Space Exploration



The scope of this exhibit is to give an overview of Space Exploration from early years up to the year 1997. It will present origins, influences and what has made it possible for humans to achieve discovery beyond the outer boundaries of Earth. It includes a timeline of space travel from initial beginnings in the 1920s to the late 1990s, looking at some of the major historical milestones in more detail. This display will conclude on Space Exploration as a global endeavour, showcasing some of the international efforts that have been made over the corresponding decades.

1 INTRODUCTION

Space exploration is investigation of the reaches of the universe and the use of the obtained information to increase knowledge of the cosmos and to benefit humanity.



Space travel refers to the human or automated journey into space beyond Earth's atmosphere. It involves the use of spacecraft and space technology to discover and study the universe.

Space travel has been a significant endeavour human history, and it covers various aspects, including crewed missions, robotic expeditions, and space tourism.

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The Smithsonian History of Space Exploration (2018), Roger Launius The complete Guide to Space Exploration (2020), Ben Hubbard

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The Penguin Book of Outer Space Exploration (2018), John Logsdon The Astronomy Book (2017), DK Digital Publishing

https://www.britannica.com/science/space-exploration

Flag image: https://www.freeimages.com/ Universe image: https://www.nasa.gov Milky Way image: https://www.nasa.gov The Auckland Star, 21 July 1969

SPACE EXPLORATION

1. Introduction

2. Historical Influences

4. The Universe

5. Timeline 1920 - 1955

6. Timeline 1955 - 1965

7. Timeline 1965 - 1980

8. Timeline 1980 - 1997

9. Milestones - Sputnik

10. First Human in Space

3. Sciences & Engineering 11. First Human on the Moon

12. Hubble Space Telescope

13. Hazards of Space Travel

14. Satellites

15. Space Creatures

16. International Collaborations

2 HISTORICAL INFLUENCES

Space Exploration

Though humans have looked to the stars and dreamed of voyaging there for thousands of years, they did not become a spacefaring species until the beginning of the early twentieth century. It was then that the concept of using rocket propulsion to accelerate spacecraft to orbital velocity came to the fore. Here are some of the most important influences from history and astronomy that would later make space exploration and space travel possible.



The ancient Egyptians saw the milky way as a heavenly version of the river Nile which sustained their civilization.



Nicolaus Copernicus (19 February 1473 – 24 May 1543) Mathematician and astronomer, formulated a heliocentric model of the Universe, likely based on the model of astronomer Aristarchus of Samos, (310-230 BCE), Greece.



Conrad Haas (1509–1576)
Saxon military engineer, pioneer of rocket propulsion, wrote a treatise on rocket technology.
Developed multistage rocket design.



Erasmus Habermel
(ca. 1538 – 1606), Prague
Major watchmaker and
maker of astronomics and
geodesy instruments.
He received commissions
from Tycho Brahe.



Tycho Brahe (1546–1601)
Astronomer
Made extensive and
accurate measurements
of the positions of celestial objects without the
aid of a telescope.



Galileo Galilei (1564–1642)
Astronomer
Built his own refracting telescope in 1609, that magnified objects 33 times.



Sir ISAAC NEWTON (1642-1727)

Isaac Newton (1642-1727)
Polymath, mathematician, physicist, astronomer (see page 9 for more information)



Johannes Kepler (1571–1630)
Mathematician & astronomer
Former assistant, to Tycho Brahe. Later
used Brahe's extensive observational data
to derive Kepler's laws of planetary motion.



Named after astronomer and polymath Edmund Halley (1656-1742), who first computed its orbit. Halley comet passes close to Earth every 76 years.



Alexander von Humboldt 14 Sep 1769 – 06 May 1859 Polymath and Author of Cosmos: A Sketch of a Physical Description of the Universe





Three pioneers, Kostantin Tsiolkovsky (tsarist Russia), Hermann Oberth (WW1 Germany) and Robert Goddard (US) carried out theoretical work on rocketry in the early 20th century. Only Goddard translated theory into experimentation, launching the first liquid-propelled rocket in 1926 (see page 5).



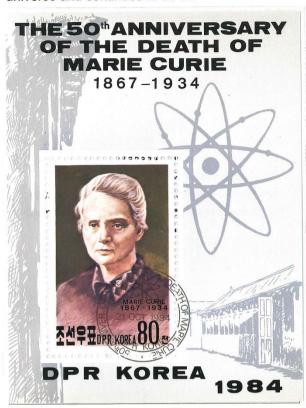
Jules Verne (1828-1905), Novelist and author of From the Earth to the Moon (1865) and & Around the Moon (1866)

3 SCIENCES & ENGINEERING

Space Exploration

Gradually, humanity uncovered the science that explains the basic workings of the solar system. From the start of the scientific revolution of the sixteenth century, the work of scientists did much to transform humanity's perspective on the world and the universe and continues to do so.

Albert Einstein, Physicist



Marie Curie, Physicist and Chemist, 2 Nobel prizes: Physics 1903 for research on Radiation Phenomena Chemistry 1911 for discovery of elements Radium and Polonium





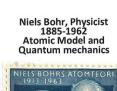
Henri Coanda inventor aerodynamics pioneer aircraft designer

Anton Davidoglu Mathematician

Spiru Haret Astronomer Mathematician



Meteorology Nimbus weather satellite

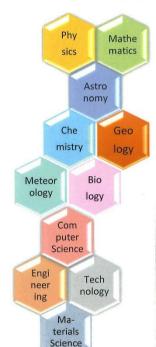


GRØNLAND

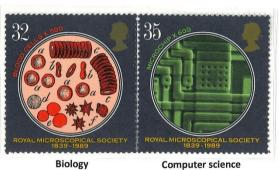


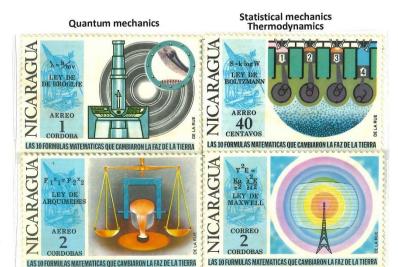
1879-1955











Fluid mechanics

Electromagnetism

4 THE UNIVERSE

Space Exploration

THE UNIVERSE – THE LOCAL GROUP – THE MILKYWAY - OUR SOLAR SYSTEM:

SUN - MERCURY - VENUS - EARTH - MARS - JUPITER - SATURN - URANUS - NEPTUNE - PLUTO (dwarf planet)



Earth is a globe of rock and metal, averaging 12,756 km (7,926 miles) across. It has water and air to breathe, and is the only known planet that can support life.

The Solar System













2.10

Earth is one of eight planets orbiting the Sun in our Solar System. The furthest planet, Neptune, is 4.5 billion km (2.8 billion miles) from the sun.

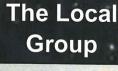
The Milky Way

It is hard to imagine that there are at least 4.3 billion km (2.7 billion miles) between Earth and Neptune.

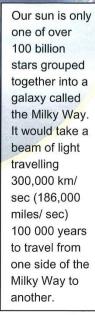
This distance however, is a fraction compared to the vastness of space. Earth seems just a speck in the open blackness of the Universe dotted with stars, galaxies, and dust. Breaking the Universe down to its parts is perhaps the easiest way to think about it.



The Local Group is just one cluster of galaxies. There are thought to be over 100 billion other galaxies in the universe.

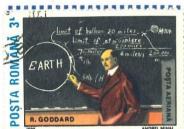


The Milky Way and around 54 other galaxies make up a cluster called the Local Group.
Light takes millions of years to travel across this region of space.



16 March 1926

Robert Goddard, 'Father of Modern Rocketry" launches the first liquidfuelled rocket.



20 June 1944

ROMÂNĂ

Launched by Nazi Germany towards the

end of World War II, a rocket-powered

missile known as V-2 becomes the first

human-made object to reach space.



31 January 1958

Explorer 1 was the first satellite launched by the US and was part of the US participation in the International Geophysical Year. The mission followed the first two satellites the previous year: the Soviet Union's Sputnik 1 & Sputnik 2, beginning the Cold War Space Race between the two nations.

04 October 1957

A Soviet Union R-7 rocket launches



03 November 1957

The first mammal in space, dog Laika is launched aboard Soviet Sputnik 2.



Sputnik 1, the first satellite, into space.



01 January 1959:

The Soviet Luna 1 becomes the first spacecraft to reach another world, the Moon.



NICARAGUA correos

14 September 1959 Luna 2 deliberately crashed into the Moon's surface, becoming the first human-made object to contact another celestial body.

14 September 1959 Luna 3 sends the first pictures of the far side of the Moon. Luna 2 and Luna 3 were the only probes to complete all of their mission objectives.

6 TIMELINE 1955-1965



01 April 1960 first US applications satellite launched.



12 August 1960

Project Echo was the first passive communications satellite. Each of the two US spacecrafts, launched in 1960 and 1964, were metalized balloon satellites acting as passive reflectors of microwave signals. The first transmissions using Echo were sent from Goldstone, California, to Holmdel, New Jersey, on 12 August 1960.

The last Echo satellite deorbited and burned up in the atmosphere on 7 June 1969.

.......................

02 April 1963

Lung 4, sometimes known in the West as Sputnik 26, was a Soviet spacecraft launched as part of the Luna program to attempt the first soft landing on the Moon. Following a successful launch, the spacecraft failed to perform a course correction, thus missing the Moon, remaining instead in Earth orbit.

Space Exploration



16 June 1963

Valentina Tereshkova on the Soviet Vostok 6 becomes the first woman in space.



26 July 1963

first satellite to operate in geostationary orbit.



1965-1/3



1965-2/3

1960

......

NICARAGUA aéreo



20 February 1947

in a captured V-2 rocket, fruit flies

become the first living creatures in

space (page 15).

Launched by the US

Vostok 2 becomes first person to spend a whole day in space and film Earth from his spacecraft.



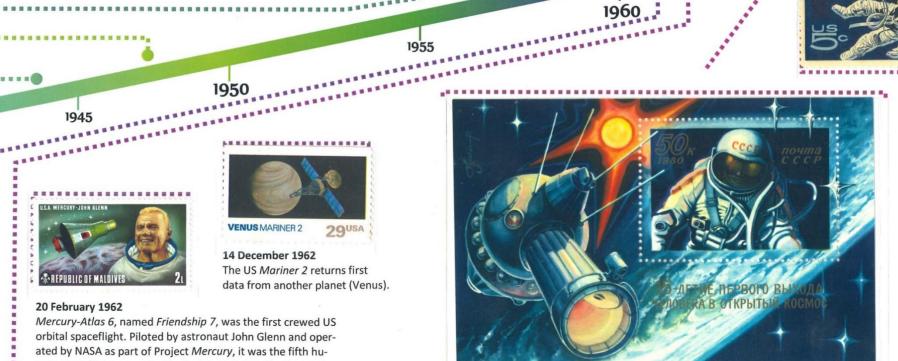
VENUS MARINER 2 29USA

14 December 1962

The US Mariner 2 returns first data from another planet (Venus).

20 February 1962

Mercury-Atlas 6, named Friendship 7, was the first crewed US orbital spaceflight. Piloted by astronaut John Glenn and operated by NASA as part of Project Mercury, it was the fifth human spaceflight, preceded by Soviet orbital flights Vostok 1 and 2 and US sub-orbital flights Mercury-Redstone 3 and 4.



23 March 1965 个

Project Gemini was the second US human spaceflight program, after Project Mercury, while the Apollo program was still in development. Gemini ran from 1961 to 1966. The Gemini spacecraft carried a two-astronaut crew. Ten Gemini crews and 16 individual astronauts flew low Earth orbit (LEO) missions during 1965 and 1966.

18 March 1965

First human spacewalk – Soviet cosmonaut Aleksey Leonov on Voskhod 2.



12 April 1961 - Soviet Cosmonaut Yuri Gagarin becomes the first human to orbit Earth.

7 **TIMELINE** 1965-1980



NASA's Surveyor program sent seven robotic spacecrafts to the surface of the Moon to demonstrate the feasibility of soft landings on the Moon.



31 March 1966

lunar orbits, performing 219 active data transmissions before radio signals were finished on 30 May 1966.

On 24 Sep 1970, Luna 16 provided the unmanned spacecraft.



20 July 1969

US astronaut Neil Armstrong on Apollo 11 becomes the first human to walk on the Moon.



8 TIMELINE 1980-1997

24 Jan 1986

1980

US Voyager 2 - fly-by of Saturn

space shuttle Columbia is the first

reusable spacecraft launched and

25 Aug 1981

SATURN VOYAGER 2

12-14 April 1981

returned from space.

Voyager 2 - first spacecraft to fly by Uranus.



06 March 1986

Vega makes its closest approach to Halley's Comet as the first spacecraft to make a flyby of a comet nucleus.

1985





1990

07 Dec 1995

The US Galileo becomes the first spacecraft to orbit Jupiter.

1995



return

Mars.

POSTA ROMANA

1965-3/3

SAMOA I SISIFO

.......

pictures of

14 July 1965 **US Mariner 4** is the first spacecraft to

The Soviet Luna 10 operated for 460

On 03 Feb 1966, Luna 9 was the first spacecraft to soft-land on the Moon. first return of lunar samples by an



29 March 1974

1970

The US Mariner 10 is the first spacecraft to reach Mercury, performing a flyby.



20 July 1976

1975

First pictures are transmitted from the surface of Mars by the US Viking 1.



The Soviet Phobos 1 was a small Mars orbiter, named



25 April 1990

Hubble Space Telescope becomes the first large optical space telescope.



25 Aug 1989





spacecraft to fly by Neptune



US Voyager 2 is the first



07 July 1988

after and intended to land on the Mars moon of the same name. It was lost in August 1988 en route to Mars.



21 August 1965

.JU/

21 December 1968

Apollo 8 – US crew

Frank Borman, James

Lovell, and William An-

ders were the first hu-

mans to orbit the

ture "Earthrise".

16 November 1965

Venera 3 was a Soviet space

probe that was to explore the surface of Venus. The entry probe crashed on Venus on 01 March 1966, making it the first space probe to hit the surface of another planet. On 15 Dec 1970, Venera 7 performed the first soft landing on another planet (Venus).

Moon. This mission

shot the famous pic-

Gemini 5 was the 3rd crewed Project Gemini flight, the 11th crewed US spaceflight, and the 19th human spaceflight of all time.



27 November 1971

on Mars.

The Soviet Marte-2 crash lands into Mars, as the first spacecraft

to reach the planet's surface.

02 Dec 1971: Marte-3 becomes

the first spacecraft to soft-land

Marte-1 had launched almost a

decade earlier, on 01 Nov 1962,

neer 11 would fly by Saturn on 01 Sep 1979.

The US Pioneer 10 becomes

the first spacecraft to fly by

Jupiter. Its twin probe Pio-

The US launch their first space

14 May 1973

station: Skylab

03 December 1973



PIONEER * JUPITER

First international dock-



The USSR launch the first space station: the Salyut 1.



19 April 1971



17 July 1975

ing in space between the US Apollo and the Soviet Soyuz spacecraft during Apollo-Soyuz Test Project.





04 July 1997 The US robotic spacecraft rover Sojourner touches down on Mars.

9 MILESTONES - SPUTNIK

Space Exploration

The launch of the first artificial satellite, *Sputnik 1*, by the Soviet Union on 04 October 1957, marked the beginning of the space age. *Sputnik 1* was a metal sphere the size of a beach ball with four antennae, weighing about 83kg (183pounds). It carried a radio transponder that enabled tracking by long-wave radio equipment while it was in orbit. Its radio signal broadcast a set of beeps at 20-40MHz and it ensured that no one could claim that the satellite launch was a hoax.







Sergei Korolev (1907-1966) Chief designer of the Soviet Space Program



temporary or permanent orbit around Earth. The idea of an artificial satellite in orbital flight was first suggested by **Sir Isaac Newton**, who, some 300 years ago, defined the physical laws governing motion.

An Earth satellite is an artificial object launched into a

In his book Philosophiae Naturalis Principia Mathematica (1687), he pointed out that a cannonball shot at a sufficient velocity from atop a mountain in a direction parallel to the horizon would go all the way around Earth before falling.

Although the object would tend to fall toward Earth's surface because of gravitational force, its momentum would cause it to descend along a curved path.

Greater velocity would put it into a stable orbit, like that of the Moon, or direct it away from Earth altogether.



↑ USSR 1967, 10th anniversary of the first artificial satellite

R-7 ROCKET TECHNOLOGY

Based on the *V-2* rocket technology developed by the Nazis, the *R-7 rocket* was the brainchild of Soviet Chief Rocket designer, Sergei Korolev.

Instead of being **stacked** in stages, the *R*-7 used a cluster of rocket stages grouped around a central core.

Operational between 1957 and 1968, the *R*-7 fired *Sputnik 1* into space and was used as the model for the later *Soyuz* family of launchers, which became the most widely used rocket in the world.



USSR 1982, 25th anniversary of the first artificial satellite:

Sputnik 1 (with R-7 rocket) →

10 FIRST HUMAN IN SPACE

Space Exploration

April 12, 1961, marked another great milestone in the space race, when Soviet cosmonaut Yuri Gagarin became the first human to reach orbit. He was propelled into the history books by a specially adapted *R-7* rocket carrying the 5,400 pounds (2,460kg) spherical *Vostok 1* capsule and its 5000 pounds (2270kg) conical equipment module.

R-7 ROCKET

The world's first intercontinental ballistic missile, the *R*-7 rocket had previously launched the Sputnik satellites before being used for the *Vostok* missions.



Vostok SPACECRAFT

Vostok 1 was made up of two parts:
a descent module and an instrument module.
The descent module contained Gagarin's ejector seat, control panel and the retro rockets that would slow Vostok 1 down for reentry. Although Vostok 1 had a control panel, the space craft was fully automated.





"Orbiting Earth in the spaceship, I saw how beautiful our planet is. People, let us preserve and increase this beauty, not destroy it!"

YURI GAGARIN (1934-1968), SOVIET COS-MONAUT AND FIRST HUMAN IN SPACE



Vostok PLAN

Vostok 1 was a small capsule launched atop a three-stage R-7 rocket designed to take Yuri Gagarin into space.

After one orbit around Earth, Vostok 1 would parachute down 108 minutes later.



06:17
THE FINAL ROCKET STAGE BURNS THROUGH ITS FUEL
AND SEPARATES FROM THE VOSTOK 1 SPACECRAFT,
NOW IN ORBIT 320 KM (200 MILES) ABOVE EARTH.

06:12 THE CORE ROCKET STAGE FINISHES ITS FUEL AND FALLS AWAY AS THE FINAL ROCKET STAGE FIRES UP. 07:23

VOSTOK 1 'S RETRO ROCKETS
FIRE TO SLOW THE SPACECRAFT DOWN FOR RE-ENTRY
INTO EARTH'S ATMOSPHERE.

07:25
AN EXPLOSIVE CHARGE TO SEPARATE
VOSTOK 1 'S INSTRUMENT MODULE
FROM ITS DESCENT MODULE FAILS.
THE SPACECRAFT GOES INTO A SPIN.

06:10 THE SHELL COVERING VOSTOK 1 AT THE FRONT OF THE R-7 FALLS AWAY. GAGARIN CAN NOW SEE EARTH BELOW.



BLAST-OFF AT 06:07 (MOSCOW TIME), VOSTOK 1 LAUNCHES FROM THE BAIKONUR COSMODROME.



07:25
AN EXPLOSIVE
CHARGE TO SEPARATE
VOSTOK 1 'S INSTRUMENT MODULE FROM
ITS DESCENT MODULE
FAILS. THE SPACECRAFT GOES INTO A
SPIN.

07:35 WIRES HOLDING THE INSTRUMENT MODULE FROM ITS DESCENT MODULE BURN AWAY.

07:55 GAGARIN EJECTS AND HE AND VOSTOK 1 PARACHUTE TO EARTH SEPARATELY.

> 08:05 GAGARIN LANDS IN A FIELD.

11 FIRST HUMAN ON THE MOON

Space Exploration

Apollo 11 – Crew: astronauts Neil Armstrong (1930-2012), Buzz Aldrin (1930) and Michael Collins (1930-2021). On 16 July 1969, the *Apollo 11* Moon mission launched from the Kennedy Space Centre, Florida for a three-day trip to the moon, propelled by the *Saturn V* rocket. On 20 July, astronaut Neil Armstrong took manual control in search for a suitable landing spot, with just seconds of fuel left. Over half a billion people watched the Moon landing on television when Armstrong announced: "Contact light. Houston, Tranquillity Base here. The Eagle has landed."

The *Apollo* space programme lasted from 1961 to 1972 during which time there were several named missions. *Apollo* missions 1 - 10 were test missions (2 & 3 were assigned numbers, but never took place). *Apollo* 12 was another successful Moon mission, but disaster struck with *Apollo* 13. Fifty-six hours into the voyage, one of the oxygen tanks blew up and the other failed. Mission control suggested the *Apollo* 13 astronauts seal themselves in the lunar module to preserve power and oxygen. This saved their lives. *Apollo* 13 returned safely to Earth, after a daring slingshot manoeuvre around the moon.



"One small step for a man – one giant leap for mankind"

NEIL ARMSTRONG, FIRST HUMAN BEING TO SET FOOT ON THE MOON'S SURFACE



In a speech to the US congress on 25 May 1961, American President John F. Kennedy announced that his country would land an astronaut on the moon by the end of the decade.

Apollo 8, 10 and 13 orbited the moon, but did not land. Pairs of Astronauts from Apollo 11, 12, 14, 15, 16, and 17 each spent time on its surface.

The Auckland Star

wrote:

Moonday, July 21, 1969

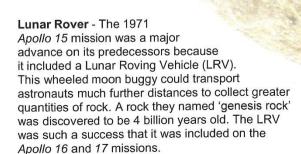
> MAN'S WALK ON THE MOON











Over and Out – Landing on 11 December 1972, Apollo 17 was the last manned mission to the moon. It included the first astronaut-scientist, Harrison Schmitt, who set up experiments to measure possible earthquake activity and explore some of the Moon's meteor strikes.

12 HUBBLE SPACE TELESCOPE

Space Exploration

Traditional space telescopes were placed in high locations on Earth to avoid light pollution, but with the arrival of space exploration, telescopes could be launched into space. Here, above the atmosphere, they have a clear, unobstructed view of the Universe.



Hale Telescope Palomar Mountain, NE of San Diego, USA



Cerro Tololo Inter-American Observatory (CTIO) Cerro Tololo Mountain, Coquimbo Region N-Chile



Hubble Space Telescope

 Length
 13.2m (43 ft, 3")

 Width
 4.2m (13 ft, 9")

 Weight
 11,110 kg (24,490 lbs)

 Power Source
 Solar (2,800 watts)

 End of mission
 on-going ↓



Total Eclipse – 11 August 1999 Commemoration miniature sheet. Image of Saturn from the Hubble Space Telescope







HUBBLE DISCOVERIES

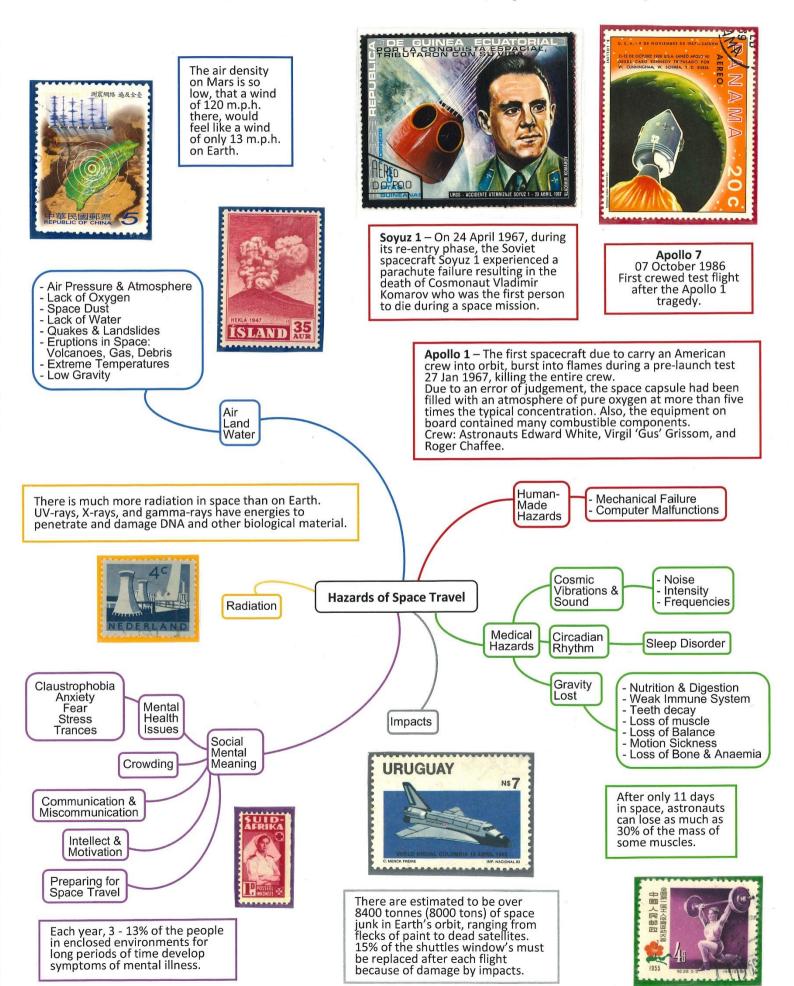
On 24 April 1990 Space Shuttle **Discovery STS-31** delivered the **Hubble Space Telescope (HST)** into orbit around 600km (372 miles) above Earth.

Hubble's discoveries have revolutionized the way we see the cosmos. Its photos have included new stars, dying stars and even exploding stars (supernovas). One image revealed 1500 new galaxies in a never-before-seen corner of the Universe. Hubble's observations have helped scientists understand the

Universe in exciting new ways.

13 HAZARDS OF SPACE TRAVEL

Space Exploration



14 SATELLITES

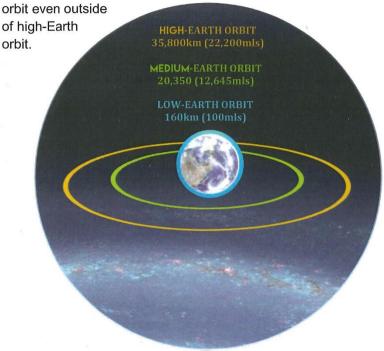
Space Exploration

Since the 1957 launch of the first artificial satellite, Sputnik 1, around 9000 satellites have been put into orbit. These satellites have provided valuable data about our universe, and help people on Earth communicate, navigate, and observe the environment.

DIFFERENT ORBITS

Satellites can orbit Earth at different distances. The closer a satellite is to Earth, the faster it will complete

its orbit. Some satellites





COMMUNICATIONS SATELLITES

give people on Earth 24-hour access to information and each other. Satellites do this by picking up television, radio, telephone, and internet signals from one place and beaming them back to different places on Earth.



US Communications satellites



Global Year of Communications 1983



Monitoring of radiation in space and atmospheric conditions



Detection of cosmic rays and

Weather and Earth observation



Eutelsat 1 Communications satellite

Military and reconnaissance



SPY SATELLITES

Reconnaissance satellites are used by governments and the military to spy on other countries. They are top secret, so the exact number of them in orbit around Earth is unknown.



elementary particles

WEATHER & ENVIRONMENTAL SATELLITES

monitor conditions on Earth's surface and report the information to stations on the ground. Weather satellite data includes everything from cloud cover and air temperature to wind speed and wave height. Environmental satellites provide a view of changes, such as shrinking ice fields and reductions of lakes and rivers.



NAVIGATION SATELLITES

Several satellites working together, such as the ones that make up the US-operated Global Positioning System (GPS), can help people on Earth navigate by sending signals to a receiver, such as a smartphone. By calculating the time, it takes for signals from at least four satellites to reach it, the receiver can work out its distance from each one and, from that, its exact location on Earth.

15 SPACE CREATURES

Space Exploration

When it comes to space travel, humanity owes a huge debt to fellow Earth inhabitants: animals. Without their sacrifices, it would not have been possible to send humans into orbit. Animals are the true pioneers of early space travel, and the mostly unsung heroes of many tests and flight missions. This is a tribute to them. We salute you:

In 1947, the US sent fruit flies on a sub-orbital flight. This meant they reached space by crossing the boundary known as the Kàrmàn line 100km (62 miles) above sea level, but did not complete an orbit.



In 1948, a rhesus monkey called Albert was launched aboard a US V-2 Blossom rocket but did not survive he flight. It took until 1959 for two female monkeys – Miss Able and Miss Baker – to return safely from their US mission. Miss Baker lived for another 25 years.



During the 1950s, the US launched several mice and monkeys.





32 - Total number of monkeys to have flown to space.

In 1961, the US staged a final dress rehearsal for its first human flight when it launched Ham the chimpanzee on a suborbital flight for 15 minutes. During the flight Ham experienced over six minutes of near weightlessness. Despite onboard cameras recording some distress during take-off and landing, Ham was able to perform the tasks he had been trained for before the flight and the mission was a success. Ham returned safely and lived until 1983.

In 1960, Russian dogs Belka and Strelka were successfully launched into space along with a rabbit, two rats and 42 mice. All animals survived and returned to Earth as global celebrities. The Russians had sent dogs to space as early as 1951.







In 1957, stray dog Laika was picked for the Russian Sputnik2 mission because of her calm nature. Laika survived the launch, but after 103 minutes the spacecraft's heat shield malfunctioned and the temperature on board rocketed. Laika probably died from a combination of heat and stress.



22 - Number of days that Russian dogs Vetrok and Ugolyok orbited Earth in 1966. This is still the longest canine space flight.







In 1973, two spiders named Anita and Arabella were sent on a mission aboard the space station Skylab in 1973. They were recorded trying to spin webs in space. They both struggled with the task initially, but after adapting to the microgravity conditions, they learned to weave a perfect web once more.







16 INTERNATIONAL COLLABORATIONS

Space Exploration

In the years following the moon landings, the first two nations to journey into space, the Soviet Union and the USA, undertook a range of new and ever more ambitious missions to travel farther outside the Earth's orbit to study the Sun and Venus. Other nations eagerly followed their path of space exploration into orbit and beyond. A significant number of the countries took their first tentative steps towards space exploration in cooperative projects with the established space powers.

Often, the choice of which of the two superpowers these other nations turned to first reflected their allegiances in the wider Cold War. America's allies in Europe and elsewhere mainly entered into cooperative agreements with NASA. These collaborations typically resulted in satellite launches.



Meanwhile, nations that looked more toward the Soviet Union enlisted its aid for access to rocket technology and seats for its citizens on various Soviet space missions.



A-1 Asterix satellite – France 26 November 1965







By 1983, the Soviet Interkosmos space agency's international collaborations included: Czechoslovakia, Poland, German Democratic Republic, Bulgaria, Hungary, Vietnam, Cuba, Mongolia, Romania, France, and the USA. ↓

San Marco-2 satellite – Italy 24 April 1967



UK-3 satellite 05 May 1967



The mid-1970s saw a period of improved relations between the US and Soviet Union and a notable example of this was the **Apollo-Soyuz Test Project** that took place in July 1975, which was primarily a diplomatic mission. It was the first international human spaceflight mission to test compatibility of rendezvous and docking systems for American and Soviet spacecraft, in the hope that developing such a capability might open the way for future joint missions.

After docking between the US *Apollo* and the Soviet *Soyuz* spacecraft, the two crew, consisting of Americans Thomas Stafford, Vance Brand and Donald Slayton, and Soviets Alexei Leonov and Valeri Kubasov, were able to swap gifts and conduct experiments. $\checkmark \downarrow \downarrow \searrow$









