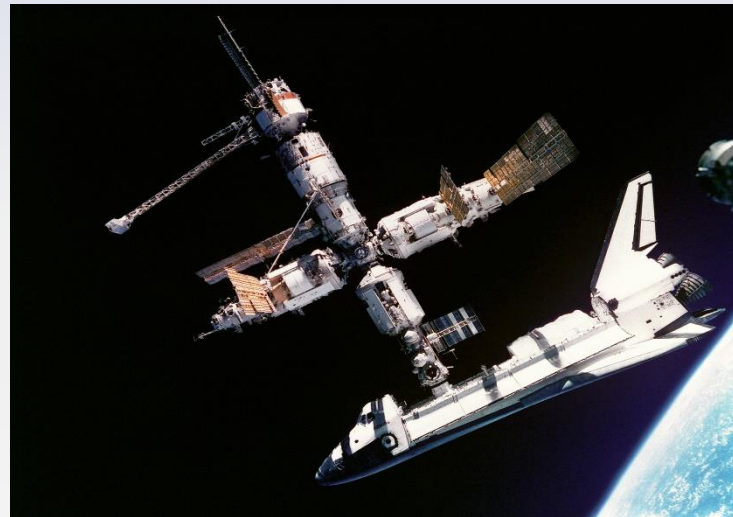
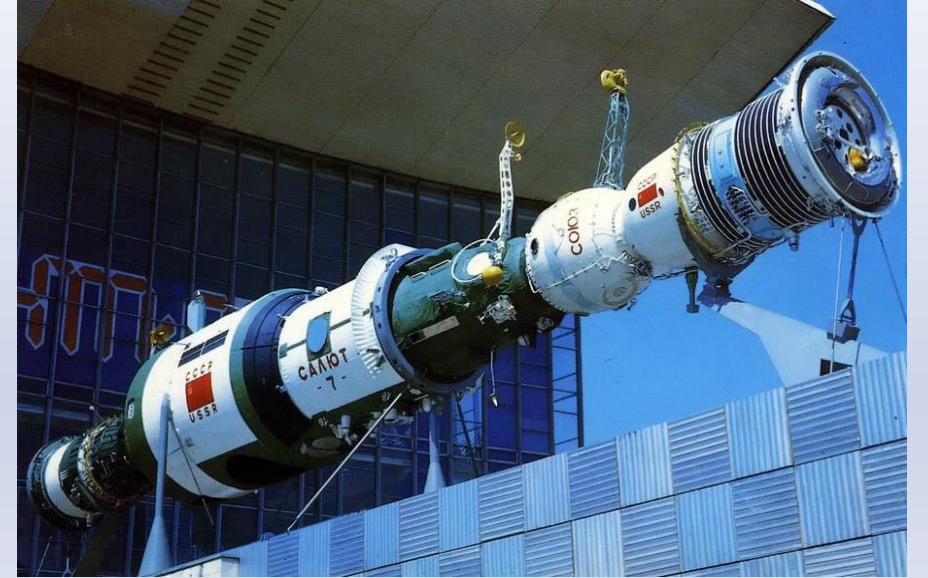


Yu.A. Gagarin and S.P. Korolev

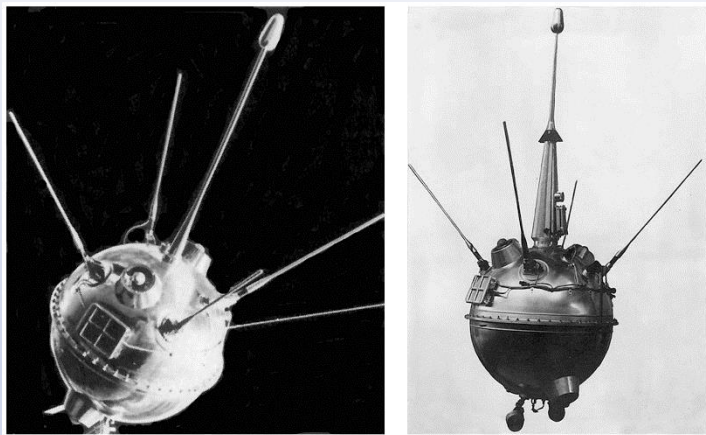
Outstanding Achievements in the first decades

- The creative collaboration of **S. P. Korolev and M. V. Keldysh** ensured our **outstanding achievements** in space research in the first decades and laid the groundwork for further development/
- Studies of the Sun, near-Earth space, the Earth's magnetosphere, and solar-terrestrial interactions – space weather.
- **First flights to the Moon**, taking images of its far side (1959), soft landing on the Moon and the first lunar satellite launch (1966).
- These achievements made true the mankind dreams for centuries.
- **The development of manned cosmonautics**, opened up by the Gagarin flight, single and group flights of cosmonauts, the first woman in space, spacewalks, prototypes of orbital stations launch.
- **Great advancement of space biology and medicine** that made possible the long-term flights.

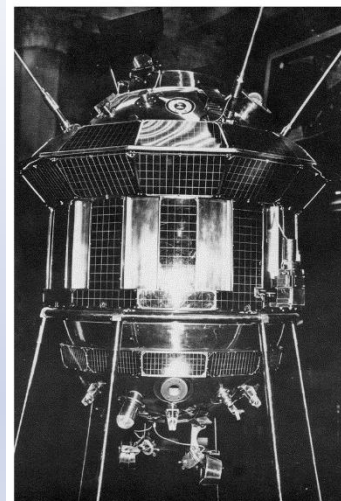
Progress of the Piloted Flights



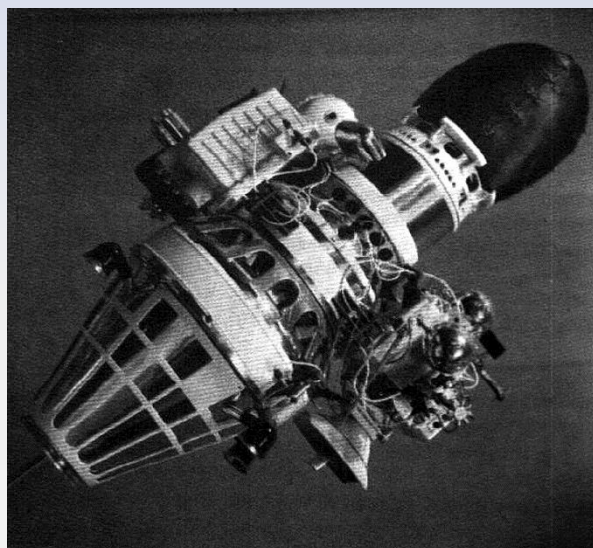
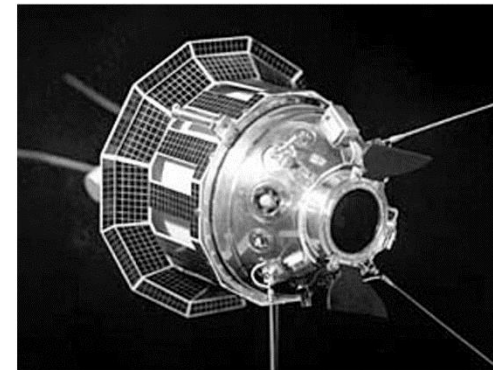
The First Lunar Vehicles



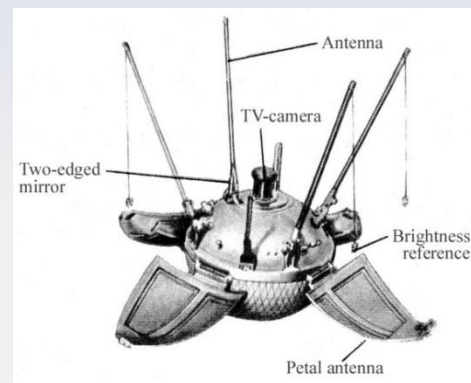
Luna 1,2



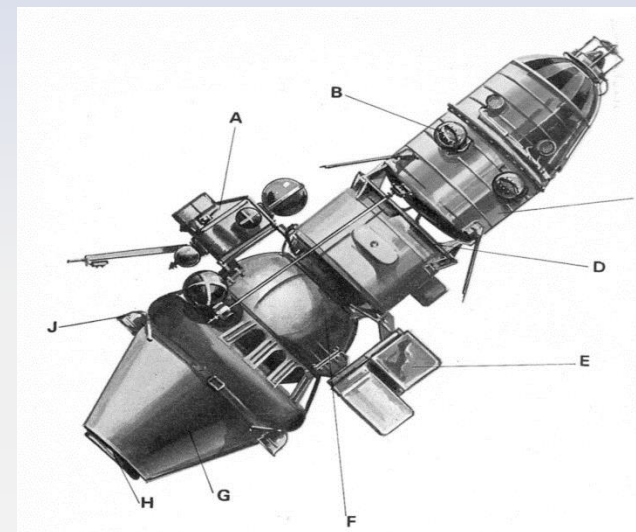
Luna 3



Luna 9



Luna 9



Luna 10



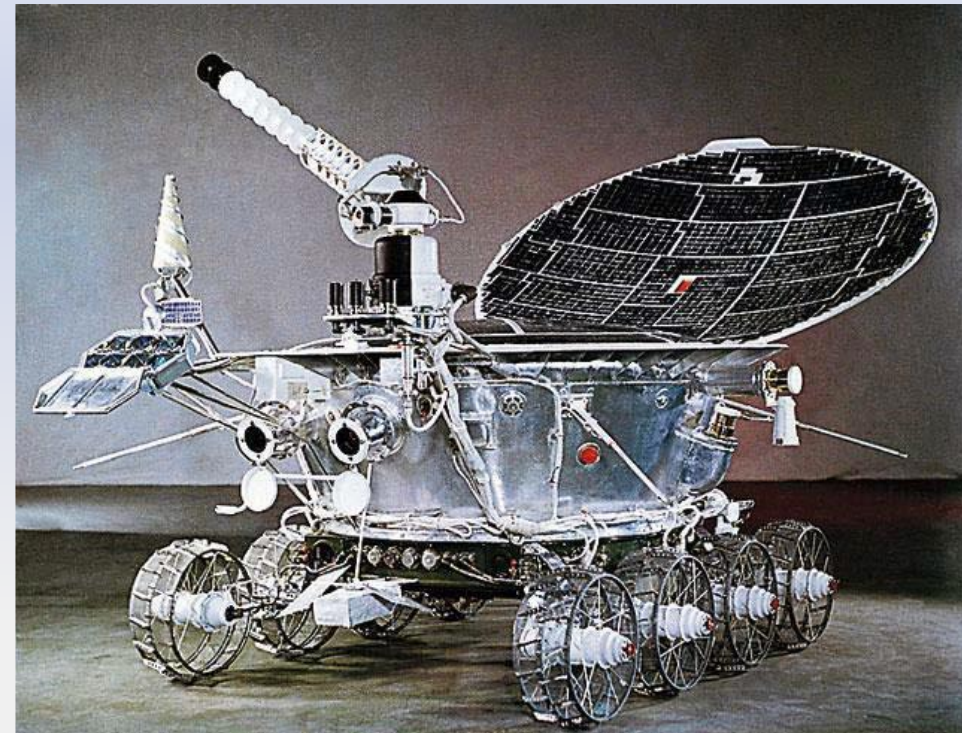
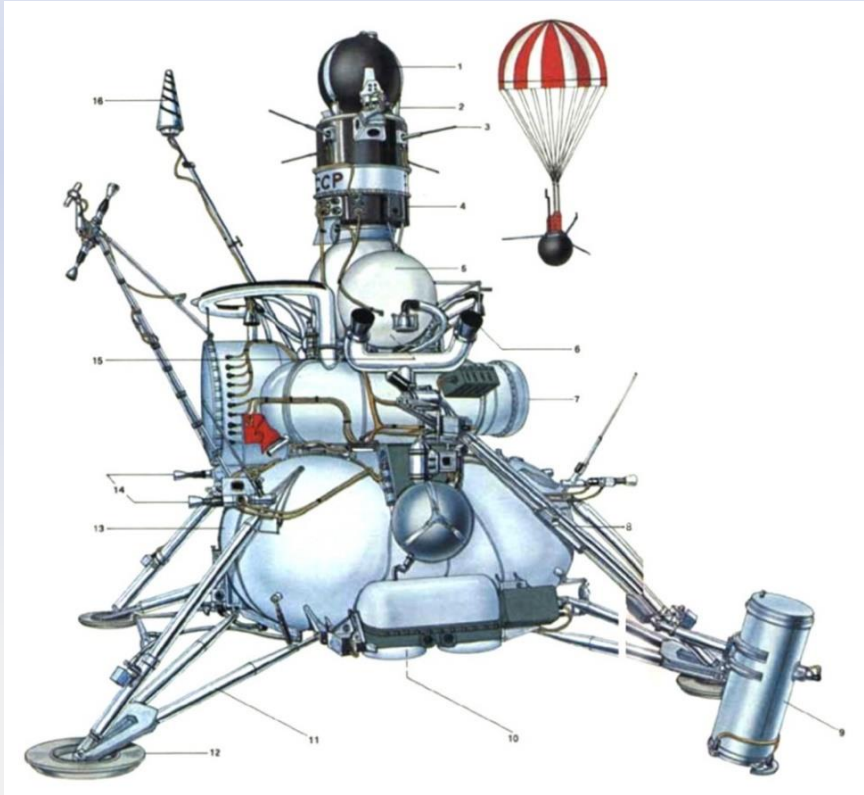
After «Luna -3» Flight Completion

Lunar Race



- Korolev and Keldysh were **enthusiasts of study** of the **the Solar system**, the Moon and planets.
- The first attempts of soft landing on the Moon, the first flights to Venus and Mars (1961-66) were accompanied by numerous failures, but this was **an inevitable period in the space technology development**, which S. P. Korolev called «**an era of gaining knowledge**”.
- Soviets attempted to chase Americans in landing a first man on the Moon but **USSR yielded USA in the Lunar race**.
- Meanwhile, Soviets gave Americans “**an asymmetric answer**” with the launch of vehicles for **automatic lunar samples return and landing on the Moon surface lunar rovers "Lunokhod"**.
- A number of the **successful Venus and Mars missions** were undertaken.
- Great contribution to these achievements were made by **George Babakin**.

Automatic Lunar Samples Return («Luna-16, 20, 24») and Lunar Rovers Lunokhods 1, 2 («Luna-17, 21»)



Korolev and Keldysh: Historical Heritage

- Korolev and Keldysh stayed at the starting point of cosmonautics **paved the road for further development in many decades ahead.**
- Their early death caused **irreparable damage** to the Soviet/Russian cosmonautics.
- They left behind a deep trace not only as **outstanding scientists and space leaders** whose authority was unquestionable, but also as **outstanding individuals** who possessed the highest civic responsibility, civic courage, and were **infinitely devoted to science and their country.**
- Keldysh remained dedicated to space being President of the USSR Academy of Sciences, nicely combining his presidency position with **leadership in space endeavors.**
- The played **historical role** in solving a number of fundamental problems of state importance.
- **We carefully store heritage left behind by Keldysh and Korolev as invaluable pages of the national and world history.**



Philosophical Concept



- M. V. Keldysh and S. P. Korolev were convinced that space flights would become one of **the greatest aspirations of our civilization.**
- *"It is safe to say that humanity will come to interplanetary flights. And just as many years ago it was impossible to predict what humanity would find on the new continents, it is impossible to predict in advance what it would find on the planets. Perhaps, many years from now, to those who fly to other planets, modern space rockets will seem as primitive and imperfect as the ancient pirogues on which the first brave navigators sailed across the ocean seem to us. After all, we are only at the very beginning of the journey beyond the Earth. Many complex technical issues remain to be resolved. But this process has begun, its pace is rapidly increasing, and there is no doubt that the prophetic words of K. E. Tsiolkovsky about the conquest of the entire near-solar space will become the destiny of humanity in the coming century."*

(Keldysh, Report at the International Astronautical Congress, 1972).

- In these words – a testament to the present and future generations.

Thank you for your attention!