

Pakistan India Space Program and the Satellite System

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ABSTRACT

The launch of sputnik is the initiation of space age and also the beginning of space race. During the cold war two strategic rivals (US-USSR) exploited the outer space for military purpose which started an intense space race for dominance and increased the probability that space would become an area of arm race between the major powers and perhaps a future field of contest. The strategic importance of space attracts India to utilize space for both civilian and military purposes. Indian strategic space programs always consider offensive towards China and Pakistan. Indian space capabilities and intention for develop ASAT technology is a new threat for the security of South Asia in general and particularly for Pakistan and further intense Asian space race. Pakistan started its space program in 1960 and still has not develop any technology that a harm or hurt the common heritage (space) of man. If India is going to develop ASAT technology in future, it will harm and destabilize the peace and security of South Asia and start arm space race that destroys the peace of this region.

Key Words: Pakistan, India, Space, Satellite, ASAT

Historical Background

The launch of sputnik demarked the beginning of the space age and also the beginning of the militarization of the outer space. During the Cold War, the two strategic competitors exploited the outer space for their military purposes, which initiated an intense space race, lasted till the end of it. Both superpowers continue to augment their war waging capability through Cold War, by developing their space assets for military purposes (Ahmad, 2015). Due to intense competition in space, the higher frontier became the area of conflict between the arch enemies. In fact rigorous R & D programs were initiated by the two sides to take the full advantage of the outer space. In doing so, satellites for photographic reconnaissance, surveillance, communication and intelligence were launched into the outer space (Mowthorpe, 2003). The major development in the militarization of space came under the President Reagan's period, when Strategic Defence Initiative was announced in 1983. This was the first step towards weaponizing the common heritage of the human beings. The global trends in the militarization of

outer space have also shown its implication on security of South Asia. China, under the consideration of security dilemma, has contributed its part in the militarization of space. As a result, India in collaboration with U.S is also crawling towards developing its space power, which has serious implications on the security of Pakistan. Therefore, the strategic competition among nations has resulted into their massive investment in the developing their space assets for military purposes (Seedhouse, 2010). The global trends in space militarization exerted by U.S and the Soviet Union, have changed the discourse of the weaponization of space and brought a paradigm shift in it. As space has become a fourth medium of warfare, the new plans from the major powers to utilize the outer space to dominant and to create their hegemony in the outer space, in the absence of an international agreement or a treaty, which criminalize the weaponization of outer space and led towards the deployment of weapons in outer space in near future. On a serious note, this will deteriorate the fragile peace in South Asia, as well as endanger the peace of the world (Sadeh, 2013).

The Beginning of Indian Space Program

Indian space program was different than other states; initially it started to counter different challenges. After the independence, India looked at the field of science and technology as a tool for socio-economic development and established the Department of Research and Department of Science (DR&DS) in 1948. At the same time the world saw, the powers started to develop nuclear weapons and established their own 'Research and Development' (R&D) Program. Super powers rivalry in space and the strategic importance of space really inspired the world and also attracted the third world's countries to develop their space programs (Pant, 2008).

Dr. Vikram Sarabahi, who is the founding father of Indian space program, returned to India and proposed the Indian Government to participate in the event. He showed deep interest in developing the Indian Space Science and successfully established the Physical Research Laboratory (PRL) during 1947. In 1962, Indian Government established, Indian National Committee for Space Research (INOSPAR) for the development of scientific research. Dr. Vikram became the member of 'Atomic Energy Commission' and started space activities under the Department. India started its space journey by establishing sounding rocket program in a church that was situated in a village called Thumba. In 1960, India became capable to launch its first rocket 'Rohini' 75 into outer space. After 3 years, in 1963, India launched first Sounding rocket Nike – Apache with the help of U.S and Russia. Both super powers, including France and UN supported, India, because the beginning of its program for socio-economic development of country. These powers were blessing for India to develop space program (Lele, 2013).

Indian space program can be better understood in three phases:

1. structure
2. design

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3. play

First phase highlighted the initial developments about building block, Second phase highlighted the mature approach of Indian Space Program to achieve the goals and bring country in real age of development and the last phase is about the leap frog in performance and entry among major space faring nations (Harvey, 2000).

Global trends in space militarization, revolution in military affairs (RMA) and the invention of new technologies changed the ideas of emerging powers and nations. In this context, India changed its all space policies and started to develop military use space satellites by arguing the need of hour. Now India, intent ended to become the regional hegemon and counter China with (ASAT) capabilities further triggered the Asian Space race that could harm the security of Asia in general and South Asia in particular. India planned to build (ASAT) capabilities and launching of Agni-V clearly showed its offensive behavior. Indian ICBM capabilities and planning in to install (ABM) System in South Asia is become the great threat for the security and stability of the region (Jaspal, 2012).

Earth Observing Satellites

India launched various earth-observing satellites into the outer space after the launch of Bhaskara-I in 1979. In the 1980s, Rohini (RS-D1), Bhaskara-II, Rohini (Rs-D2), IRA-1A, SROSS-2 were launched into space. Later on, in the 1990s, the Russian made VOSTOK space launch vehicle was used to send IRS-1B into space. Similarly, IRS-1E, IRSP2, IRS-IC, IRS-P3, IRS-ID, and IRS-P4 were all different earth observing satellites, which were sent into the outer space. India has launched various satellites and the latest successful flight was RISAT-1 on April 26, 2012 which can see through clouds and in pitch black darkness (Sachdeva, 2016).

Communication Satellites

The communication satellites are also used in boosting the command and control and India has launched its first communication satellite GSAT-1 in April 2001, using geo-synchronous Satellite Launch Vehicle (GSLV) form the Sriharikota Launch Centre. In fact, India launched GSAT-1, GSAT-2, GSAT-4, GSAT-5P, GSAT-8 in the past decades and more recently GSAT-12 on October 12, 2011 in the GEO. Similarly, satellites from INSAT-1A to INSAT-4B have also been sent into the outer space in different orbits (Pant, 2008).

Weather and Navigation Satellites

The RISAT-1 was India's first weather satellite which was also capable of giving pictures in the night, and especially in pitch-black conditions. RISAT-1, replaced the Canadian satellites used for weather update at night. India also plans to build an Indian Regional Navigation Satellite System (IRNSS), which will establish a

constellation of GEO and geo-synchronous (GSO) spacecraft over the Indian Ocean (Chandrashekar, 2015).

The Initiation of Pakistan's Space Program

Pakistan started its space program after the launch of Sputnik 1 and started its space research wing under the supervision of Pakistan Atomic Energy Commission (PEAC) in 1961. At the time of space race between USA and USSR, Pakistan also became the aspirant of space technology and established Pakistan Space and Upper Atmosphere Research Commission (SUPARCO) in 1961. It was the first step towards the space exploration. The Pakistan Space and Upper Atmosphere Research Commission (SUPARCO) initially worked on space exploration, space technology and Geographic Information System (GIS). Pakistan launched its first satellite, Rehbar1 with the help of NASA in 1961, from sonniani satellite and later, Rehbr2 in 1962 (Mehmud, 1989).

Pakistan space programs never count for military purpose, due to lack of resources and related technologies. Despite the lack of financial resources SUPARCO developed Hatf Ballistic Missile series in 1980, with the collaboration of Kuhata Research Laboratory (Mehmud, 1989). In 1995 SUPARCO worked with Dr. Samar Mubarak Mand for the development of Shaheen Missile System. Now, the current Indian Intention toward Pakistan and China forced both nations to build more friendly and strategic relations to counter India. In this context, Pakistan launched its first communication satellite PAKSAT-IR into geostationary Orbit with the help of China and showed its capacity to develop and send satellites into outer space for both commercial and military usage.

Now, Pakistan also stands with China, in the agenda of peaceful use of outer space. Pakistan military strategies to maintaining a credible minimum deterrence vis-a-vis India and planning has always been India centric, and India has always been Pakistan's major adversary. Although, the Indian advantageous position in the conventional weapons, which has created a huge disparity; but, the role of nuclear weapon, and possession of missile in both countries, also has made satellite. If India is able to develop its ASAT capability in future, then it will be destabilizing for the peace and stability in the region. It will start the new arms race in the region that is hostile towards fragile peace in South Asia (Jaspal, 2016).

Major Objective of Pakistan Space Program

- Human resources development
- Tele Medicines
- Remote Sensing (GIS)
- Communication satellites
- Peaceful use of Outer Space
- To support the UN and other nations agenda for peaceful use of space and stop the arm space race

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- To explore the space for socio-economic development

Pakistan Space ‘Vision 2040

In the 19th National Command Authority (NCA) a meeting chaired by Yousaf Raza Gillani on July 14, 2011, Pakistan Space Vision 2040 was announced to “bring the benefits of the full spectrum of space technology” to the people of Islamic Republic of Pakistan. Pakistan is planning to build its earth observation (remote sensing) satellites in future as well as its communication satellites in order to take the benefits of the outer space. In this regards, Pakistan has launched PAKSAT-1R in 2011 into the outer space in cooperation with China. In an interview with Ahmad Khan has rightly pointed that Pakistan has to develop its reconnaissance satellites that are “indispensable for its national security in the age of nuclear deterrence”. Now, it is the need of the hour for Pakistan to develop its navigation satellites, early warning satellites and reconnaissance satellites (Lele, 2013). Similarly to maintain a credible minimum deterrence in South Asia requires a “sufficient, survivable and operationally deployable nuclear forces, with robust command and control system and effective intelligence and early warning system”. For effective intelligence and early warning system, there is a need for a satellite system encompassing photographic reconnaissance and early warning satellites. With Chinese cooperation and Indian space ambitions, and Pakistan Space Vision 2040 indicates that sooner or later Pakistan will also enter into the club of space faring nation and enable it to “sustain its credibility of its nuclear deterrence and solidify its defensive fence (Lele, 2013).

The Space and the Satellites System

Types of Outer Space Orbits

The space orbit is the path of satellites revolving around the earth can be defined as regular and repeating path of a satellite or object in space moving around other objects or satellite. There are four types of earth orbits (Scott, 2005).

- a) Highly Elliptical Orbit
- b) High Earth Orbit
- c) Medium Earth Orbit
- d) Low Earth Orbit

Types of space orbit showed in next page figure.

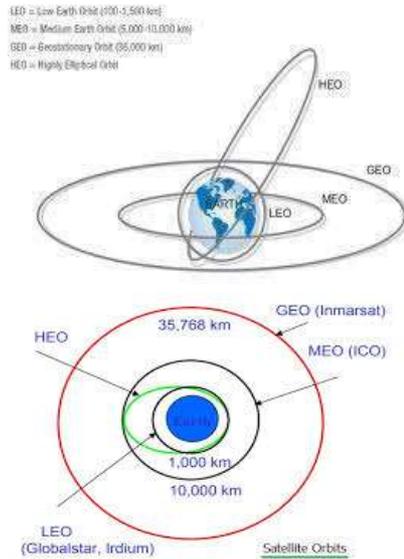


Figure 1.1: the space orbit
Source: <https://iasmania.com>

Low Earth Orbit (LEO)

The Low Earth Orbit (LEO) starts from the sea surface to an altitude of 2000 km in space and it has both military and commercial significance. Mostly, Reconnaissance, Intelligence and navigation satellites move around the earth with the almost speed of 26,000 km per 60 minutes in LEO (Fujikawa, 2018).

Medium Earth Orbit (MEO)

The Medium Earth Orbit (MEO) is the central part of orbit which starts from 2000 km to 42,146 km. In this orbit satellite provides better coverage than LEO. Navigation satellites mostly travel in this orbit and complete their maneuver in 2-12 hours (Scott, 2005).

Geo Stationary Orbit (GSO)

The Geo Stationary Orbit is highly important orbit which starts from approximately up to 36,000 km from the earth surface. In this orbit satellites travel from west to east over the equator and moves in the same direction and at the same rate Earth is rotating. From Earth, the satellites look like it is standing still since it is always above the same location. Mostly weather and communication satellite travel in this orbit with a pace of 11200 kph (Fujikawa, 2018).

The Satellites and the System

The human dream to journey in space and walk on moon, come to true with the revolution in technology. Today, satellites play a vital role in human life and the dependency on satellites increases day by day due to its dual use for both military and economic purposes. The history of satellites and space proved that powers used satellites for both civilian and military purposes. Today U.S and other great powers are more dependent on satellites that used in earth based armed forces and weapons. No one can deny the dual use and importance of satellites (Lele, 2013). There are different types of satellites, some major satellites are below.

- Early Warning Satellites
- Navigation Satellites
- Weather Satellites
- Communication Satellites
- Meteorological Satellites
- Nuclear Explosion Detection Satellites
- Photographic Reconnaissance Satellites
- Electronic Reconnaissance Satellites
- Ocean Surveillance Satellites
- Geodetic Satellites
- Remote Sensing Satellites
- Astronomy Satellites
- Space Exploration Satellites

Early Warning Satellites

In 1963, an early warning satellite was launched by U.S under the Program 461 with the objective to detect the missile launched from the USSR and the early warning to the weapon system for its interception. At the start, it was only able to detect only nine missiles launches. The payload on the satellites was an infrared sensor array and a telescope inside a turret attached on the nose the spacecraft. The best interception of the ballistic missile is in its boost phase, therefore the early warning satellites are considered the integral part of the Boost Surveillance and Tracking System (BSTS).

The reconnaissance satellites can also provide the same signal of the missile launch; but, the early warning satellites, which are carrying the infrared cameras are able to detect the “hot spot” made by the thrust or exhaust of the ICBMs launched from the land or the submarines. These satellites are mostly used for monitoring missile launches to ensure the treaty compliance, and can be used to locate the missile launching pad during the war or combat operations (Norris, 2008).

Communication Satellites

Then communication satellites are most widespread used among the other satellites, due to its dual use for military and civilian purposes and reduced the dependence on the ground based system, which proved to be expensive, vulnerable and increased the level of command and control. Other satellites, which are creating the date, a reliable and strong integrated communication system to communicate the data to the space or ground based systems is needed. These satellites provided the military need for strong communication to aid highly complex and sophisticated weapons. These satellites are classified into different fields according to their orbital characteristics (a) geosynchronous, (b) semi-synchronous or nonsynchronous mostly on operating frequencies, bandwidth or by the type of traffic and service provided (Maini, 2011).

Navigation Satellites

In 1964, the world’s first navigation system achieved the operational capability, became fully functional in 1968 in space which is called TRANSIT. These satellites provided a very high degree of positioning on the ground and send signals to ground forces to formulate their positions. The GLONASS and Global Positioning System (GPS) or NAVSTAR were originally designed to determine the position in three dimensions within 20 meters of any naval ship, aircraft, or even a foot soldier. These satellite systems were the first ever military application of the space and the aircrafts are using these satellites widely during the war to drop the bomb on their designated targets with a pinpoint accuracy. These satellites provided accurate position of rival or any target to forces and today great powers along other countries around the globe are now widely using these satellites for both civilian and military but its commercial benefits are vital (Norris, 2008).

Weather, Geodetic and Meteorological Satellites

These satellites have multiple features which cannot be ignored and also provided vital support in military applications both in peace and war. The meteorological satellites collected the information about missile route and weather and the target are weather. These satellites provide the real time weather analysis about the water

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vapors and cloud for the better photographic reconnaissance. The geodetic satellites provide information about the shape and size of the earth of shifting, earth's gravitational field, which give more accurate and precise mapping of the earth's surface and also for improving the accuracy of ballistic missiles (Maini, 2011).

Photographic Reconnaissance

The Photographic Reconnaissance satellites used to see and identify the military targets on the ground and capture the high-resolution images or pictures of the surface of the earth by using electro optical radars or cameras. They gathered information from these satellites to use for several purposes with the strong cameras for the better imaging of earth. These satellites used to observe and locate the strategic locations of the rivals and also used for the arms control verification. These satellites play a vital role in battlefield to provide the information about the enemies and denied territory like during the cold war both powers used CORONA (KEYHOLE satellite) and KOSMOS (Zenit-satellites) to collect the information and launched hundreds of satellites for photographic surveillance of each other. These satellites provide the military observation of a region or territory to locate the strategic location of the rivals or enemy forces. Today these satellites are the integral part of world armies that play a vital role in both peace and war time (Norris, 2008).

Electronic Reconnaissance (ELINT)

These satellites are launched in space for electronic intelligence gathering to detect the minor radio signals produced by the rival's military activities. The main objective of these satellites is to estimate the deployment and readiness of the enemy's strategic activities on the ground. These satellites are also spy satellites which can also be used to corrupt or disturb the enemy communication, radar and electronic system. These satellites not only provided information about the missile testing, radars and other communication system but also determined the distinctiveness of the signals for the better battlefield management (Norris, 2008).

Nuclear Explosion Detection

The first space nuclear surveillance system was made Vela Hotel to detect the post explosion; the primary task was to monitor the compliance with the Nuclear Test Ban Treaty. For this purpose nuclear surveillance sensors were fitted into the satellites to assess the bomb damaged area and collecting the date regarding the yield of the nuclear bomb, damage, and nuclear bursts (Maini, 2011).

Ocean Surveillance

These satellites initially used by both U.S and USSR for surveillance of the oceans and contain same technology used in the ELINT satellites. These oceanographic satellites are used to detect the naval ship and deep under water submarine. Today it is very important in the peace and war time and because many countries like U.S, Russia, and China including other great powers have nuclear capable naval ships as well as the nuclear capable submarines and that submarines are equipped with the ICBMs with nuclear warheads. These satellites are able to determine the height of the waves, the strength and direction of the ocean waves, sea salinity and coastal features which can be obtained by space based oceanographic sensors, which can give better accuracy of the missiles launched from the submarine (SLBMs) (Maini, 2011).

Conclusion

The human dream to fly or journey in the space began with the discovery of rockets. After the end of World War 2, both powers captured German V-2 rocket technology and started to develop V-2 rocket advance technology in their indigenous space program. Which was the first global space race. During the cold war both powers started to enhance their space capabilities for the survival and security with the ultimate goal of hegemony. The big powers, rivalry in space with advance technologies attract other nations to develop space capabilities like China, India and Pakistan.

In sum, the motivation behind the space program of U.S and USSR was hegemony, and establishing reconnaissance communication and surveillance (IRS) to dominate the space, while the motive behind China, Pakistan and India is to gain economic and scientific development.

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