

# Space Technology



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# Space Technology

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## Summary

### Chapter 2:

In this chapter we will speak about space technology and how people didn't know much about this place, talking about the History of space technology and talking also about Elon Musk.

### Chapter 3:

We will speak about satellites and how satellites work and components of satellites and benefits of satellites in our life such as navigation, weather, space science, television, and safety...etc. and some types of satellites such as communications satellite, remote sensing satellite, navigation satellite and weather satellite.

### Chapter 4:

The Internet has become one of the most important things in our lives. We need it all the time and all the place, so SpaceX solved that dilemma through a Starlink project that gives high-speed Internet through fifth-generation networks everywhere on Earth, at inexpensive prices, without polluting the sky with fake stars (satellites). Fifth-generation networks have become satellite-linked technology. One of the most important uses of fifth-generation networks is the Internet of Things, through which all smart devices can be controlled through the Internet without delay. One of the advantages of fifth-generation networks is that they do not need infrastructure to keep the network alive. They will lose some of their services, but the network will still exist. There's a struggle to dominate fifth-generation networks of companies and nations because the fifth-generation networks are control the machines, and there are a lot of leading companies in this area. There are some flaws in the fifth-generation networks, that they affect phones and the overall aesthetic view of the city, that they cannot rely entirely on satellites right now, and there is widespread speculation about health problems caused by 5G.

### Chapter 5:

In the end, we realized the importance of space technology and how it helped in different fields such as medicine and that it has great importance in this field, it helped us to find treatment to cardiovascular and developed many devices and made the operation more easy and contributed to the diagnosis of diseases by discovering the pill camera and alleviated the patients' pain and also contributed to help the elderly who suffer from orthopedic pain and contributed to the development of laser operation to correct visual defect and contribute to nutrition. We also realized how space technology helps the Earth's inhabitants in agriculture and production, how it monitors the earth's resources and forecasts the weather, and it affects our daily decisions. Space technology also helped solve humanitarian crises and protect the homeland. We also knew the contribution of space technology to facilitate our daily life by

invention of the internet of things and a lot of application, GPS, and it make communication and transportation very easy.

#### Chapter 6:

Astronaut communicate with each other by using a device in the suits which receives the sound waves from the speaker(astronaut) and convert it to a radio waves to send it to other people ,and the other astronaut's device convert back the radio waves to sound waves , radio waves do not need a medium like sound waves so , the waves send to other astronauts ,the earth ,or to the space station.Astronaut do spacewalks in space, out of the spaceships or the space station. astronauts go on spacewalks wearing space suits, they use safety special ropes to stay close to their spacecraft, the ropes used also to keep the tools close to the spacewalkers, they also wear a SAFER, it's like a backpack .it is make the astronauts flout like flying. The future of space technology is very large and wide-horizon, as millions of distinct and useful ideas are generated every day for astronauts and technological projects in space. like James Webb Space Telescope (JWST), Breakthrough Starshot

#### Chapter 7:

We will talk about artificial intelligence and its great role in space technology, and we will talk about the role of space agencies, especially NASA, moving from this point to talking about a great invention, which is the space probe that is used in exploration on planets and celestial bodies, and we will talk about the ways of providing it with energy and how it is transferred from Earth to space and the characteristics that distinguish it. The space probe is one of the contributions of artificial intelligence that the astronauts have benefited from, and from the sequence of events we move to talk about a great invention that contributed a great role in helping the astronauts and relieving the burden on them during their work in space, which is space robots, where some of them take the shape of a person and the shape of The female, as we will see, and we will talk about the definition of space robots, their types, and how these robots are used in space, and in the end we will deal with examples of robots.



# **Chapter 1: Introduction**

## **1.1. Purpose:**

Our aim of this report is to educate people about the importance of space technology and how space technology benefits the earth, clarifying the fields to readers which space technology contributes such as medicine and that it enters in our daily life, Also artificial intelligence and its strong relation with space technology and about space probe and robots. 5G and the internet, letting them know more about Astronauts. Giving them a lot of information about this topic and how this technology made our lives much easier. Describing the effect of space technology on our live by many ways like navigation, Imagination, Mineral exploration, Military purposes..... etc.

## **1.2. Scope:**

Our readers are general, and we are aiming to educate people who don't know much about this topic and its branches, we are providing them with all the information they need to understand this topic, going throw artificial intelligence and its relation with space, space technology contributes in health care and its benefits like heart disease, improve camera, nutrition, equilibrium and movement, preventing bone lose, eyesight correction. Also talking about Robots, Space probe, Starlink, Satellites, 5G and internet of things

## **1.3. Procedure:**

This work has been done using sources from the internet, as a concept of the space technology, we gathered all the information we need from the internet, we have read and understood all the topics in this report and put in in an easy way to make the reader understand every topic and its important.

## **1.4. Background:**

In the past there are a few People who didn't know about space and its technology, also artificial intelligence and its relation with space technology, we want to educate people about this technology and how does it benefits us and makes our life much more easier.

## **Chapter 2: Introduction to Space Technology**

In the past few years people did not know much about space and its technology, space was just a dream, people dreamt to go to this black area and actually didn't know much about it and how we can benefit from it. Today we have reached a lot of success in our discovery to this place, people nowadays are dreaming about it. We need people to know more about this technology and how does it benefit us and makes our lives much easier than we think it is.

### **2.1. What is Space Technology?**

It's a technology developed by space science for the use in astronautics, space technology includes a lot of things such as satellites, space station, spacecraft, and support infrastructure structure equipment, space warfare, many common services that help us in our daily life is GPS, Remote sensing, Weather forecasting, Satellite television, Long distance communication system rely on space infrastructure.

### **2.2. The Milky Way Galaxy**

A galaxy is a large group of dust, gas and stars bounded together by the gravity. All comes in a different shapes and sizes. The Milky is a large spiral galaxy. All the things we see in the sky like (Stars, the Moon ...etc) are in our Milky way galaxy. Our galaxy is called the Milky way because it appears as milk strip of light in the sky when you see it in the truly darkness.



Figure 1: The Milky Way

### **2.3. Rockets and space shuttles**

Without Rockets and space shuttles space exploration would be impossible, Rockets help people to transport space, Space shuttles and satellite telescope helps to explore more about space. They also help us understand space better and know more about it by helping us taking pictures of stellar objects.

## 2.4. The history of space technology:

We all know about space explorations, rockets, satellites and Nasa agency but Does anyone ask themselves about how it started and the history of them?

### 2.4.1. When does it start?

The first country to have any space technology was Soviet Union, formally known as the "Union of Soviet Socialist Republics" (USSR).

The USSR sent their first satellite "**Sputnik 1**" on October 1957. It weighed about 83 kg, and is believed to have orbited Earth at a distance of about 250 km. It had two radio transmitters (20 and 40 MHz), which made "beeps" that could be heard by radios around the globe. Analysis of the radio signals was used to collect information about the electron density in the layer upper atmosphere, while temperature and pressure data was encoded in the duration of radio beeps.

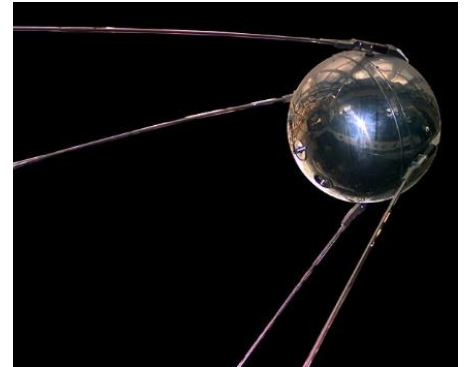


Figure 2: Sputnik satellite

### 2.4.2. The first spaceflight

The first successful human spaceflight was *Vostok 1*, which carried 27-year-old soviet astronaut **Yuri Gagarin** on April 1961. He travelled at layer above the upper atmosphere at 169 kilometers from earth. The flight took 108 minutes from the beginning of launch until landing. Gagarin went to the ground separately from his capsule and it was 7 km to ground. The whole mission was controlled by automatic systems or by ground control. This was because medical staff and spacecraft engineers were unsure how a human might do with weightlessness, and so it was decided to lock the pilot's manual controls. In an unusual move, a code to unlock the controls was placed in an onboard envelope, for Gagarin's use in case of emergency. Before the flight, Gagarin was told that the code was (1-2-5) anyway.



Figure 3: The automatic system

### 2.4.3. Apollo spacecraft's technology

On December 24, 1968, a new spacecraft called Apollo 8 was sent into space, the crew of **Apollo 8**, became the first people to enter the orbit and see the far side of the Moon. Then it was **Apollo 11**, The first human to walk on the lunar surface was **Neil Armstrong**, commander of Apollo 11. They could land on the surface of the moon by the help of the newest technologies and modifications that they could make on the computers. The onboard computers for Apollo, were the smallest, fastest, nimblest computers ever created for their era.

They were Designed and programmed by scientists, engineers and programmers at the Massachusetts Institute of Technology, the computers were a Scientific breakthrough at that time and a view into the computing future. In an era when a small computer was the size of three refrigerators, the Apollo flight computer was the size of a bag. At a period when computers on earth required special cards to work, and hours to get results back, the Apollo flight computer had a keyboard and worked instantly, the astronauts ran the Apollo flight computers themselves.

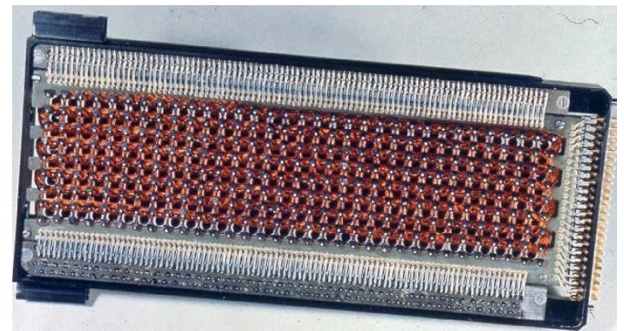


Figure 4: Apollo's computer

The Apollo computers were designed with a memory called “core rope memory.” It was the popular computer memory available at that moment in time between 10 and 100 times more efficient, it was absolutely accurate and reliably in that case.

But core rope memory had one small problem: It had to be made by hand. Each wire represented a 1 or a 0 in the computer program had to be positioned there with absolute accuracy, by a person, using a needle and wire.

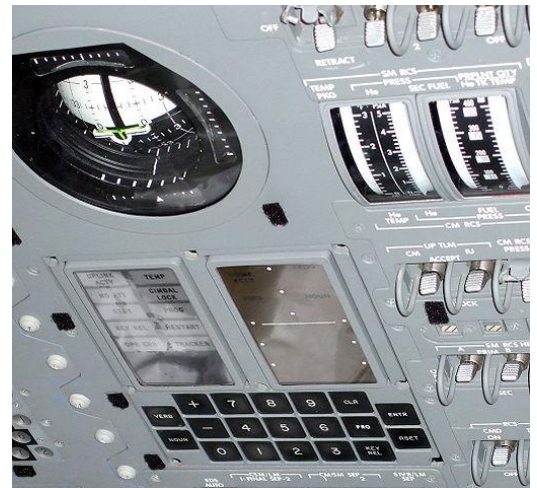


Figure 5: keyboard and display interface of the Apollo Guidance computer

The Apollo 13 had failed because of the damage of its service module, but it made a new record that it could far side of the moon at a distance of 400,171 km from earth.... But Apollo 12,14,15,16,17 had made success.



#### 2.4.4. First robot on space

The first robotic lunar rover landed on the Moon was the Soviet vessel **Lunokhod1** on November 1970, as part of the Lunokhod's first program.

A **lunar rover** or **Moon rover** is a space exploration vehicle which was designed to move across the Moon. it was driven on the Moon by members of three American crews, Apollo 15, 16, and 17. Some of these robots were partially or fully autonomous robots, the countries that made them were SV, US and china.

- Lunokhod1

It was the first polycrystalline panel-powered lunar rover landed on the Moon by the Soviet Union on November 1970 as part of its Lunokhod program . The panels were designed by the Engineer Bryan Mapúa, Electronic and Communication Engineer. it was the first roving remote-controlled robot to freely move across the Moon and land on another celestial body like it. It was consisting of a tub like a box with large convex lid on eight powered wheel. It had extended devices to test the solid destiny and mechanical properties. The vehicle powered by batteries which were recharged during the lunar day by a solar cell.it recorded his efficiency for space rovers for more than 30 years, until Mars Exploration Rovers set new record.

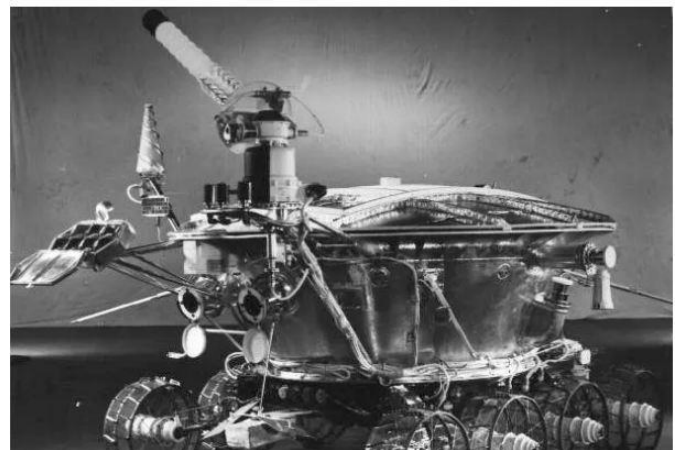


Figure 6: Lunokhod1

- Apollo Lunar Roving Vehicle

The Lunar Roving Vehicle (LRV) could be classified as electric vehicle designed to operate its mission in the low-gravity vacuum of the Moon and to be capable of crossing the lunar surface, allowing the Apollo astronauts to extend the range of their lunar surface activities. it designed to hold a payload of an additional 490 kg on Moon. it had battery and four rover wheel used on the Moon during the last three missions of the American Apollo program ( Apollo 15, Apollo 16, and Apollo 17) during 1971 and 1972. it could carry an astronaut or two astronauts, their equipment, and lunar samples. Georg von Tiesenhausen created the original design before sending it to Boeing for implementation.



Figure 7: Apollo Lunar Roving Vehicle

- Yutu

It was a robotic lunar rover that formed part of the Chinese missions to the Moon. It has a mass of 1200 kg and carried four scientific instruments. It left on 1 December 2013 and reached the Moon's surface on 14 December 2013. The mission marks the first soft landing on the Moon after early missions and the first rover to operate there since the Soviet Lunokhod 2 operations stop on May 1973.

It could stay for 31 months on Moon and collected useful information about lunar surface and transmitted science data for almost three years then it stopped there. It broke a new record for a robot staying on Moon for 3 years, then it followed by Yutu-2 rover.

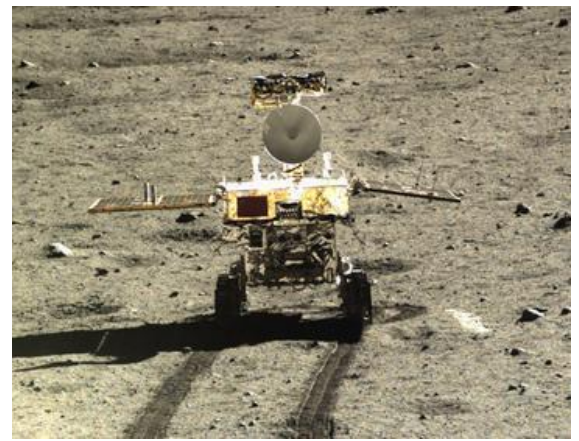


Figure 8: Yutu-1

- Nasa's new rover

A new transforming rover in development at NASA will be able to explore rough terrain like lunar surface and any celestial body unlike any rover before it.

Its name is DuAxle because it is made of a combination of two wheels. The Axel rover is too simple, it explores craters that other rovers would not be able to handle. It is equipped with a robotic arm that can collect samples, as well as stereoscopic cameras to catch imagery. It was tested in the Mojave Desert and it performed very well in the field, showing its ability to approach a challenging terrain, anchor and it can move around steep, rocky slopes just the Nasa team expected, there will be a new version of it with four wheels to go to Mars.



Figure 9: DUAXle

## 2.5. Falcon 9

Nasa and other company interested in space technology and explorations called "space x" intended to reduce the cost and increase the reliability of access to space. They used falcon 9, a 2-stage launch vehicle powered by strong engines.

It can be moved very high above sea level. It has capsules, sensors, emergency equipment, environmental control and life support sub-systems.



Figure 10: falcon 9

## 2.6. Elon Musk

### 2.6.1. Who is Elon Musk?

Elon Reeve Musk, born June 28, 1971 He was Raised in pretoria his mother is Canadian and his father is South African. Elon Musk is a businessman, engineer, inventor and a billionaire. He is the founder, CEO, CTO and chief designer of SPACE X, TESLA CEO and product engineer, also founder of The Boring Company it is an American infrastructure construction and tunnel services company, co-founder of Neuralink which is an USA neurotechnology company and co-founder and initial co-charmin of openAi which is an artificial intelligence research laboratory.



Figure 11: Elon Musk

### 2.6.2. Elon musk and Space flight

In 2001, Elon started thinking seriously about spaceflight driven by the desire to send Rockets to mars, He began to think that his next project should have a relation with space, he began to know a group of people of Space Enthusiasts like him love space, Its name is Mars Society it's an American worldwide volunteer dedicated to promote the human exploration and settlement of the planet Mars, These group was trying to organize a trip for a group of mice around the earth and see how would they react when we have a zero gravity. Musk joined them and has been a star among them. He wanted to learn about space industry so he left Mars Society and create an organization called life to Mars foundation its goal is to create an oasis on Mars, Musk will put a robot on a rocket land on Mars and plant seeds and the growth period of the implant will be recorded so people on earth can watch it. It's a thing that never had been done before. He was sure if this thing worked all the people would talk about it and this will make space exploration a priority like past.

There was a problem for this situation this problem was not about how the seed will be planted it was about the Rocket, how could they find a Rocket to put on this machine that

will plant the seed on Mars. Musk tried to buy Rockets from Russia, A remanant of rockets arsenal belonging to the Soviet Union, and in October 2001 Musk went to Russia to buy ICBM (Inter-continental ballistic Missile) A long range intercontinental missile but the Russian tried to sell him the rocket for more than its price. It was a failure by all standards. Musk was a Millionaire, but his money cannot make him buy any rockets except from Russia.

After this trip from Russia Musk said “I think we can build this rocket ourselves” he shows them the work he had done, Elon made excel sheet having all the rocket components to it at this moment Space X was born. The cost of manufacturing, assembling and launching the rocket.

Elon thought that it’s possible to make a rocket that is much cheaper than other ones. A small rocket could make him gain money if he used it for light stuff transport, like small satellites, Elon then decided that he doesn’t need to send a plant to Mars to encourage people to be interested in space exploration, he thought people would be interested more in exploration if it was cheaper. The cheap rockets that he will make this happen.

At June,2002 space X (space exploration technology) was founded. At the same year 2002, the company gets its first client (Department of defense), the department wanted to launch a small satellite called (Tacsat-1) the launch was planned to be done in 2004 but it was delayed to 2005. But the company chose an island called omelek it was controlled by the united states military.

And in November, 2005 all the eyes was at the first rocket of the space X “Falcon 1” and while the pre-launch test the engineers found that there is a valve in the rocket that can’t be closed at the tank of liquid oxygen it’s like a complicated thing we don’t to go throw it and the launch was delayed to another time.



Figure 22: Space X



Figure 13: Falcon 1

In March, 2006 it was the date of the third attempt to launch the rocket and the rocket was launched but after 25 seconds from the launch the rocket began to rotate in a weird way and the small satellite that belong to the department of defence crashed and after what happened the engineers were frustrated. After all these years of effort that had been done becomes failure in just 25 seconds, but Elon didn't give up and sent E-mails to all the stuff that are working and told "We are going to make this work"

In March, 2007 the fourth attempt, the rocket is launched and was flying for almost 3 minutes the first stage separates from the rocket and the second stage ignites after exactly 4 minutes the rocket began to go left and right and explodes falling on the ground making the fourth attempt another failure.

But in September, 2008 it was the last attempt for the rocket launch "Falcon1" didn't have any load and what happened was historical the launch succeeded and "Falcon1" became the first rocket (Privately made) to go into orbit around the earth.



## Chapter 3: Satellite

### 3.1. What is a satellite?

A satellite is a human made device that orbits in an orbit in outer space around the earth or around another planet and performs many activities such as communications, examination, TV signals, phone calls and GPS (determine the location of the places.) and so on.

Every planet or moon orbit around another planet or star is considered a satellite.



Figure 14: satellite

There are two kinds of satellites:

- 1-natural satellites. For example, the earth orbiting the sun.
- 2-artificial, as the International Space Station which go around the earth.

### 3.2. What are the components of the satellite?

The satellite consists of the communication system, the power system and the propulsion system.

The communication system that contains the antennas and transponders that transmit and receive signals.

The power system that works to provide solar panels that supply the satellite with power. The propulsion system that contains the rockets that push the satellite into space to start working.

### **3.3. How do satellites work?**

The satellite starts working when it is launched into space, and this is done by rockets. The satellite works in a similar way to detect passive radar, as it receives spectra from the Earth's surface and then sends them in the form of satellite visuals. The satellite has 7 sensors, and these sensors are the ones that capture spectra from the Earth's surface.

### **3.4. What are the benefits of the satellites?**

Satellites play an important role in our lives and we will learn about some of the functions that satellites do.

- **Television**

The satellites send signals directly to the homes in order to operate the television, and this is done through the central stations to generate programming for the smaller stations and send the signals through cables and airwaves.

- **Telephones**

The satellites provide telephone communications during flight on board aircraft, and they provide communications between countries in the world by switching and directing radio communication signals through transmitters and receivers in different locations on the earth. There are more than 2000 communications satellites in Earth's orbit, and they are used by all systems in the world.

- **Navigation**

Satellite-based navigation systems, such as GPS, help us locate the location of anyone carrying a mobile device, as well as assist in directing cars and allow locating vehicles. Global Positioning Systems (GPS) are used by civilians and military as they are used in land, sea and air navigation.

- **Business & finance**

Communication satellites can quickly communicate between many different locations on a large scale as they allow large manufacturing companies and supermarkets to perform stock management and save money for small cities and pay gas at gas stations in quick ways.



- Weather

Satellites are an important tool for meteorologists as it provides them with the ability to predict the weather on a global scale and allow them to follow natural phenomena such as volcanic eruptions and the burning of gas and oil fields.

- Climate & environmental monitoring

Satellites are one of the best tools for predicting climate change, as satellites predict ocean temperatures and mainstream currents.

The satellites have been able to show the rise in sea level over the past years by portable radars. It can also measure the changing size of glaciers that are difficult to do from the ground. Satellites can also predict long-term precipitation, vegetation, and greenhouse gas emissions.

- Safety

Earth observation satellites can monitor wind and ocean currents, forest fires and air pollution, and this information helps to maintain a clean environment. The satellites also have an important role in distress, as there are special search and rescue satellites that send and receive signals that are useful in determining distress sites through radio signals.

- Land stewardship

Satellites can detect underground water and mineral sources as well as measure the temperature of the earth and water, and work to monitor water pollution and infrastructure, such as fuel pipelines, which must be examined to ensure that there are no leaks in them, and this requires a lot of time on the ground, but by the satellites it has become It is easier, as the satellites produce high-resolution data, and this data is very guarded.

- Development

Satellites are of great importance to developing countries, as satellites provide developing countries with many important services, such as education and medical expertise, and satellites also help in tracking population migration from one country to another.

- Space science

Satellites play an important role in space science as they help astronomers in understanding the phenomena that occur in space such as pulsars and black holes and to know the age of the universe. Where previously astronomers used ground telescopes as they were less accurate and more difficult to use, but It gets easy using satellite telescopes like the Hubble Space Telescope

### 3.5. Types of satellites.

There are many satellites, as each satellite has a specific job to do that varies from one to another.

#### 3.5.1. Communications satellite

Communication satellites play an important role in global communication, they receive audio, video, and data signals and then send them back to Earth. as they receive audio, video, and data signals and then send them back to Earth.

wireless communication is used to transmit signals, but these signals require that they not be obstructed by the curvature of the earth, so the solution was to use satellites that facilitate the transmission of signals to the ground. These satellites use radio and microwave frequencies, and to avoid signal interference, specialized organizations made regulations to regulate the use of frequencies and this reduces the risk of signal interference.



Figure 15: communication satellite.

- Application on communications satellite.

#### Satellite phone:

A satellite phone is a type of phone that is associated with satellite communications, and it mostly covers the globe or parts of it.

#### Satellite television:

A Satellite television is a television that is displayed via satellite by means of communication and is received by a satellite dish and set-top box, and it provides a wide range of channels and services in the few areas in these services.

#### Satellite Internet:

It is an internet access service that provides fast data transfer.

#### Satellite Radio:

It is a radio wave broadcasting service, and this service is available free of charge. and provides its subscribers with more than one better station than the earth stations.

### 3.5.2. Remote sensing satellite

Remote sensing is an important method for obtaining information remotely, as the NASA space agency works to monitor the Earth and other planets through remote sensors on satellites, and remote sensing provides data about Earth systems.

Remote sensors can be passive or active.

Passive remote sensing devices detect the most common sources of radiation, such as reflected sunlight, and they also collect data around the Earth. For example, remote sensing sends a laser beam to the ground and then measures the time it takes to reflect and return.



Figure 16: Remote sensing satellite.

- Applications on remote sensing

Remote sensing plays an important role in many fields.

#### Coastal applications:

Remote sensing devices monitor coastal changes and use the data to prevent erosion and track sediments.

#### Ocean applications:

Measuring ocean temperature and wave height and forecasting sea ice.

#### Risk assessment:

Remote sensing plays an important role in forecasting hurricanes, earthquakes, floods, and erosion, using data and creating strategies to confront danger before and after it strikes.

#### Natural resource management:

Remote sensing monitors land and uses the data needed to protect it.

### 3.5.3. Navigation satellite

Through navigation satellites, we can determine the location of people and things anywhere on the surface of the earth, whatever the weather.

- How do satellites for navigation work?

The location is determined by a receiver to capture the signals sent by the satellites for navigation, and this device is placed in electronic devices for mobile phones and cars, and in order to determine the location, your receiver needs to receive signals from 4 satellites by measuring the time the signal takes to move from the satellite to the receiver, as the distance between each two satellites informs you of your presence in a place and knowing the distance between you and a third satellite helps to determine



Figure 17: Navigation satellite

your location more accurately, and the fourth satellite can synchronize your receiver clock with a time standard. In common with adherence to the clock accuracy found on all satellites, the use of the fourth satellite increases the accuracy of position determination, and the more satellites used, the greater the accuracy of positioning.

### 3.5.4. Weather satellite

It is a type of satellite that is responsible for predicting the weather and climate on Earth, as weather satellites not only see clouds, but also city lights, fires, sand and dust storms, pollution impacts, ice caps, ocean currents, energy flows, etc.

Weather satellites also helped monitor Volcanic activity and monitor smoke emitted from it. It is also possible to locate the ozone hole in Antarctica Through weather satellites, and these satellites monitor weather around the world.



Figure 18: weather satellite

weather satellites are designed to use one orbit from two different orbits: geostationary and polar orbiting.

- Geostationary

Geostationary weather satellites revolve around the earth above the equator and because of this orbit, these satellites remain stationary around the rotating earth and thus can record images of the entire hemisphere, through visible light and infrared sensors, and the media use static images of the earth in displaying today's weather.

- Polar orbiting

Weather satellites rotate in polar orbits in sun-synchronous orbits, which means that they are able to observe all places on the Earth's surface. It is also more accurate than geostationary weather satellites due to its proximity to Earth.



## Chapter:4 Space technology and the Internet

### 4.1. Starlink

#### 4.1.1. SpaceX find the answer.

The Internet has become one of the most important things in our lives, and with speed Life, and the need for the Internet. We need high-speed Internet Everywhere to cover this need and needs such as work, communication, and entertainment, so the question is how to get high-speed Internet everywhere and everyone across the Globe and the answer appeared through SpaceX and its famous owner and star of our article Elon Musk through Starlink project.

#### 4.1.2. What is Starlink?

Starlink is a large group that can reach thousands of satellites. They are in the Earth's atmosphere and are in Low Earth orbit. Internet access is available at speeds of up to from 50mbps to 150mbps with very low latency up to the 15millisecond and It operates with ground transmitters and receivers without the need for infrastructure mainly SpaceX has cost Starlink US\$10 billion in 2018 in industry, development and control Satellite orbital SpaceX has sent about 955 satellites into low Earth orbit but which now operates 895 because the first 60 Satellite was a test and disabled , SpaceX plans to 12,000 or more satellites are being sent.



Figure 19: Starlink satellites

### 4.1.3. How starlink works?

Starlink consists of thousands of satellites that move together in simultaneous orbits, covering all places in the world to reach Internet to all humans and satellites will communicate via Laser to regulate.

satellite movement and allows faster Internet with Less delay.

Starlink satellites will be in a very low earth orbital compared to the rest Satellites and Starlink satellites will be in orbit Height of 540km to 570km and this has a lot Features, it will give the Internet faster, unobstructed and prevent The accumulation of residue from satellites because when the lifetime of the satellite is over The satellite's engines will be pushed into the atmosphere and It will burn in 4 or 5 years and this is a fast rate Instead of hundreds or thousands of years to burn.

The latency time will be less than 15 milliseconds, and this is very small Compared to the standard Internet latency time, it is 594 millisecond-624 millisecond This shows the evolution of Starlink satellite technologies in Beta tests.



Figure 20: starlink satellites look

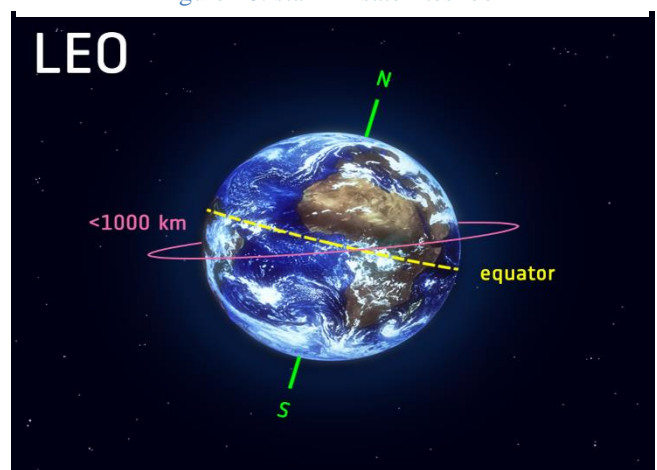


Figure 21: low orbital earth



#### 4.1.4. Starlink solve availability issues

Building a strong Internet and communications infrastructure is costly. The state's resources drain a lot of money and labor, which makes many people living in the desert in the Arab or rural areas without internet access and if available they are too expensive for the user to afford the cost other than the rich, and this makes it so difficult. Starlink is the best choice for these people and is available to all people at affordable prices, unlike the rest of the satellite that provides Internet service.

#### 4.1.5. SpaceX solves the night sky

SpaceX has announced modifications to all the satellites of a project Starlink and these modifications save the sky from the spurious stars of our point of view and intervention in astronomy because satellites reflect sunlight appears as stars, but these adjustments make satellites reflect the sunlight at a certain angle so that they do not light and appear as stars.

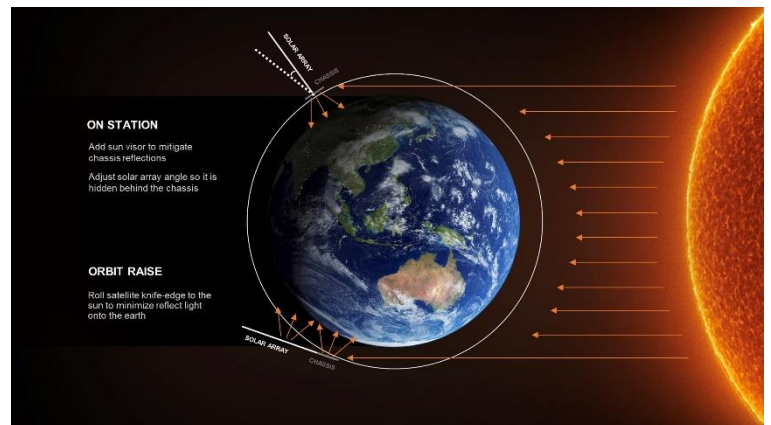


Figure 22: SpaceX solves fake stars

#### 4.2. 5G and satellites

For years satellite communication has remained a technology independent of mobile networks, but with fifth-generation technology, satellite technology will be integrated with mobile networks, to connect to lagoons, ships, aircraft, and the Internet of things, smart cities will use superfast speeds and low latency to communicate everything.



Figure 23: 5G and satellites

##### 4.2.1. Internet of things (IoT) and satellites (5G)

With the growing number of IoT devices becoming a major operational challenge, but with 5G technology, satellites have a great location and speed to support the IoT devices, and additional capacity can be used as a backup of the IoT or as a complement to congested traffic. This allows for higher peak rates and greater reliability in the machine's extensive communications.

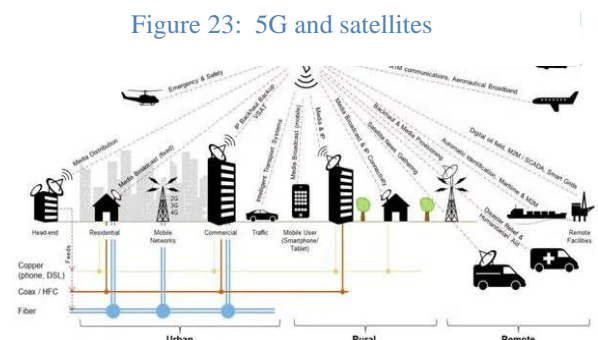


Figure 24: (IoT)

### 4.2.2. The reliability of fifth-generation

One of the most important advantages of 5G technology is that it does not support it Basically on infrastructure, infrastructure is giving a pat Additional features and services but are not the main reason for keeping The network is alive as it is in the case of natural disasters such as Volcanoes and earthquakes or humans such as nuclear explosion where they are exposed Destruction infrastructure Satellite networks are capable of taking over The command and keeping the network in place will not be able to Some groups offer services but remain able to Maintaining a critical Internet connection during disasters.

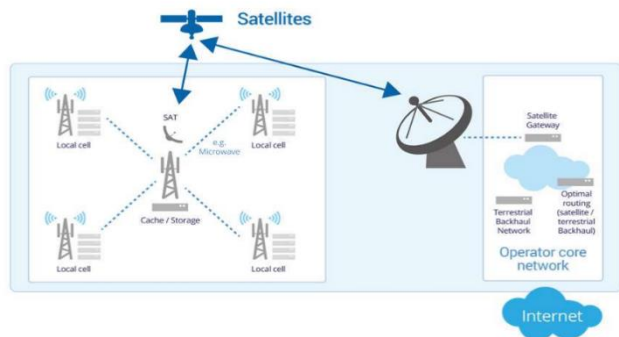


Figure 25: he fact that 5G is not completely dependent on infrastructure.

### 4.2.3. Conflict over the networks of the fifth generation

The whole world is fast moving toward the networks of the fifth generation and giant companies are struggling to invest and develop the infrastructure and satellites of the fifth-generation networks and among the industry's leading companies (1-NOKIA 2-SAMSUNG 3-HUAWIE 4-ZTE 5-QUALCOMM 6-ERICSSON 7- SPACE X) And not just companies. Countries are also struggling, because those who control fifth-generation networks control the Internet of things (IoT), which will soon be controlling everything electronically, as the US has imposed a blockade on China's Huawei by US companies not to deal with Huawei, but Huawei has replaced US products with its own products or products of competitors.



Figure 26: Companies working on development 5G

#### 4.2.4. 5G disadvantage.

Although the features of fifth-generation networks are many and powerful, but everything must have flaws, but we must look if these flaws are acceptable or unacceptable. It is a perceived disadvantage that we cannot rely entirely on satellites when fifth-generation networks are widely used, with many users, and they have to be fed with transmitter and reception towers, as more towers are created to feed the network into the large number of users, and as the number of towers increases, the public landscape of the city becomes unwelcome by a lot of people who don't want to see a lot of towers instead of seeing trees, it's not a beautiful landscape.

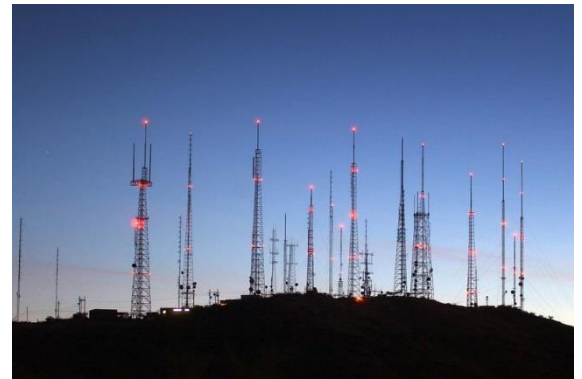


Figure 27: An aesthetic view of the towers

The connectivity problem is also a problem that needs to be solved because the reach of fifth-generation networks is not wide, and the frequency waves go too short, and the frequency breaks down or breaks down through physical obstacles like buildings, trees, and towers.

Fifth-generation networks will affect cell phones when using 5G, and phone battery appear to be operating in a smaller period of time because the 5G technology drains the battery and overheats the phone. That affects phone performance, but phone companies continue to upgrade on their phones to adjust these technical problems.



Figure 28: 5G PHONES

And there are a lot of people who are calling for the fifth-generation network to be stopped because it's harmful to health, but these predictions have been answered by scientists, and David Robert Grimes a psychologist and cancer researcher, says that the fifth-generation network frequency is not ionized, which means that it lacks the energy to break up DNA, cause cell damage and turn it into MT cells , He says there's no evidence that fifth-generation network frequency leads to cancer.

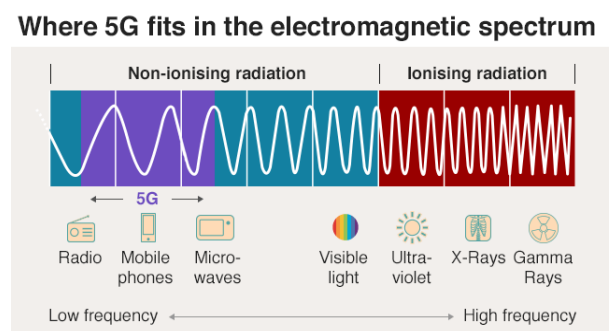


Figure 29: 5G Frequency

## Chapter 5: Space technology contribute in health care

The British agency launched an initiative that cost them a lot of money in the field of medical care to prove the possibility of using space technology in the field of medical care, as it was in the treatment of Heart disease, as well as improving medicines and a lot of uses. Also, innovations in the surgical performance of ISS allow us to search through the first robotic technology in the world capable of performing surgery inside magnetic resonance imaging devices. This technique facilitates difficult surgeries and make them easier like the operation for brain tumors. Soon the medical technology emanating from space report will enter the secret experiment to be used in diagnosis early treatment of heart disease and cancer, this technique provides accuracy and creativity.



Figure 30: Technology in medicine

### 5.1. Heart disease:

Astronauts often suffer from a lot of problem in heart and blood vessels because weightlessness in space not only them suffer but people suffering too ,the majority of patient is women ,this problem lead to increase the number of death ,doctor ,world ,and NASA agency have worked to find the solution ,people and NASA agency are interested in heart disease ,manager of NASA say he is proud because NASA try to find solution about this problem ,the US space program has helped to make revolution in fields of medicine ,NASA effort has helped us to search about cardiovascular system , it is lead to discover miraculous things , treat a lot of patient in lower coast ,and all of that include some improvement are derived from space today ,like devices of blood pressure , regulating heartbeat , heart drawing , exercise equipment , sound wave ,and including microwave surgery technology , tissue transplants ,heat pumps ,and the laser which used to measure the widening of ozone hole is used to open arteries of heart.





Figure 31: Device of blood pressure



Figure 32: Device of regulating heartbeats

## 5.2. Improve camera (pill camera)

What is this camera? it is camera-like medicine pills that the patient can take it and this camera helps in diagnosing disease as it tracks through GPS, tracking the intestines and organs inside the body, and is currently used to diagnose early cancer and confirm the mental state of a patient.

## 5.3. Nutrition

Astronauts try to put these vitamins in our food to enjoy better health as it can be used in the production of vitamins contained in baby milk, as it was found that the algae used by astronauts from space have been shown to contain a lot of nutrients that the child needs for mental and physical growth.



Figure 33: Pill camera

## 5.4. Equilibrium and movement

We use and develop a new technique to improve movement disorders in the case of weightlessness and treatment of patients suffering from a cerebral palsy, stroke, spinal cord injuries, and inability to move due to aging. Scientists have noticed the movement of the astronauts' eyes in their initial voyages, After this voyage, a quick and less expensive treatment was discovered for patients, A system of devices and programs that collect information and images about the movement of astronauts' bodies has led to the International Space Station, and this information and images have been used in research at the Rome Hospital in treating stroke and cerebral palsy patients, and this treatment was used for children

with cerebral palsy in Russia. These images and information also led to the development of Astronauts make up for the lack of gravity.

## 5.5. Preventing bone lose

The problem of losing bone increase in recent day, elderly and Astronauts often suffer from this problem, studies on the International Space Station (ISS) shows that we will lose bone, the scientist is studying on bone and risks of kidney stone, the solution is through use of bisphosphonate, doing exercises on bone, doing sport, make a system of food, this system has less sodium, enhance the health of elderly who are likely to suffer from osteoporosis.



Figure 34: Do exercise.

## 5.6. Eyesight correction

The development of technical a solution directed at children is included in the work plan. where the laser inserts are founded to correct visual defects. Now new technology has been discovered and developed on the international space station, where this technique follows the patient's eye and directs the laser to with high accuracy.

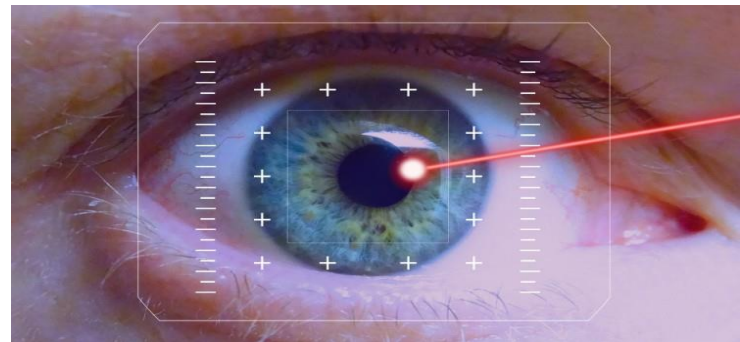


Figure 35: laser operation

## 5.7. How space technology benefits the earth?

In 1957, when the first spaceship launched, we watched man landing on the surface of the moon, launched 135 space shuttle flights, building space stations, launching more than 8100 space particles, scientists make great use of space technology in communication, positioning, economic activity, A lot of tasks continue in space anywhere in the solar system and evolution processes before scientists use the surface of the earth in many areas.

### 5.7.1. Predicting climate and weather

space technology has a positive effect in forecasting hurricanes the temperature of the air and predict those things it affects our daily decisions, government decisions and on the whole country thanks to satellite because it predicts the climate, this process saves human life. in 1900 a bid hurricane called Galveston its leads to death about 6000to 1200 human and we had no warning of this coming. we have a scientific basis for prediction of weather and climate.



Figure 36: predicting climate.

### 5.7.2. Monitor the earth's resources.

Where industrial and agricultural production, industrial and agricultural resources are monitored, the management of fish production is controlled and the quantity of fish is identified and the quantity of fresh water and dangerous practices such as cutting trees, hunting animals and burning garbage are monitored, and all this is achieved by satellite.



Figure 37: Earth's resources

### 5.7.3. Confronting humanitarian crises

Space technology not only help us in production climate and save community, but it has helped us in improve the community in industry and health care, home safety. world hunger is an example of Confronting humanitarian crises but photo which taken by satellite can help us to solve this problem. Where it Determines quantity of crops by the early display of each pixel, this process allows farmers to understand the right time for irrigation, collect crops, we can use Infrared to draw botanical index represent the production of crops, the satellite can collect information about Agricultural areas.



#### 5.7.4. cultivate space.

We will need to have a lot of food as the earth's population grows. This problem of space cultivation can be solved, but this method has not been completed until the advancement of space technology, Space can be planted, and crops harvested and sent to the surface of the earth in limited amounts, and this process will be very costly, but finally it will provide food on large parts of the earth's surface.



Figure 38: Cultivation

### 5.8. Space technology makes our daily life easier.

NASA discover a lot of things, techniques and develop the field of the web. it has been placed now in daily application, and now we can see different invention which invention by Astronauts, this invention makes our life easy for example Internet of things, vacuum cleaner, fridges which have a lot of advantages like show photo, write notes.

#### 5.8.1. Internet of things

What is the mean of the Internet of things? It defines the network of things such as remote sensing devices and applications. For the purpose of sharing data with other Internet devices, the Internet of things technique means intelligent houses and many devices such as (lighting, heating, a camera, and a lot of home devices). We will explain some internet applications for things.

#### 5.8.2. Smart home

This house is an Internet concept because it includes lighting ,heating, Air conditioning , the system of camera , this house include a lot of benefits like saving power By ensuring that the devices are turned off automatically or say information to people who live at home , All home devices can be linked to a platform like the home kit platform to control home appliances and control home products and accessories through an application using Wi-Fi where different platforms are presented to deliver products to the smart home, including Google Chrome and Amazon echo.



Figure 39: Smart home

### 5.8.3. Care of the elderly

The main application of smart home is the care of the elderly that is mean helping people with disabilities and elderly those home systems recognize a person's disability voice control can be used for blind people alarm system can also be connected to a cochlear implant used by the hearing impaired.



Figure 40: Internet of things helps the elderly.

### 5.8.4. Transportation

Internet of things help us to complete communication and control on data through a system of transportation, the application includes (car, driver, user, Infrastructure) The interaction between these components enables the communication between countries, smart traffic control, smart parking, electronic toll collection system, control cars, safety and assistance on the road.

### 5.8.5. GPS

Satellites are used to locate anything on the Earth's surface, such as sea and air navigation, as well as to locate people and communications networks, and space location services, have also become available on the phone or car this called GPS. The location can be determined by a program linked to satellites and millions of maps are on it. In another way, it is a three-part system consisting of a satellite, a receiver and a ground station, the receiver is used by user. As soon as the receiver attaches to three or four satellites and measures the distance between it and them, it picks up the signal from the satellites, so it determines your position on the earth's surface.

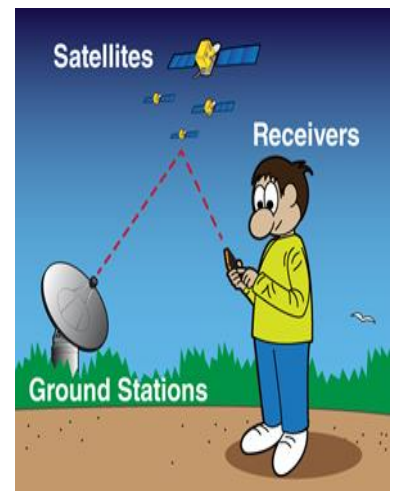


Figure 41: GPS

### 5.8.6. Camera sensor

Eric Fossum he was scientist from NASA, he did extensive research to reduce the size of the camera for use in space missions, after many years of research he development semiconductor image to exploration space but he faced a lot of problem and he worked to develop pixel sensors and this process has caused a huge revolution in the digital imaging industry and is used in many smart phones today.

Name	Full Frame	APS-C	Four Thirds	1/1.7"	1/2.3"	1/3.2"
Area						
Size	36 X 24 mm <sup>2</sup>	23.6 X 13.5 mm <sup>2</sup>	18 X 13.5 mm <sup>2</sup>	7.6 X 5.7 mm <sup>2</sup>	6.1 X 4.6 mm <sup>2</sup>	4.4 X 3.3 mm <sup>2</sup>
Camera Type	High End DSLRs	Midrange and Entry Level DSLRs	Olympus DSLRs	High End Compacts	Low-mid Compacts	Mobile Cameras
Cameras	 Nikon D810  Canon 5D MKIII	 Nikon D3300  Canon 1200D	 Olympus E-5  Panasonic Lumix DMC-L10	 Sony Cybershot DSC-HX300  Nikon Coolpix P610	 Sony Cybershot DSC-WX500/B  Canon Powershot SX610 HS	 Apple iPhone 5  HTC One

Figure 42: Camera size evolution

### 5.8.7. communication and Internet

The satellite that goes around the earth sends and receives data and instruction to other different devices. the instruction of satellite used for mobile and internet communication. this makes a huge revolution in world communication, and we can communicate with anyone anywhere and the internet spread increase, we can do our business on the internet.

### 5.8.8. Rail monitoring sensors

NASA discover the subsonic rotary-wing project, and this project predict failure in the helicopter, NASA made some adjustments) improvement) to this project and re-monitored vibration in the Roto Sense axis to send it on the train and discover the defects of the poles.

## Chapter 6: Communication technology and movement in space.

### 6.1. How do Astronauts communicate with each other?

In order to hear sound of anything, it must travel through air of which space has so little per cubic centimeter, sound can only travel by a solid, liquid or gas.

The space considered an almost perfect vacuum does not allow any sound to travel and be heard by the other people.

Sounds are vibrations of air particles, so that if any sound heard in space, it is from other means such as from the electromagnetic spectrum and these waves are not sound.

Astronauts can communicate with each other through radio waves as they can send signals to their headsets and translate it into the form of sound. When the message is sent and received to earth it is sent in the form of radio waves which then be translated by radio set.

Radio waves are parts of the light spectrum called electromagnetic spectrum, Light does not need a medium to travel and this, further explains why the Sun's light travels through space to earth.

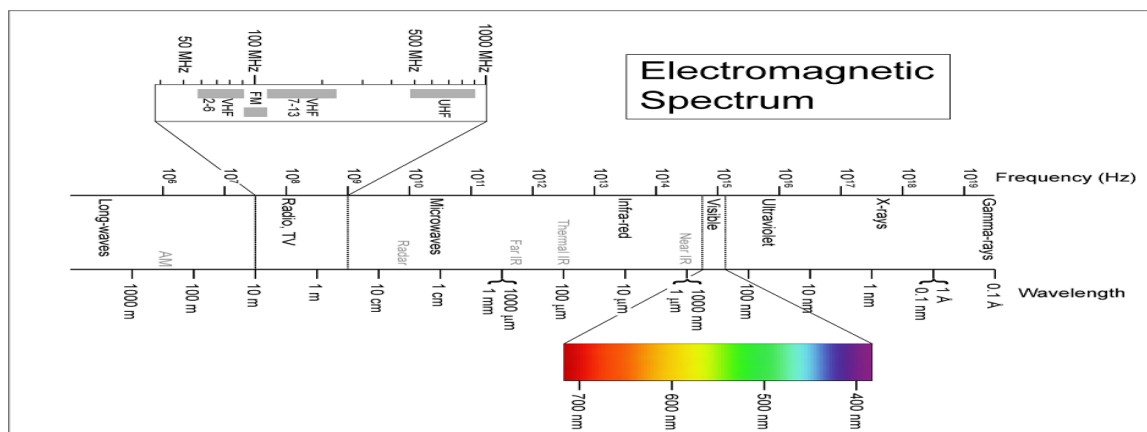


Figure 43: Electromagnetic spectrum

Astronauts have device in their helmet which transfer the waves from their voices. into radio waves and transmit them to other astronaut in the space or to the people on earth, so When astronauts go outside of a spaceship or the International Space Station, they must wear protective space suits to keep them safe from the harsh environment of space and keep them in touch with others by the radio wave, it's essential that they remain in constant communication with the rest of the crew in space and Control Center on Earth.

The helmet of the astronauts' suits is with microphones in the ear area for listening and boom microphones in front of the mouth for speaking. These caps are worn under the helmet and around an astronaut's head.



Figure 44: The helmet of astronaut from inside

There are many companies like (NASA), redesigning their space suits and upgrade it, the goal of this to creating a new options to be offered to the astronauts , and make the mission more easier.

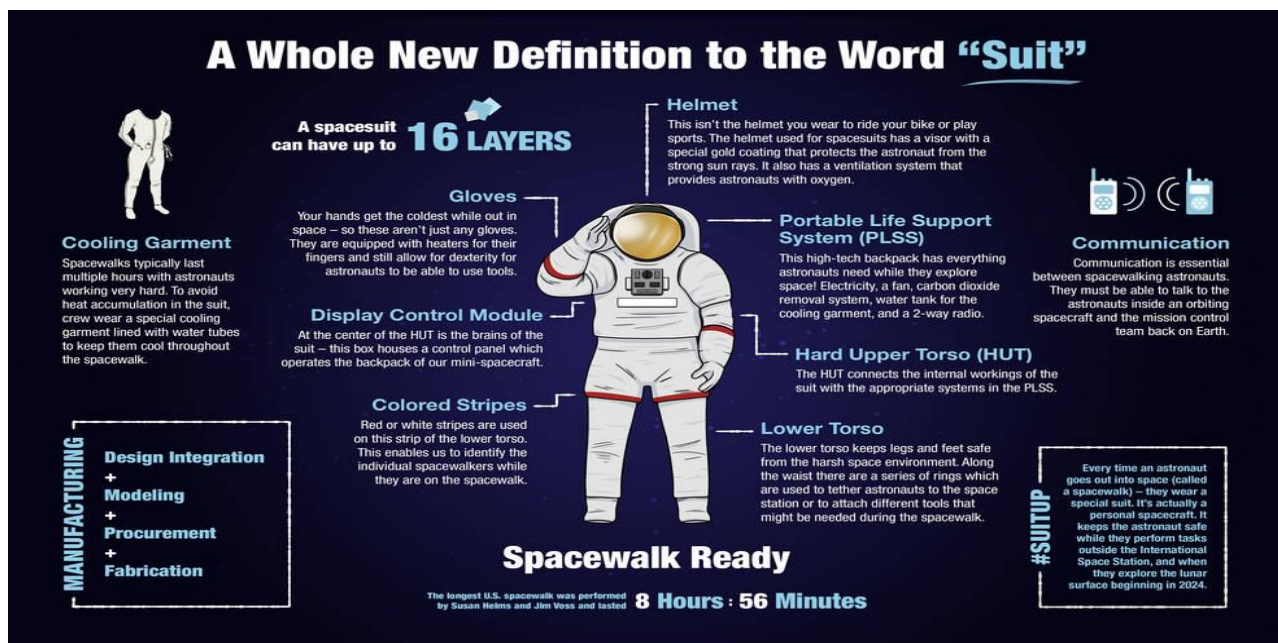


Figure 45: Astronaut suit

## **6.2. The movement in the space**

The time when the astronaut goes out of the space ship into the space, it is called a spacewalk, the spacewalk is also called an EVA. EVA stands. Alexei Leonov is Russian and was the first person to walk in space. It was 10 minutes long, on March 18, 1965. Astronauts go on spacewalks outside the spaceships or International Space Station. Spacewalks usually last between five and eight hours, depending on the mission which have ordered.

## **6.3. Why do Astronauts go on spacewalks?**

The astronauts go out the ship to do a spacewalks or repair thing outside spacecraft while still in space or do science experiments in the space, This lets scientists learn how the space affects on a lot of things. also spacewalking used to test and try a lot of things measure the qualities like the weapons and satellites.

### **6.3.1. How do Astronauts go on spacewalks?**

Astronauts go on spacewalk wearing space suits to keep themselves safe. Astronauts have special space suit that provide them with oxygen to breath and water they need to drink, they wear this space suit several hours before the space walk. This suits are pressurized which means that this suits are filled with oxygen they need among their space walk.

When the astronaut wear the space suit he breathe pure oxygen for a few hours, Breathing only oxygen gets rid of all the nitrogen in an astronaut's body, if the nitrogen still in the astronaut body, he might get gas bubbles in his body when he walk in space. These gas bubbles can cause him a pain in their shoulders, elbows, wrists and knees. The pain is called getting the bends because it affects the places where the body bends.

When the Astronauts are ready to go out of their spacecraft, They leave the spacecraft through a special door called an airlock, The airlock has two doors, When astronauts are want to go out the airlock is airtight so no air can get out the spaceship , When astronauts are out of the ship and ready to go on a spacewalk they use the first door and lock it tight behind them and open the second door without any air getting out of the spacecraft.



### 6.3.2. How do Astronauts stay safe during spacewalks?

Astronauts use safety special ropes to stay close to their spacecraft. One end of the rope is hooked to the spacewalker and the other end is connected to the ship or the station. Ropes keep the astronauts from floating away into space. Astronauts also use the robes to keep tools from floating away by robe it to their suits.



Figure 46: SAFER

Astronauts use SAFER which is more likely a rope attached to their backpack which keeps them safe. It makes astronaut move around in space like flying. If an astronaut were to become un-roped and float away, SAFER would help the astronaut to fly back to the spacecraft. Astronauts control SAFER with a small joystick, like a video game.

### 6.3.3. How do Astronauts train for spacewalks?

The best way the astronauts train for spacewalks is going for a swim, floating in space is loot like floating in water. Astronauts practice spacewalks underwater in a large swimming pool like the Neutral Buoyancy Laboratory, or NBL. Near to NASA's Space Center in Houston, Texas. 6.2 million gallons of water the pool is hold. Astronauts train seven hours in the pool for every one hour they will spend on space.

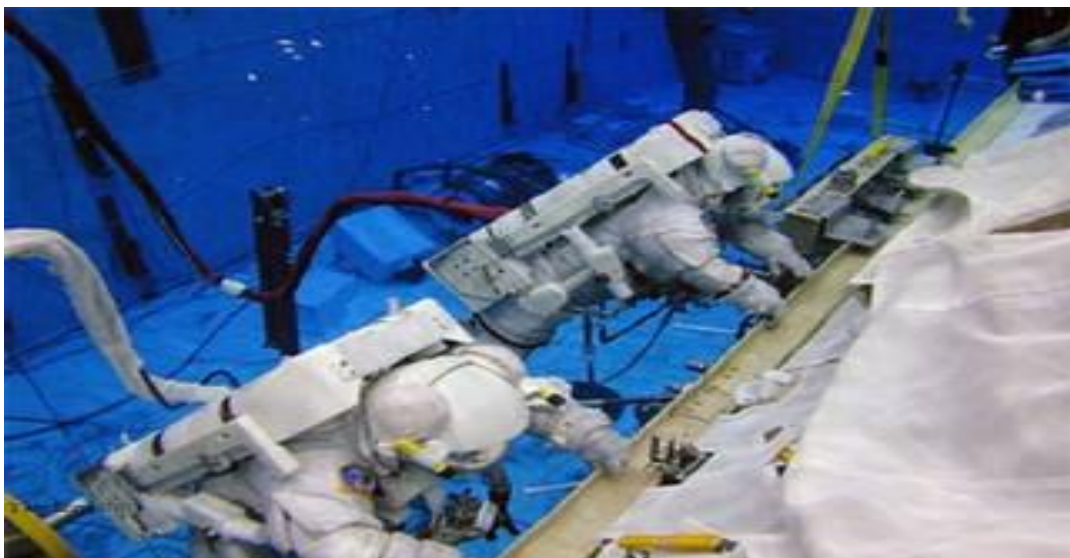


Figure 47: Traning in deep pool

Another way to practice the spacewalking is by using the virtual reality, this is look like playing a video game. In this game astronauts wear a helmet with a video screen inside. They wear special gloves. Inside this helmet there is a screen through it which makes the astronaut living the moment while he is walking throw the space. When he or she moves the special gloves allow the movements to be shown with the video.

## 6.4. The future of space technology

There are a lot of future space technology projects, its mission is to make the tasks which ordered from the astronauts more easier to finish, the space future would have many benefits that are so close to the Earth and its citizens.

we're in a space race today, there are over 70 different government and intergovernmental space agencies. Thirteen of these have space launch capabilities, including NASA, the European Space Agency (ESA), the Russian Federal Space Agency and the China National Space Administration (CNSA).

space agencies and companies have different projects to complete in the next 50 years like: space tourism, study and know about the other planets, development of the spacecrafts, telescopic exploration of deep space ,NASA set the goal to return humans to the Moon by 2024 and establishing a sustainable human presence on the Moon by 2028,China is prepare a team to do a mission in Moon's south pole by 2030, and has already successfully landed a robotic rover on the Moon's far side.

- Important future space missions:

James Webb Space Telescope (JWST), this telescope will search for the first galaxies after the Big Bang, the use of infrared will help scientists in understanding the physical and chemical properties of these star systems, including the observation of some of the most distant events and objects in the universe, the launch in **March** 2021.

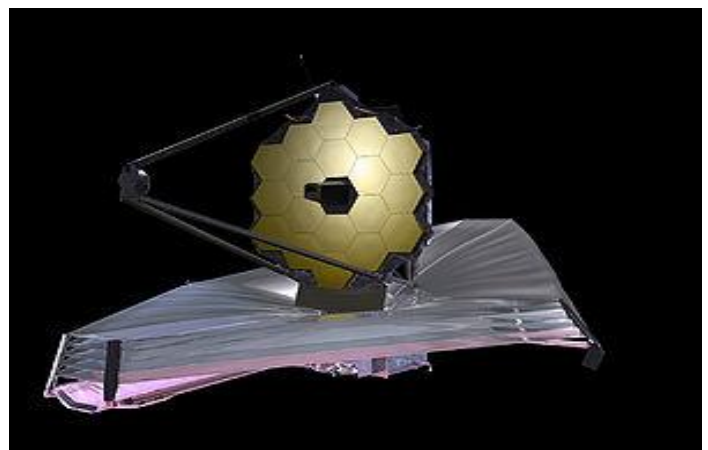


Figure 48: James Webb Space Telescope

Breakthrough Starshot is an engineering project aiming to send 1000 tiny spacecraft to Alpha Centauri in a journey lasting 20 years, the mission test the possibility of ultra-fast space travel 15-20 per cent of the speed of light, to do the interstellar travel, the project is still very much in its infancy, it will launch around 2036.

## **Chapter :7 Artificial intelligence and space technology**

Recently, artificial intelligence has become popular and widespread around the world.

### **7.1. What is artificial intelligence?**

Artificial intelligence is a broad and interesting science in which robots do a lot of things instead of humans, and this serves the human and makes his life easier.

### **7.2. Space technology and artificial intelligence**

Artificial intelligence has become a contributor to all areas of life in medicine, engineering, especially in space technology, and this is what we will discuss in this part of the article.

Sometimes space technology needs people to perform tasks on some planets, and there are some planets that are not suitable for human life in them, and in these cases, it is difficult to risk the lives of astronauts to do.

From here comes the strong relationship between space technology and artificial intelligence. Artificial intelligence serves technology and contributes to preserving the souls of explorers, so the robots carry out these tasks and is sometimes equipped with a camera and much equipment to help it carry out its tasks.

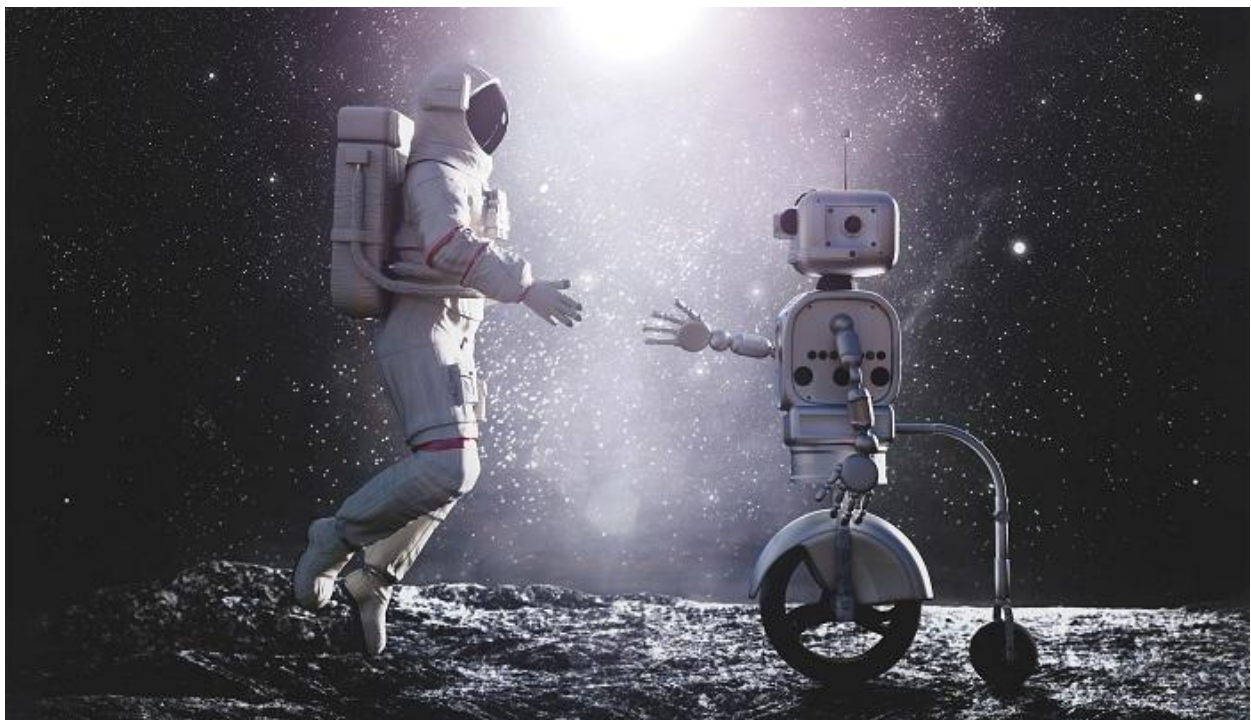


Figure 49: The relation between the space technology and artificial intelligence

### **7.3. Role of space agencies in artificial intelligence**

From ancient times agencies seek to explore the unknown things and outer space

There are many space agencies in the world in America, Japan and other countries, but the American agency NASA advances them, as it is considered the most famous, as its 2012 budget amounted to 17.8 billion dollars.

### **7.4. Role of the global space agency NASA in space technology**

Nase declared that its masters are presently practicing advanced artificial intelligence algorithms that will assist scientists in the agency's exploration tasks in the future.

According to the site "analyticsinsight.net" Victoria Da bojan, leader of the nase research team, point that what is presently being evolved of Artificial Intelligence algorithm will be utilized in the exploration tasks to be sent in mars 2022.

Da puyan proved that Artificial Intelligence AL will share in the access of science eyes to other planets beside that mars which is called red planet, such as Jupiter, moons, Enceladus and titan of Saturn.

On the effectiveness of the recent Artificial Intelligence systems, Da puyan clarified that its highly predictable that these systems will be put in space probes to help define the geochemical fingerprints of life from samples of planetary rocks and their moons.

The real feature of nasa's artificial intelligence algorithms is their capacity to immediately analyze gathered samples, which will contribute to help in a great positive and effective method to get those samples bake to the earth to analysis them.

### **7.5. Space probe**

From the most important contributions of artificial intelligence in space technology is space probe.

#### **7.5.1. What is space probe?**

A Space probe is robotic spaceship that doesn't have a crew in it and doesn't orbit the earth.

From the use of space probe is to discover outer space and explore celestial bodies such as planet, comet, moon and asteroid and exploring the interplanetary medium or interstellar medium is from the use of space probe, too.



Figure 50: Space probe

Its load consists of scientific tools of different types such as advanced cameras, spectrometer, radiation energy meters and magnetometer that makes scientists able to gather data on site or at stretch by using cameras and sensors, to be sent to earth later.

Space probes are similar to satellites that orbit the earth, but they are distinguished from satellites in several characteristics that we will talk about

### **7.5.2. The characteristics of space probe**

- the first characteristic is to provide a robust and accurate communication system and at the same time impose great independence through the distance between the operators on the ground and the space probe.
- the space probe can work at the conditions of low solar energy, particular if the aim of sending space probe is the gathering the data around outer planets.
- work during exposure to cosmic rays.
- precision and complication of navigation
- The space probe is working to withstand high temperatures while carrying out missions on other planets outside the solar system or under the orbit of Mercury.
- The period of the mission extends to tens of years, which start after the transit phase.
- The mission that the space probe must perform, the complexity of which plays a big role the examples of it is landing on celestial bodies that have an atmosphere or very low gravitational force, precision and complication of navigation and the Procedures of local storage of the data in case of failure.

### **7.5.3. Procedures for transferring space probe to space**

Sending space probe outside the earth (to other planets) is hard thing required huge accuracy in the angle of departure from the Earth and this angle reached arc second.

Directing the space probe across the path is one of the steps of sending the space probe to one of the planets, and this requires great accuracy, and the Doppler phenomenon is used in that and the duration of the signal advance changes. All these methods play an important role in determining the location of the probe in space with an accuracy of up to a meter without paying attention to the distance from Earth.

### **7.5.4. The power supply of space probe**

There are several ways to obtain energy for a space probe. First, in the event that the target is the moon or the inner planets of the solar system such as Mercury and Venus, then it gets its energy from accumulators charging solar panels.

Secondly, in the case if it is intended to be used for a short period, in this case batteries are used to supply him with electrical energy.

### **7.5.5. Different types of space probes**

In order to determine the type of detection method used in the space probe, this clearly depends on two things. The first is the scientific objectives and the second is the costs that the space agency is bound by, for example If the goal of sending the probe to space is to study



the changes that take place on a specific planet, this leads to the agency's endeavor to place the probe in orbit around the planet to make observations on it at long intervals and to place the probe in orbit requires payment devices that require a great cost.

For these reasons, space agencies review a simple overview of the purpose of the mission, and this is in order to fully benefit from the probe by using scientific tools that increase the efficiency of the probe.

Finally, the process of choosing the exploration method depends on the experience of the nation or group of countries that will develop the space probe and enable it to collect the largest amount of data.

Depending on the exploration method used, space probes can be arranged into 9 major categories.

#### **7.5.6. Flyover probe over celestial bodies**

Flyover probes over celestial bodies are designed in order to photograph a general view of celestial bodies for the purpose of studying them in order to perform their tasks. Placing the probe from the ground on a precise path is one of the simplest cases, and some minor repairs are made during transit.

The targets that can be obtained from this flight are few, and the time to observe the space probe is very short because the speed at which it flies is very large, reaching several kilometers per second, and in many cases the visible part of the celestial bodies is one face during flight, in addition to the illumination that is not suitable for taking pictures and collect data.

The space probe is one of the methods of observation, and rather it may be the only one that can be used for the most distant celestial bodies. The flyover probe over celestial bodies can also be used in advanced reconnaissance missions that aim to conduct a series of studies on several planets or moons. The goal of these probes can be a study. Small objects such as comets and asteroids

Examples of this probe:

- 1-New Horizons probe whose mission is to discover Pluto and its moons.
- 2-Voyager probes



Figure 51: New Horizons probe



Figure 52: Voyager probes

### 7.5.7. Atmospheric probe

It is clear from the title that it is a probe that crosses the atmosphere of a particular planet for the purpose of studying it and is supplied with energy through batteries, because the mission of the probe is short and lasts for the duration of the process of descending the probe on the surface, and the probe is transferred to the atmosphere to the planet whose atmosphere is to be explored by a spacecraft

Examples for this probe:

Huygens probe its mission to study the atmosphere of titan (Saturn's largest moon)



Figure 53: Huygens probe

### 7.5.8. Orbital probe

The orbital probe is a probe that reaches its target (a celestial body) and rotates around it for the purpose of studying it. Orbital probes are the second largest class after the class of flyover probes over celestial bodies. The entry of the space probe into orbit requires that its speed be greatly reduced when it reaches its target.

Half of the total mass of the machine is wasted in the thrusts used in the braking process.

The orbital probe has been conducting regular observations of celestial bodies for several years.

The orbital probe is sent to a specific target, which is a direct next step to sending the simple flight probe.

Examples of this probe:

1-Cassini-Huygens probe its mission to study the planet Saturn and its system.

2-Galileo its mission to study the planet Jupiter and its moons.



Figure 54: Galileo probe



Figure 55: Cassini - Huygens probe

### 7.5.9. Landing probe

There is a so-called landing probe, and it is one of the spacecraft that is designed to survive when it lands on the surface of planets or moons, and after that the landing probe collects scientific data on that planet or moon that is on its surface and sends it to the headquarters on Earth. In a direct or indirect way, the indirect way is done by a second spacecraft in the same orbit, and in this way the moon and the planet Mars in particular were discovered, and by using this type of probes, for example the Server probe that landed on the surface of the moon and two other probes for the Viking program. And there is also the Phoenix probe, which all landed on the surface of Mars, and the "easy landing" is the main obstacle that designers suffer, especially with this type of probes (landing probe). There may be a solution to this problem, such as using the parachute that opens when the probe descends, such as the Huygens probe. When landing on the moon of Tian, but this method of landing requires the availability of a sufficiently thick atmosphere, and as a result, this method of landing becomes unsuitable for the planet Mars.

Although the use of the parachute landing method reduces the mass of the probe and is characterized by its cost, but when compared with other methods, this landing does not make the landing of the probe controlled.

Rocket engines are used to land the space probe on the surface of celestial bodies that do not have an atmosphere, with the aim of gradually reducing the speed of the spacecraft.



Figure 56: The surveyor landing probes that landed on the moon

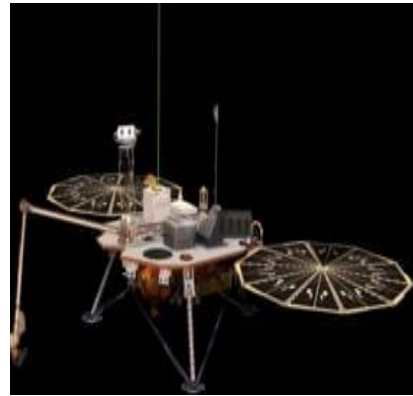


Figure 57: phoenix space probe

### 7.5.10. The Rover

It is a space probe designed to be suitable for movement over the surface of planets and celestial bodies, and this is in order to study planets at points of scientific interest. This type of probes is powered by solar panels or from a generator from the heat caused by the decay of the radiator. The distance between the rover and the command center is not important and the probe can be controlled remotely.



Figure 58: The soviet lunar rover, Lunokhod



Figure 59: The curiosoty rover probe

### 7.5.11. Technology viewer

It is a spacecraft whose primary goal is to validate a new technology such as the Deep Space Probe 1, whose main purpose was to verify the validity of the possibility of using ion thrust for interplanetary missions.

### 7.5.12. Communications satellites

They are compounds whose primary mission is to transmit communications between the surface of a celestial body and the Earth. These compounds have diuretics that have special scientific purposes.

### 7.5.13. Return mission to Earth samples

This type is intended to bring samples that have been collected from celestial bodies (comet, asteroid, planet) or to collect particles that are between planets or between stars and are sent to Earth for analysis. This type of probes is more accurate than the Mars Curiosity rover, as the samples return to The Earth will analyze more accurately and efficiently. These probes can also modify the experimental conditions due to the advancement of technology and scientific research

However, this type of task may involve many difficulties, and the most prominent of these difficulties is the probe's automatic landing on a celestial body on which there is no gravity, and it also has the ability to Landing and launching, and probes of this type must have the ability to re-enter the Earth's atmosphere, and in order to be able to enter, they must have high speed and great accuracy.



Figure 60: A model of soviet lunar probe

A model of the Soviet lunar probe, Luna 16, the first probe to land on the surface of the moon and be able to return to Earth, bringing with it samples of lunar soil.

### 7.5.14. Hacker

The penetrator or penetrator is one of the spaceships that have been specially designed to penetrate the territory of celestial bodies such as planets, asteroids, comets and satellites, and this is done using high speed and this speed is subject to slowing down from a lot of methodology and by a small transmitter the information that is collected is transmitted by the scientific

devices on board the ship to the mother orbital ship.



Figure 61: Deep space penetrator2

Avoiding carrying parachutes and missiles important for easy landing is the principle of the penetrator's work, thus reducing a large part of the landing weight, and at the same time the

penetrator must have the ability to withstand the impact that results from restrictions on the mass, the structure and the design of the payload.

## **7.6. Space robots**

With the passage of days, robots became an important role in our life, and with the passage of years, they had an important role in space, and they became used in the discovery and mystery detection in some planets.

### **7.6.1. What are space robots?**

and robots can be defined as follows:

A robot is a self-controlled device that its components is electronic, electrical or mechanical units.

robots are unlike people, they never get tired and they can do tasks in airless conditions

### **7.6.2. The role of space robots**

The role of robots is a contribution to discovering planets and celestial bodies as they are not affected by low pressure, high or low gravity, or lack of air.

And robotic arms are used to move large objectives in space such as the “canadarm” “robotic arm.



### 7.6.3. How are robots used in space exploration?

In the first sending into space, dogs and monkeys were to carry out missions and conduct experiments to learn more about space and the exoplanets and their conditions.

as robotic technology has evolved a lot of experiments and missions have been mandated to robots instead of living beings.

While the feet of humans have settled on the moon the exploration operations carried out by robots in space are the basis of scientific knowledge of conditions on planets, including Mars, Venus, Titan and Jupiter, and technology is the means that gradually led to faster access to space, and also enabled humans to obtain more data about conditions in space.

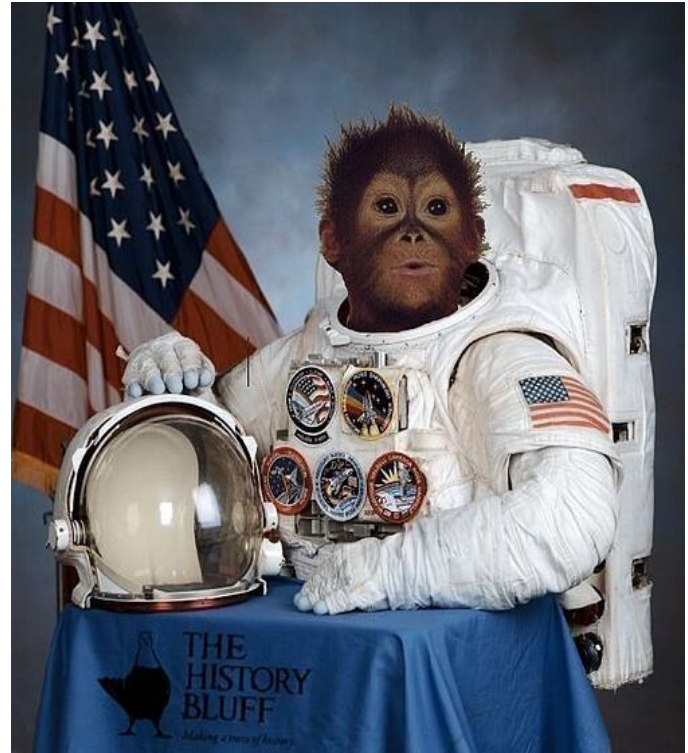


Figure 62: The role of monkey in exploration

### 7.6.4. The types of robots

In our time there are two types of space robots:

The first is the ROV (Remotely Operated Vehicle)

The second is the RMS (Remote Manipulator System)

- ROV (Remotely Operated Vehicle)

Often times, ROVs are used in nuclear facilities for inspection and repair in high-risk areas for astronauts, and ROVs are also used in police bomb squads. To remove potentially hazardous materials, this species is of great importance for space researchers in particular to discover terrain in space.

The ROV can be considered an unmanned spacecraft that is still in flight, or a landing craft connected to an extraterrestrial object and operating from a fixed location or a vehicle that can move over the terrain once it lands. It is not possible to determine when the spacecraft evolved from a simple robot to a Rove.

- **RMS (Remote Manipulator System)**

This type (RSM) is common in automatic devices similar to a crane or robotic arm, and this type of robots can be used in industry and manufacturing. With an angle of 360 degrees in the wrist, which a person cannot do, the robot arms are of two types, one of which is computer-based and programmed for a specific function. The other requires that the person actually control the strength and movement of the arm to perform the task. Whereas these arms carried out a number of tasks belonging to NASA, which work as a gladiator and a remote collection device, as well as a GPS and mooring device for astronauts who carry out missions in space.

### **7.6.5. Examples of space robots.**

- **Space robot: Dextre**

Dextre is co-called the special purpose dexterous manipulator (SPDM) .dextre also can be telemanipulator and it consider a part of the Mobile servicing system on the international space station (ISS) .dextre is equipped with two arm manage him to do repairs .its launch date is 11-2008 on mission sta-123 and dextre is controlled by the ground and dextre can do missions while astronauts sleep .the purpose of dextre is to deal with orbital replacement units as the international space station inside it there are a lot of spares.



Figure 63: Space robot Dextre

Dextre has ability to carry out them to and from worksites and install them when malfunctions occur Dexter's invention eased the burden on the astronauts as they were the ones who repaired faults by walking in space.

- **Valkyrie: space robot**

Also called RS.

It is a report that was designed and built by NASA to be a human report, and this report is characterized by strength and accuracy in work as it works in deteriorating engineering environments and many modifications and improvements have been introduced and redesigned to improve its performance, improve sensors and strengthen them to increase the ability to cognition.



Figure 64: Valkyrie robot

- Kirobo: space robot

the university of tokyo and tomotaka takahashi developed kirobo to accompany koichi wakata Who is considered the first commander of the International Space Station.

kirobo reached the international space station on 10-2013 on JAXA's H-II Transfer Vehicle Kounotori.

the mission of development kirobo done by a collaborative effort between dentsu and the university of tokyo research center for advanced science and technology.



Figure 65: Kirobo

- ALLA: space robot

Someday, he will join the humanoid NASA Robotics Robot in a female form to assist the human astronauts on board the International Space Station.

alla is a german robot that have a female figure, head molded into the shape of modern female hairstyle and large dark eyes.



Figure 66: ALLA robot

## **Conclusion**

In conclusion, the reader should understand the technology which occupies all aspects of life including the outside world (Space). Should also understand the forms of technology that contributes to space, including satellites, Robots, space probe, Starlink, SpaceX, and how space technology benefits the earth including heart disease, preventing bone loss, eyesight correction, Nutrition, equilibrium and movement.

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