Longman Structural Readers: Non-Fiction
Stage 6

Man Against Space

Norman Wymer

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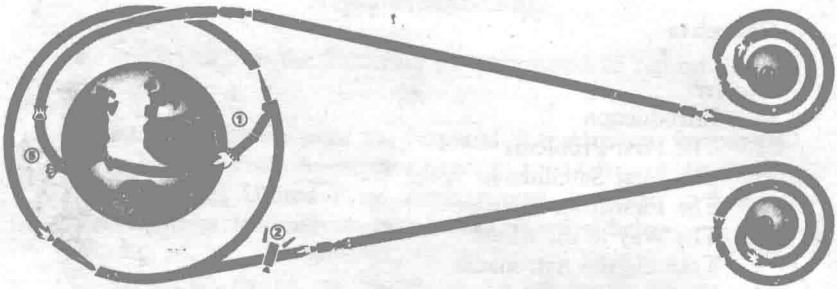


The picture shows how the astronauts made the journey, landed on the moon and returned to earth.

The three American astronauts prepare to leave on their journey to the moon.

Introduction

In July 1969 men landed on the moon for the first time.

Three American astronauts climbed into a spacecraft, and an immense rocket shot them into space. The rocket carried them about 160 kilometres above the earth. The spacecraft reached a speed of 40,000 kilometres an hour. Then it left the rocket and flew to the moon alone.

For four days the astronauts travelled through space on their long, lonely and dangerous journey. At last, they reached the moon. The spacecraft then divided into two separate sections. One of the men stayed in the main section and flew round and round the moon. The other two men dropped down in the smaller section and landed. A few hours later, these two astronauts got out of their spacecraft and walked on the moon – the first men on the moon.

The astronauts were nearly half a million kilometres from the earth. But people were able to see them on television. They could see and hear the men during their journey and they could also watch their actions on the moon.

The two astronauts stayed on the moon for about twenty-one hours. Then they took off and joined their companion who was travelling round the moon. The three men then made the long journey home again. They returned safely to earth three days later.

Since man's attempt to conquer space began in 1957, scientists and engineers had been planning and preparing for this great event.

This picture is from From the Earth to the Moon *and shows what people thought a moonship would look like.*

Chapter 1

THE FIRST PROBLEMS

The moon has always been a mystery to men. How old is the moon? Where did it come from? What is it made of? Since early times, scientists have been trying to find the answers to these and many other questions.

It is not possible to solve these mysteries from the earth. Men must explore the moon and gather information which may help scientists to discover its secrets. This had been the dream of scientists for a very long time. But few people thought that it would ever be possible to send men to the moon.

The famous French writer Jules Verne (1828–1905) wrote an exciting book called *From the Earth to the Moon.* Most people who read the story considered it impossible, but some men gave serious thought to the subject.

They studied the way the planets move round the sun. The sun has nine planets: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune and Pluto. They are natural satellites of the sun and they travel round the sun in separate paths or orbits. The planets are controlled by the sun's gravity and also by their own speed. The gravity is very strong and pulls the planets towards the sun. If the sun had no gravity, the planets would shoot towards the distant stars and disappear. Instead, they travel round the sun in an almost circular path, and they cannot escape. If the planets were not moving, they would fall into the sun. But this cannot happen because they are travelling too fast. The speed of the planets balances the pull of the sun. All the planets are different distances from the sun, and for this reason they all travel at different speeds. The nearer a planet is to the sun, the stronger the pull of gravity is. Therefore, the faster it must travel in order to balance the sun's pull.

The moon moves round the earth in the same manner.

The laws of science which control the natural satellites – the planets and the moon – must also apply to artificial satellites. An artificial satellite in space is also controlled by gravity and speed.

Men soon worked out the theory, but they still did not know how to send a spacecraft into space.

A Russian schoolteacher, Konstantin Tsiolkovsky, first

suggested the use of rockets, in 1903. At that time, rockets used solid fuels and they had not much power. Tsiolkovsky suggested using liquid fuels to increase their power. A few years later, an American scientist, Dr. Robert Goddard, made the first experiments with liquid fuels and built the world's first liquid fuel rocket. It climbed nearly fourteen metres and stayed in the air for two and a half seconds. Goddard tested different engines and fuels and built bigger and more powerful rockets. His last rocket climbed 2,250 metres and reached a speed of nearly 1,200 kilometres an hour.

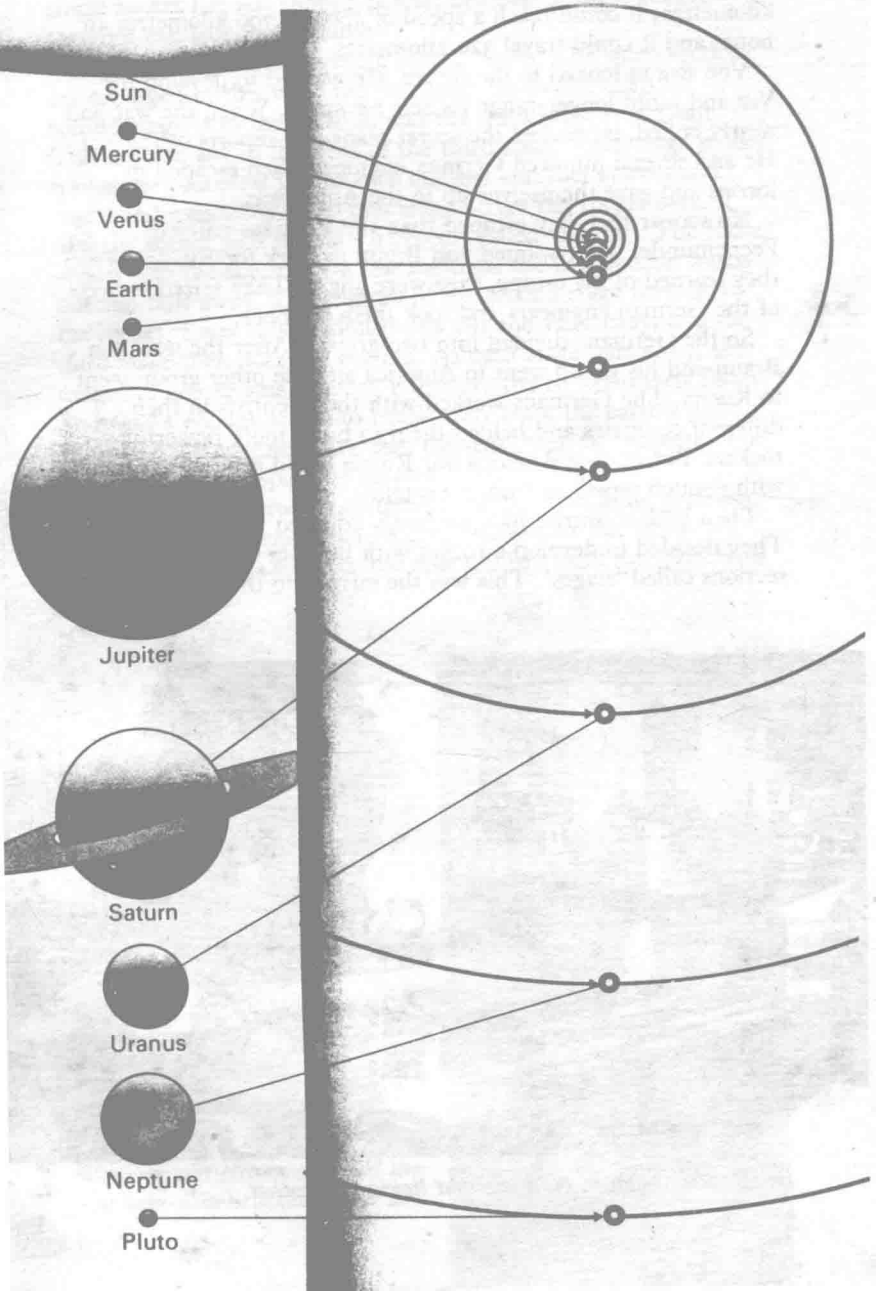
Meanwhile, a German scientist, Hermann Oberth, was also making experiments with rockets; and in 1930 he wrote a book called *The Way to Space Travel*. His book attracted much attention. As a result, German scientists and engineers formed a society to study rockets and space – the German Society for Space Travel.

One member of the society was Wernher von Braun, a clever young engineer who had watched some of Oberth's experiments. Space was von Braun's greatest interest in life, and he had one great ambition: he wanted to build a rocket that would be able to send men to the moon. He was a very confident young man. He told nearly everybody he met: "One day men will land on the moon."

Von Braun and his companions tried to solve a very difficult problem. They had to build a rocket with enough power to overcome the pull of gravity and break away from the earth's atmosphere. The atmosphere consists of various gases, water vapour and dust. The air is heavy and dense near the surface of the earth. It then gets gradually lighter and less dense further away, until there is no air at all.

The German engineers had very little money; they could not afford wonderful workshops and expensive machines. They built their rockets in a humble hut in Berlin and then tested them in a field. During the Second World War (1939–45), von Braun and his friends worked at the famous German rocket station at Peenemunde. There von Braun designed the powerful V.2 rocket, which Hitler used to attack Britain. The V.2 was the first long-range rocket. It could climb to a height of over 160

The orbits of the nine planets round the sun. ▶


Sun
Mercury
Venus
Earth
Mars
Jupiter
Saturn
Uranus
Neptune
Pluto

kilometres; it could reach a speed of about 5,700 kilometres an hour; and it could travel 320 kilometres.

Von Braun looked to the future. He wanted to develop the V.2 and build longer-range rockets for space. When the war had nearly ended, he packed the secret plans and reports of the V.2. He and several hundred German engineers then escaped in lorries and gave themselves up to the Americans.

No sooner had they escaped than the Russians entered Peenemunde. They wanted von Braun to work for Russia. When they learned of his escape, they were angry. They seized the rest of the German engineers and took them prisoner.

So the Germans divided into two groups. After the war, von Braun and his group went to America and the other group went to Russia. The Germans worked with the scientists in their different countries and helped them to build more powerful rockets. But neither America nor Russia could produce a rocket with enough power to launch a satellite.

Then both countries independently adopted the same idea. They decided to develop a rocket with three or more separate sections called 'stages'. This was the answer to the problem. A

Dr. Robert Goddard built the first liquid fuel rocket.

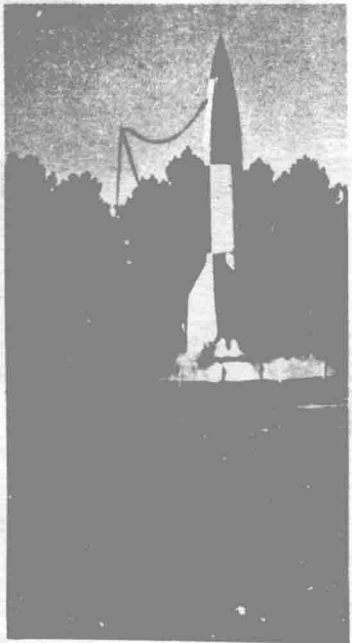
single rocket has not enough power, but two or three rockets together can launch a satellite.

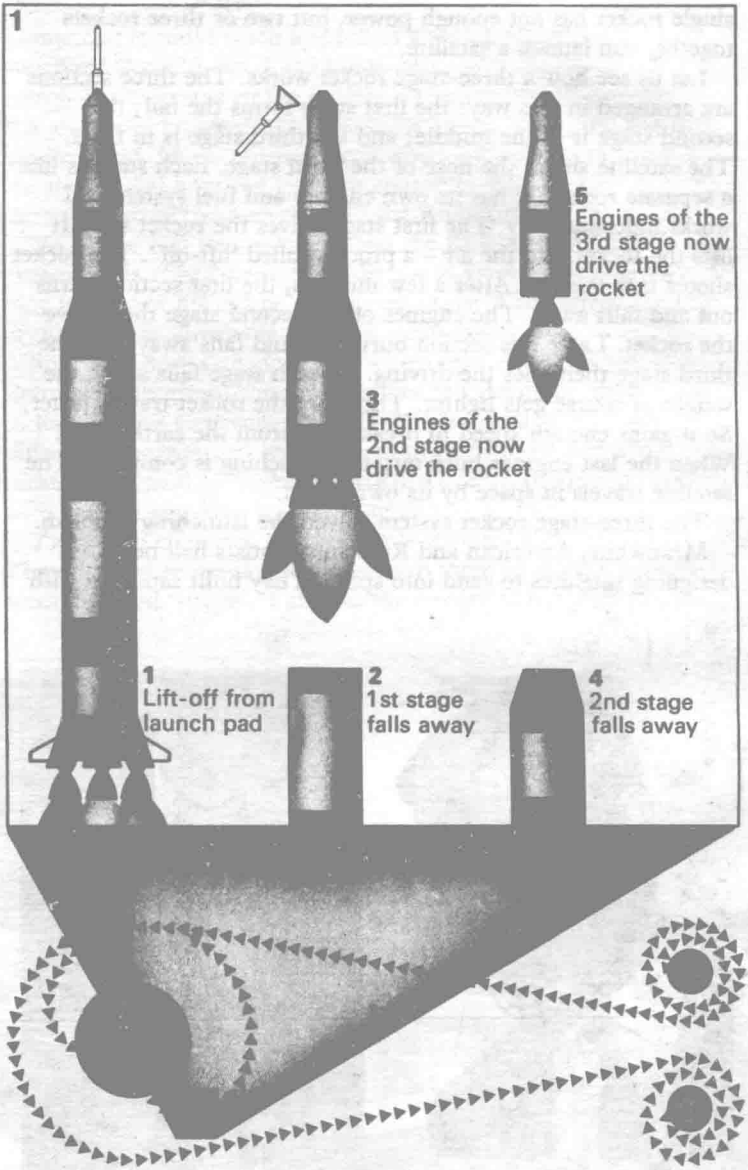
Let us see how a three-stage rocket works. The three sections are arranged in this way: the first stage forms the tail; the second stage is in the middle; and the third stage is in front. The satellite sits in the nose of the third stage. Each stage is like a separate rocket: it has its own engines and fuel system and works independently. The first stage drives the rocket first. It lifts the rocket into the air – a process called 'lift-off'. The rocket shoots into the sky. After a few minutes, the first section burns out and falls away. The engines of the second stage then drive the rocket. Later this section burns out and falls away, and the third stage then does the driving. As each stage falls away, the weight of course gets lighter. Therefore the rocket travels faster. So it gains enough speed to break away from the earth's pull. When the last engines burn out, the launching is complete. The satellite travels in space by its own speed.

The three-stage rocket system solved the launching problem.

Meanwhile, American and Russian scientists had been designing satellites to send into space. They built satellites with

Wernher von Braun designed the first long-range rocket: the V2.





The answer to the problem was a rocket with three stages and this picture shows how it works.

thousands of electronic parts and instruments which worked automatically. There were 'solar cells' on the outside walls. In space, these cells would draw light from the sun and produce the power for the electronic instruments.

The scientists also worked out a system to track and control satellites from the ground. A satellite automatically sends out 'tracking signals' in space, and these signals show its position in the sky. An immense aerial at the 'control centre' picks up these signals. Small spots of light then appear on screens and show the satellite's path. At the same time, electronic machines -'computers'- at the control centre receive messages from the satellite. Engineers can watch the screens and computers and check that everything is correct. If there is any trouble, an engineer may be able to correct the fault by 'remote control'; this means 'control from a distance'.

At last, in 1957, both America and Russia were ready to send a satellite into space. Each country had the same secret ambition – to launch the first satellite. Russia gained this honour.

Chapter 2

THE FIRST SATELLITES IN SPACE

Early in the morning of 4 October 1957, Russia launched the world's first satellite, Sputnik 1. It was very small: it was nearly sixty centimetres in diameter and it weighed about eighty-two kilograms. The satellite sat in the nose of a three-stage rocket. With a roar, the rocket shot into the sky above Central Asia. The first stage burned out, and the engines of the second stage drove the rocket. Then the second stage burned out and fell away. The lighter the rocket, the faster it travelled. With increasing speed and power, it climbed higher and higher. The third stage carried the satellite above the atmosphere, and Sputnik 1 then left the rocket and travelled alone in space. As soon as its speed balanced the pull of the earth it went into orbit.

While the satellite was travelling round the earth, it gathered some important information. Electronic instruments measured the density of the highest layers of the atmosphere. Sputnik then radioed the information to a radio station in Russia.

This great scientific event surprised and excited the world. Many Americans refused to believe that Russia had sent a satellite into space. They thought that the Russians were making false claims.

The Russians soon gave the world another surprise. A month later, they launched their second satellite, Sputnik 2 – and this satellite carried a dog, Laika. The Russians were already planning to send a man into space, but they were not yet ready to risk a human life. They needed more information about conditions in space, where there is no air. So they sent up a dog in order to discover the effects of space conditions on a living creature. The results of this test provided some very important information.

America's first attempt to launch a satellite failed. Millions of people sat in front of television screens, eager to watch the event. They were disappointed. The rocket rose a few metres – and then fell to the ground in smoke and flame.

A few weeks later, the Americans tried again and succeeded. They sent a small satellite, Explorer 1, into orbit round the earth; and it made a very important discovery. It discovered