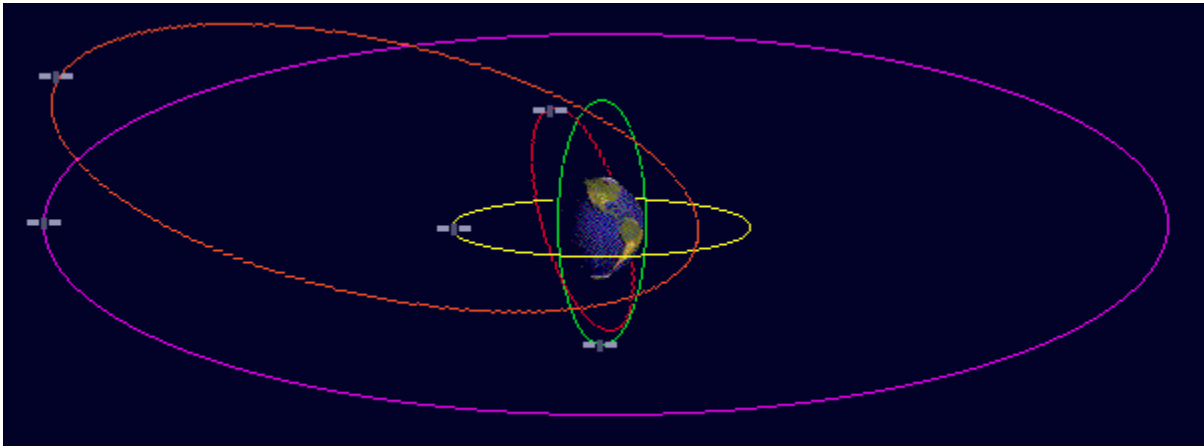


Report
On
Satellite Communications
(Geostationary Orbit, Medium Earth Orbit, Low Earth Orbit Satellites)



Contents	Page No
Summary	3
1.Introduction.	4
2.Types of satellites.	5
2.1 Geostationary Orbit satellite	5-6
2.2 Medium Earth Orbit satellites	6-7
2.3 Low Earth Orbit satellites.	7-8
3.Social implications on satellites.	9
4.Comparisons between satellites.	10
5.References.	10

Summary

In order to that the rapid growth of technology Satellite Communication has become the accepted important part and the importance of satellite has steadily increased. So this report comprises the overview of satellite communications ,the types of the satellite and its social implications.

Satellite is defined as something that's orbiting or rouding something else these may be natural or man-made.The first idea about satellite was proposed by Arthur C.Clarke in 1945 then the first satellite was launched by Russians in 1957.Noways there are many powerful satellites are launched by different countries of the world.

It must be considered that the velocity when launching a satellite to blance the earth's gravity. When the transmissionmessage sent to the satellite from the earth is uplinked and transmitted to earth is downlinked. These are powered by rechargeable batteries,fuel cells and nuclear energy.

Satellites are divided into three types by considering the space segments such as Geostationary Orbit(GSO) Satellites,Medium Earth Orbits(MEO) Satellites and Low Earth Orbit(LEO) Satellites.GSO satellites are located in the distance of 35,786 km from the earth surface and these are widely used now but its propagation latency (250-280 ms)is undesirable.MEO satellite is 3000-35786 km from the earth and required to be used in order to offer constant coverage.LEO satellites are in the distance of 200-3000km from the earth surface and its propagation delay (20-25 ms)is desirable compared with GSO and MEO. So every types includes some pros and cons.

Although satellites impact on all the fields and everyday life especially the uses of satellites are in the telecommunications such as international calls, cellular phone calls,TV,Radio,Fax and so on.Navigation satellites are used for the navigator in the domestic vehicles. Weather reach centres use the satellites for predict the weather and space researches are also researched by the satellites so these are able to make the maps of the planets and others. Overall it is understandable that the improvements and advantages of the satellite is obvious and significant.

Introduction

It stands to reason that Communications Technologies have been modernized in many ways in this modern era. According to that Satellite Communication has become the accepted important part of today's technology and the importance of satellite has steadily increased. Although the purpose of this report is to provide, the three main types(GSO,MEO,LEO Satellites) of satellites, it includes the basic terms of satellite, comparisons and the impacts of satellites as well.

Approaching as a definition of satellite is that an any object, whichever naturally or manmade occurring, that orbits or goes around something else. For instance, The Earth orbits around the sun and is a satellite of the sun and the moon orbits around globe and is a satellite of earth. Other examples of obviously occurring satellites include asteroids, comets, stars, and other planets. They are used for several purposes from providing link to long- distance telecommunications, to direct broadcast radio and television gathering weather and geological information as well as a host of other facilities.

As far as the historical developments are concerned the idea of Satellite Communication was first proposed by Arthur C.Clarke in an article in the British magazine –“Wireless World” in 1945, the first satellite was launched by Russians on the 4th of October 1957,named *Sputnik*. It weighed over 80kg and placed into a low earth orbit, circling the earth every 96 minutes. Despite relatively the size was veryl size, people were able to see it on the earth with their naked eye.

Then as a result of the technological development the *Score* (the first telecommunications satellite) on the 18th of December1958 , *Echo1* in 1960,*Telstar1* in 1962,*Syncom1*,*Syncom2*(the first geostationary communication satellite) on the 26th of June 1963,*Echo2* in 1964 were launched by NASA these developments have been continuing up to now gradually.Nowadays there are more powerful latest satellites such as *COSMOS 2458*,*YAOGAN 6*,*SICRAL1B* and so on are launched by the different countries such as USA,Russia,China,India and etc.

A human made satellite is interconnected between the originating ground station and the destination ground station with the components of solar panels and antennas. The solar panels recharge many satellite batteries and some satellites have fuel cells ,some rely on nuclear energy. The messages sent to the satellite from a ground station are uplinked, the messages transmitted from the satellites to earth are down linked. The area of coverage of satellite is called the footprint. When a satellite is launched from the earth its velocity must be at 27,000 kmph because it is to balance the earth's gravity. Satellites are mainly circular orbits and the highly elliptical orbits.

2.Types of satellites.

According to the space segments satellites are classified into three types such as Geostationary Orbit(GSO) satellites,Medium Earth Orbit (MEO)satellites ,Low Earth Orbit (LEO)satellites.

2.1 Geostationary Orbit (GSO) Satellites

GSO satellites are placed in in a geostationary orbit that they remain stationary relative to a fixed spot on earth, that the satellite is 35,786 km(22,236.39 miles) above the equator, and its revolution around the earth is matched with the earth's rotation. Because of its angular velocity is equal to that of the earth, it appears fixed to an observer on the earth's surface, it means that providing continuous link between ground stations in its line of sight.and may serve as the repeater in the sky. This orbital pathway is called the Clarke Belt, in respect of Arthur C. Clarke.These are preferred for telecommunications.

GSO satellites are now widely used in the modern world. They go around the earth in 24 hours, the same time that it takes the earth to rotate once ,so they seem to us on earth to keep station at 35'786 km vertically above the same point on the earth's surface. The round trip propagation delay for GSO satellites links is 250ms-280 ms. Its high altitude allows each GSO satellite to cover about one third of the earth's surface, not including the polar areas. Three GSO satellites are sufficient for global coverage. This considerably simplifies the design and construction of antenna for direct broadcast satellites it means that people with dishes outside the house do not need to adjust them once they have been directed to the satellites. Even though it is always in view the satellite's axis inclination must be parallel to the equator,or the satellite will float north and south in a model, requiring the earth station antenna to shift to follow the satellite. A few specific communications satellites have been located in geostationary orbit. Because geostationary orbit is restricted to a scarcely bounded region above the earth's surface, it is suitable for the first area of space confronted by traffic jams.

Advantages of GSO Satellites .

GSO high points are that its satellites are geostationary,which means that the difficulties of inter-satellites communications are avoided.

They are available to all the earth stations within their shade 100% of the time. The shade of a satellite includes all earth stations that have a line-of-sight path to it and lie down within the radiation model of the satellite's antennas.

There is no require to switch from one satellite to another as they orbit overhead. Accordingly, there are no breaks in transmission as of the switching times

The Doppler's effect shift is negligible

Disadvantages of GSO Satellites

The rate of launching GSO satellite is high because of their high altitude and the natural signal dilapidation calls for large antennas and large transmission power for both the GSO satellite and ground terminals.

The problem arises due to the large propagation delay for GSO satellites links it is 250ms-280 ms, ,is caused by the high orbit. Applications, which depend on steady bandwidth, like multimedia will definitely be affected so this is adverse for real time traffic.

They require complicated and heavy force devices on board to keep them in a fixed orbit.

2.2Medium Earth Orbit(MEO)Satellites

MEO satellite is positioned 3000 km-35,786 km (1,864.11 miles-22,236.39 miles)above the earth surface. These type of satellites orbit higher than low earth orbit(LEO) satellites, but lesser than geostationary(GSO) satellites. The round trip propagation delay for MEO satellites links is110ms-130ms.

In a variety of patterns, these satellites make the trip around globe in anywhere from 2-12 hours, which provides better coverage to wider areas than that provided by LEOs.The first communications satellite, Telstar, was launched. In 1962. It was a medium earth orbit satellite intended to assist high-speed telephone signals, but some of the problematic aspects of a single MEO in space were learned by the scientists soon. It only provided transatlantic telephone signals for 20 minutes of each approximately 2.5 hours orbit. It was obvious that multiple MEOs required to be used in order to offer constant coverage.

Since then several companies have launched both LEOs and MEOs. It is needed about two dozen LEOs to provide constant coverage and fewer MEOs. . A MEO satellite may have a range of different orbits, as well as elliptical ones and may supply better generally coverage of satellite communications, if enough of them are in place and the orbit is quick. The coverage of earth surface is called a footprint, and MEO satellites usually are able to create a larger footprint as their different orbital patterns, and because they are higher than LEOs. A few MEO satellites orbit close to ideal circles, and then have stable altitude and travel at a steady speed. Other MEO

satellites rotate in stretched out orbits. Several MEO satellites, with orbits correctly matched, can supply worldwide wireless communication coverage. Because MEO satellites are nearer to the earth than geostationary satellites, earth-based transmitters with comparatively low power and modest-sized antennas can right to use the system.

Advantages of MEO Satellites

The atmosphere is thinner at high orbits so the MEO satellites experiences lower resistance with atmospheric molecules ,a detail that convert in to higher life times.

Relatively the foot print is increased because of its high orbit.

Disadvantages of MEO Satellites

Although not much higher than the LEO satellites the the round trip propagation delay or latency in MEO satellites is higher that is 110 ms-130 ms .

Even high orbits of MEO satellites is higher compared with the LEO satellites, fewer satellites are wanted to accomplish world wide coverage. A typical number is ten but the exact number depends on the orbit radius.

2.3 Low Earth Orbit (LEO) Satellites

LEO satellite is positioned 200 km-3000 km(124.27 miles-1,864.11 miles) above the earth surface. This type of satellite decreases transmission time, which is similar to that of a terrestrial link. A LEO can also be used to cover a polar region. Since does not appear stationary to earth station. However earth station wants an antenna assembling that will path the movement of the satellite. LEO satellites typically orbit in a circular pattern around the equator.

LEO satellites must move very quickly to oppose the pull of gravity about 17,000 miles per hour. Because LEO satellites can orbit the world in as little as 90 minutes. These satellite systems need a number of dozen satellites to offer coverage of the whole world.

LEO satellites are currently in commercial service, and their numbers are increasing. Depending on the height of the orbit, the systems are elected as “little LEO” or “big LEO.” The little LEO satellites is in an orbit that is about 780 km high and inclined 86.6° to the equator. The constellations are situated so that the orbital plane of one is 60° out of phase with the next. In this

way, the entire globe is covered. Big LEO systems use orbits a few thousand kilometers high, so less satellites are wanted for global coverage.

Advantages of LEO Satellites

LEO satellites can provide true global coverage and also use to cover polar region.

This allows for much a smaller amount of latency, which means that its propagation delay/latency is 20ms-25 ms from transmitter to receiver. At the lower end the delay is the order of optical fibre systems which offer the possibility of developing fibre optic-like satellite systems.

Lower path makes loss it probable to use hand-held terminals.

Disadvantages of LEO Satellites

The problem that these satellites have is that since they are not geostationary (they are frequently orbiting around the earth) they cannot talk constantly to that the same ground station. However this is defeated by using, inter-satellite communications. So the role together as a layer of coverage.

Al though the amount of atmosphere is far too little there is enough to place a small amount of pull on the satellites .Consequently, over time these satellites slow down and their orbits gradually decay,just put, the satellite slows down and this allows the control of gravity to pull the object towards the globe.So a large number of satellites are wanted.

Another disadvantage has to do with how fast a satellite in LEO goes around the Earth. As we can imagine, a satellite roving 18,000 miles per hour or faster does not spend for along over any one part of the Earth at a given time. So it is not suitable for the a weather satellites and the satellite visibility is the order of 10 minutes-180 minutes which necessitates.

Social implications on satellites

Nowadays satellites are used widely for variety of purposes and to fulfil number of roles in all fields. So the satellites are integrated with our everyday life and these are carried out by different types of satellites.

The widespread use of satellites is in communications, communication satellites are used for this. It means that it is difficult to go through a day without using these type of satellites at least once. When we make a long distance phone call, use a cellular phone, a fax machine, a pager, or listen to the radio, we probably used a communications satellite, either directly or indirectly. Therefore communications satellites allow radio, television, and telephone transmissions to be sent live anywhere in the world.

Navigational satellites are available at low cost enabling them to be used in domestic vehicles and in many other everyday applications as well as for very many professional and military uses. We can predict the weather anywhere in the earth any time of the day. The television stations that bear weather information all day long. In addition these satellites are able to detect the volcanic eruptions, amount of snow in winter, temperature of the sea, radiation and so on.

The next application is in Space exploration, Space exploration satellites are used for this. Space exploration satellites are liable for many of astronomy's most vital achievements. Jupiter's rings, for instance, were discovered by a space exploration satellite. Astronomy satellites are used to study mysterious phenomena, to make star maps and to take pictures of the planets in the solar system.

4.Comparisons between GSO,MEO and LEO satellites.

Parameters	GSO	MEO	LEO
Distance from the earth(km)	35,786	3000-35,786	200-3000
Round trip propagation latency (ms)	250-280	110-130	20-25
Transmitter power	Large	Medium	Small
Antenna size	Large	Medium	Small
Required numbers to cover the whole world(typically)	3	10	66
Covering polar region	No	No	Yes

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