

Serdyuk Oleksiy, Shkurat Natalia

Space exploration



THE EARTH'S ORBIT

The aspirations of the human race conquer outer space have their origins in ancient times. Down through the ages, the mysterious starry sky fascinated people.

The first observations of space began thousands of years ago. For a long time, flying into space was just a dream. Many science fiction writers wrote about fantastic flights beyond the Earth.

The twentieth century marked the beginning of the era of space exploration. What scientists and philosophers have dreamed of for hundreds of years has become a reality. A little more than half a century has passed since humans launched the first object created by them into space. Since then, astronautics has leapt ahead. Using outer space is now an integral part of supporting our lifestyles on Earth.

Successes in the conquest of near-Earth space allow scientists to set ambitious and sometimes even fantastic goals for the further development of the vast cosmic space.

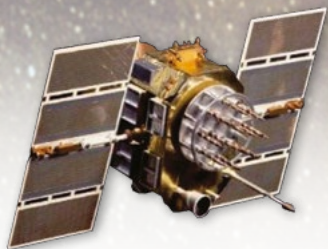
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SPACE EXPLORATION. THE EARTH'S ORBIT

by Serdyuk Oleksiy and Shkurat Natalia

This book will tell you about how humanity has made its first steps in conquering outer space. About how the first rocket took off, how the first spacecraft sent its signal to Earth, how people flew into space, how different countries, such as the USA, the European Union, China, Japan, India, Russia, master space technologies, and as well as many other things related to human activities in the Earth's orbit.

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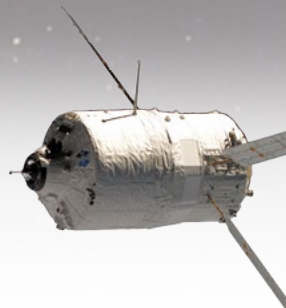
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International Space Station and the docked space shuttle Endeavour (by NASA)

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THE BEGINNING

Scientists' minds have been excited by dreams of flying in the sky and conquering outer space for many centuries. Interplanetary travels were often described in the books of science fiction writers.

In 1881, M.I. Kibalchich formulated the idea of a rocket aircraft. In 1883 the idea of using rockets to reach outer space was developed by a scientist, Konstantin Tsiolkovsky. He even drew a diagram of a spacecraft. And in 1886 he formulated the theory of jet propulsion. In 1903, he published an article theorizing that a rocket would be able to go into space. Later, he developed his ideas and calculated the second cosmic velocity (escape velocity). Tsiolkovsky became one of the founders of the new science – Cosmonautics.



M. I. Kibalchich
Ukrainian inventor,
a rocket pioneer



Tsiolkovsky's ideas were picked up and developed by a German researcher Hermann Oberth.

Oberth came to the conclusion that it is possible to travel into space by using a multistage rocket with liquid fuel. He justified the possibili-

Draft of first space ship by Konstantin
Tsiolkovsky, Manuscript "Free space", 1883

**TSIOLKOVSKY
KONSTANTIN EDUARDOVICH**
1857-1935

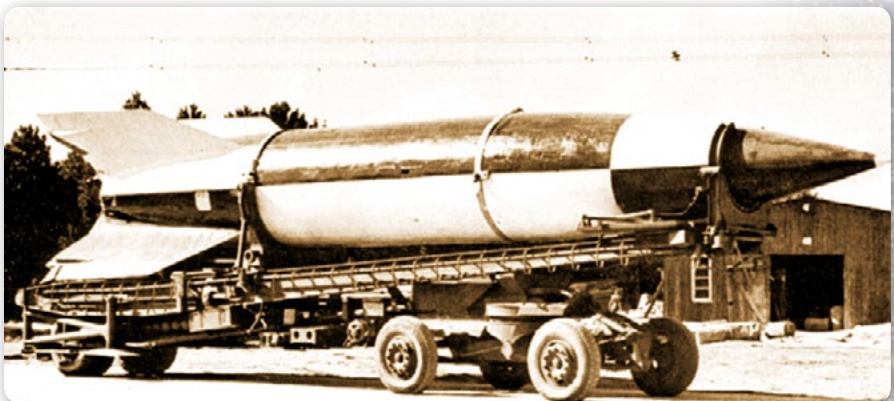
Russian scientist, philosopher and writer. Author of works on aerodynamics and aeronautics. One of the founders of Cosmonautics. Tsiolkovsky had been dealing with issues of the movement of jet vehicles since 1896. He developed schemes for the operation of rockets for space travel. He was a supporter of the idea of colonization and exploration of space.



ty of creating such a rocket with great accuracy. Oberth shared his ideas with an American scientist Robert Goddard, who worked on developing a liquid rocket engine. In March 1926 Goddard managed to complete a working prototype of the engine and he launched the first rocket powered by liquid fuel.

The theme of space flight was becoming more and more popular throughout the world. The results of the works by Tsiolkovsky, Oberth and Goddard were used by scientists from many countries.

V-2 rocket on Meillerwagen near Cuxhaven in 1945

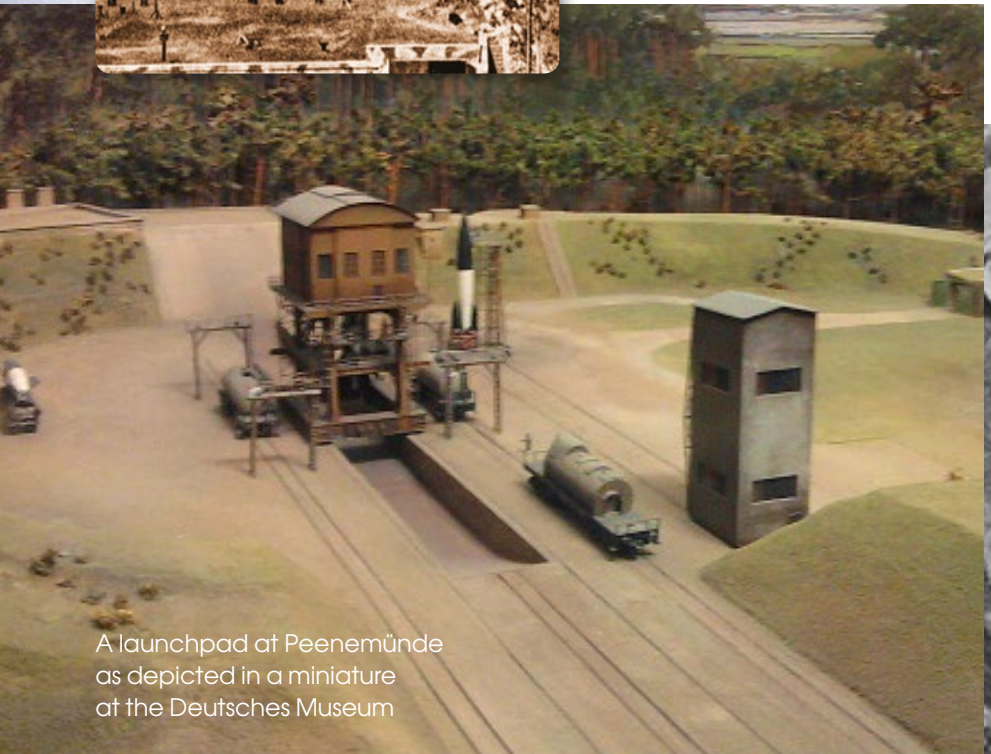




The deepest interest in rocketry was in Germany. In 1936 a rocket center was founded in Peenemünde.

An engineer, Wernher von Braun, was appointed as one of its leaders. Under his leadership, a ballistic rocket A-4 was developed in that rocket center. In serial production, the rocket was named V-2. That rocket was the first man-made object

A V-2 launched from a fixed site in summer 1943



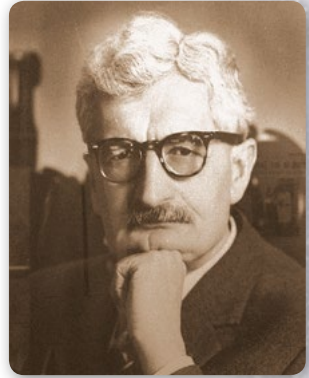
A launchpad at Peenemünde as depicted in a miniature at the Deutsches Museum

HERMANN OBERTH

1894-1989

Austrian-German physicist, researcher, inventor. Founder of rocket technology and astronautics.

He was engaged in researches in the field of developing rockets and launching them into outer space. He was the first to formulate the idea of creating an orbital telescope. In the 1950s, he was dealing with the problems of space exploration by people.



in history to reach outer space. In 1944, several vertical rocket launches were made. It reached an altitude of 188 km.

After the end of the Second World War, the USSR and the United States gained access to the rocket technology of the Third Reich.



Rocket site at Peenemünde, 1943

SATELLITE

The Second World War gave a powerful impetus to the development of military and civilian technologies. In the early post-war years, Cosmonautics occupied one of the key places in scientists' research.

After the Second World War, scientists and inventors did not abandon their plans to explore outer space. Both in the USA and in the USSR, engineering groups working in the field of rocketry had been promoting and developing ideas since 1946 for launching the first space satellite of the Earth. In the Soviet Union, the ideologist of this project was the Ukrainian design engineer Sergiy Pavlovich Korolev, and in the United States – the German engineer Werner von Braun.



KOROLEV
SERGIY PAVLOVICH
1906-1966

Ukrainian scientist. Constructor. The largest specialist of the twentieth century in rocket engineering and astronautics. The creator of the Soviet space industry. Ideas and development of Korolev's design office made it possible to launch the first artificial Earth satellite, launch of the first cosmonaut, first spacewalk and much more.

Mikhail Tikhonravov
and his team



On May 12, 1946, von Braun's engineering team submitted a report to the US Department of Defense, which described the possibility of putting an artificial earth satellite into orbit by 1951. On May 21 of the same year, Mikhail Tikhonravov made a similar report to the USSR Ministry of Aviation Industry. However, neither of the engineering groups received support at the state level.

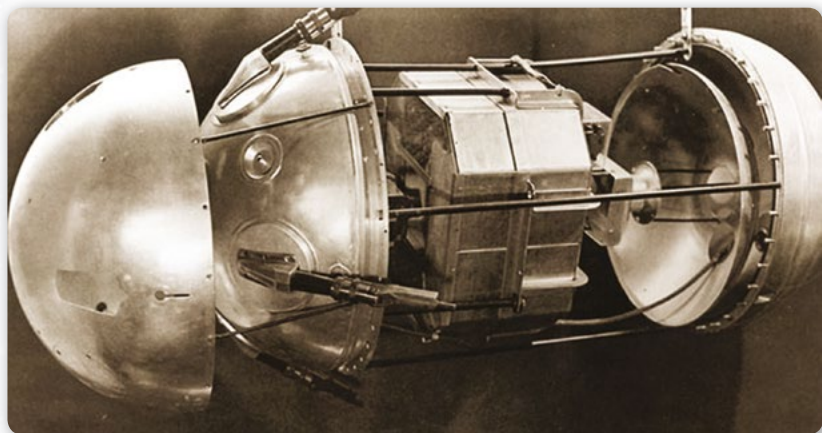
In October 1954, the Organizing Committee of the International Geophysical Year sent a request to the leading countries to consider a project to launch an artificial Earth satellite for research. US President Dwight Eisenhower responded by saying that the United States was ready to implement that

project. As the relations between the US and the USSR were imbued with a spirit of rivalry, a similar announcement was soon made by the Soviet leadership.



PS-1 in laboratory

In the USSR, the date for the satellite launch was set for 1957. The satellite which was prepared for the launch in the technical documentation was listed

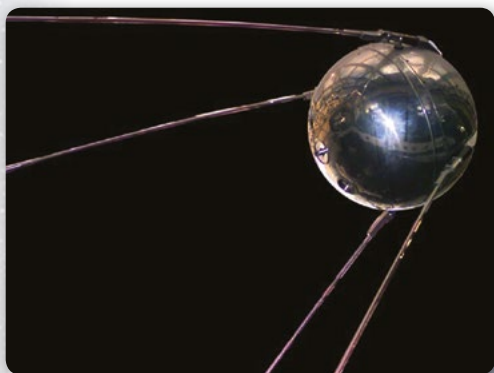


The design of the first artificial Earth satellite.
There is a transmitter and a power source inside.

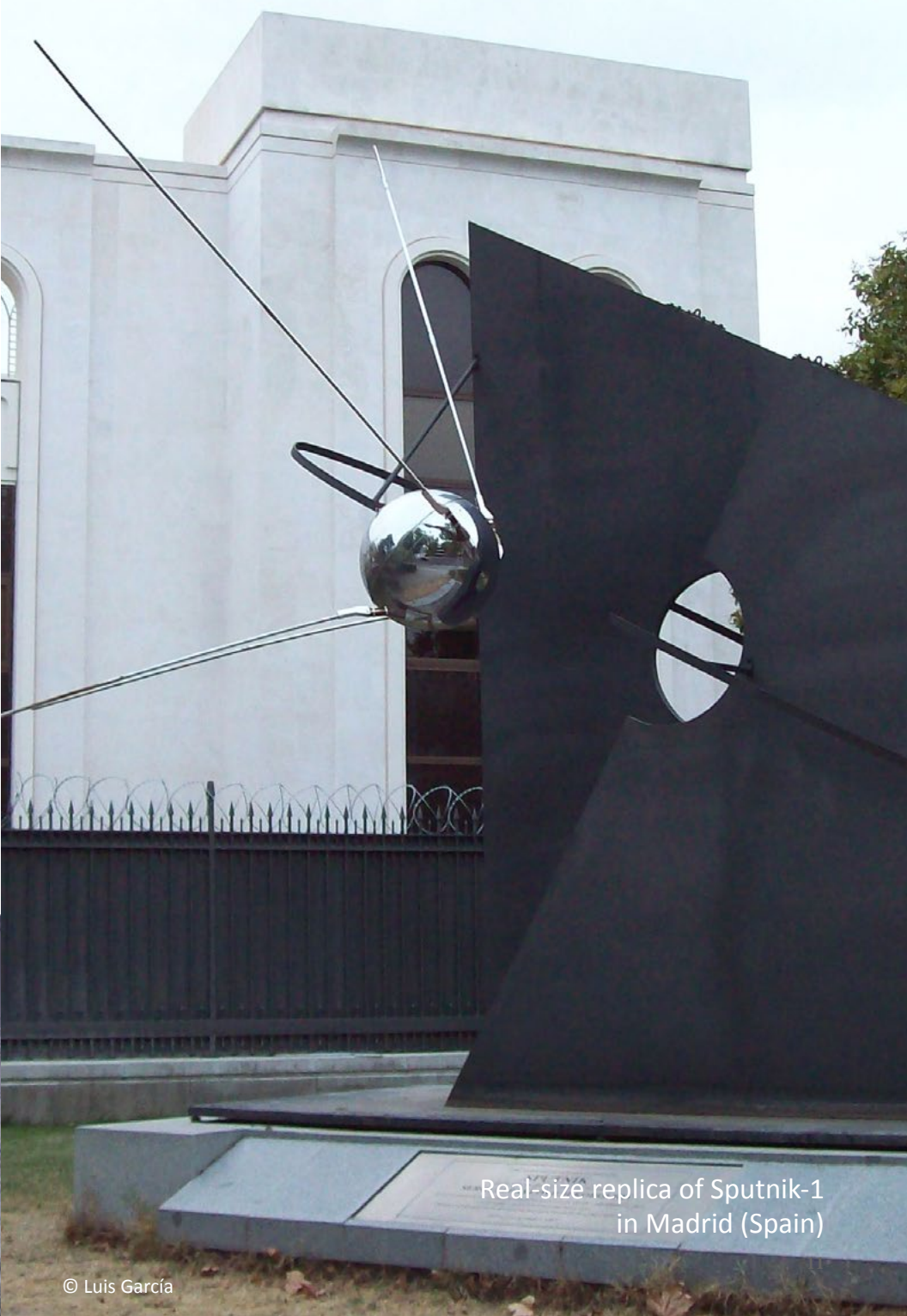
as Sputnik-1 – the simplest satellite. On October 4, 1957, the R-7 intercontinental ballistic rocket launched the first artificial satellite into the Earth's orbit.

The satellite was in orbit for 92 days – until January 4, 1958. It made 1,440 revolutions around the Earth. On Earth, information about the launch of the satellite caused a sensation. People in different countries all over the world started to watch the sky at night, trying to see among the many glowing points the one that moved around the Earth.

This is how people began to master outer space.



A replica of Sputnik 1 at the U.S.
National Air and Space Museum



Real-size replica of Sputnik-1
in Madrid (Spain)

THE FIRST STEPS IN COSMONAUTICS

The launch of an artificial satellite made space exploration one of the most prioritized branches of science. In the early decades, space programs were developing very actively.

After the launch of the Soviet satellite, the United States accelerated the process of creating its own satellite. So the space race began and it lasted 18 years.

On November 3, 1957, the Soviet Union launched the second satellite, which weighed 508 kg. It was effectively an entire self-contained space laboratory. In addition, it had a dog on board – Laika, the first living creature sent into orbit. However, after several orbits around the Earth, the dog died because of overheating. But the launching of a living creature into the cosmos brought scientists



The dog Layka on board of Sputnik-2

Monument to the dog Layka



WERNER VON BRAUN
1912-1977

German design engineer, who worked in the United States. Creator of ballistic rockets. Founder of the US space industry.

substantially closer to the possibility of sending a human being into space.

In the United States, the Navy Research Laboratory (the Vanguard project) and the RAND Corporation Laboratory (the Explorer project), headed by Werner von Braun, worked on the artificial satellite project. Priority was given to the project Vanguard by order of the state.

On November 11, the United States announced the launch of its satellite, Vanguard. But that launch ended in complete failure. The United States had to return to Von Braun's project

The Vanguard-1 satellite

The crash of a rocket with the Vanguard-1 satellite,
December 6, 1957





Explorer 1

Explorer. The launch of Explorer was successful. It was held on January 31 1958. The United States became the second space power.

Further exploration of near-Earth space was very intensive.

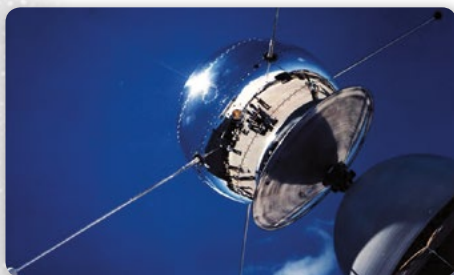
On May 28, 1959, the United States launched a monkey into space (AM-18 mission). And the Soviet Union sent the station Luna-1 towards the Moon, which passed at a distance of 6,000 kilometers from it and entered a heliocentric orbit. In the same year, the USSR sent two more stations towards the Moon. The first of them, Luna-2, reached the surface of the Moon, and the second, Luna-3 was the first to study the dark side of the Moon, invisible from Earth, and it also practiced a gravitational maneuver.

On August 19, 1960, the Soviet Union launched dogs Belka and Strelka into space on the ship Sputnik-5. On August 20 they successfully returned to Earth.

The 60s were marked by the appearance of new space powers on the map. In 1962 the United Kingdom and Canada launched their first satellites, in 1964 – Italy, in 1965 – France.



A monkey, Miss Baker, in bio-pack couch being readied for Jupiter (AM-18 flight).



Vanguard II is an Earth-orbiting satellite launched February 17, 1959

Launch of Explorer 1



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