INDIAN SPACE EXPLORATION

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PREFACE

This report deals with the activities and achievement of The Indian space research organisation in the space exploration which was established on August 15 1969.

Subject matter of this report has been elaborated with simple words and lucid. Tables, figures have been given to facilitate under – standing.

I gave my complete effort to make it valuable, useful and enrich it with my views so that it give complete sense and benefit to readers.

ACKNOWLEDGEMENT

I would like to express my special thanks of gratitude to my subject teacher of soft skill development miss nirmala kaur for their able guidance and support in completing my Project.

Then I would like to thank my parents and friends who have helped me with their valuable suggestions and guidance has been helpful in various phases of completion of the project.

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ABSTRACT

India decided to go to space when Indian National Committee for Space Research (INCOSPAR) was set up by the Government of India in 1962. With the visionary Dr Vikram Sarabhai at its helm, INCOSPAR set up the Thumba Equatorial Rocket Launching Station (TERLS) in Thiruvananthapuram for upper atmospheric research.

Indian Space Research Organisation, formed in 1969, superseded the erstwhile INCOSPAR. Vikram Sarabhai, having identified the role and importance of space technology in a Nation's development, provided ISRO the necessary direction to function as an agent of development. ISRO then embarked on its mission to provide the Nation space based services and to develop the technologies to achieve the same independently.

Throughout the years, ISRO has upheld its mission of bringing space to the service of the common man, to the service of the Nation. In the process, it has become one of the six largest space agencies in the world. ISRO maintains one of the largest fleet of communication satellites (INSAT) and remote sensing (IRS) satellites, that cater to the ever growing demand for fast and reliable communication and earth observation respectively. ISRO develops and delivers application specific satellite products and tools to the Nation: broadcasts, communications, weather forecasts, disaster management tools, Geographic Information Systems, cartography, navigation, telemedicine, dedicated distance education satellites being some of them.

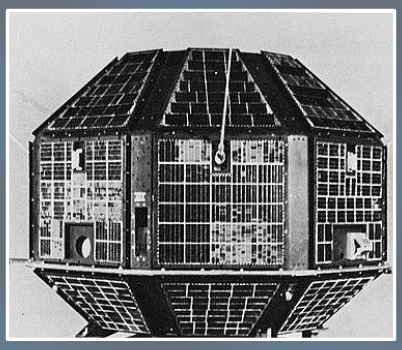
INTRODUCTION

The Indian Space Research Organisation[a] (ISRO /ˈɪsroʊ/) is the national space agency of the Republic of India, headquartered in Bengaluru. It operates under Department of Space (DoS) which is directly overseen by the prime minister of India while chairman of ISRO acts as executive of DoS as well. ISRO is the primary agency in India to perform tasks related to space based applications, space exploration and development of related technologies.[6] It is one of six government space agencies in the world which possess full launch capabilities, deploy cryogenic engines, launch extraterrestrial missions and operate large fleets of artificial satellites

ISRO built India's first satellite, Aryabhata, which was launched by the Soviet Union on 19 April 1975.[15] It was named after the mathematician Aryabhata. In 1980, Rohini became the first satellite to be placed in orbit by an Indian-made launch vehicle, SLV-3. ISRO subsequently developed two other rockets: the Polar Satellite Launch Vehicle (PSLV) for launching satellites into polar orbits and the Geosynchronous Satellite Launch Vehicle (GSLV) for placing satellites into geostationary orbits. These rockets have launched numerous communications satellites and Earth observation satellites. Satellite navigation systems like GAGAN and IRNSS have been deployed. In January 2014, ISRO used an indigenous cryogenic engine CE-7.5 in a GSLV-D5 launch of the GSAT-14.

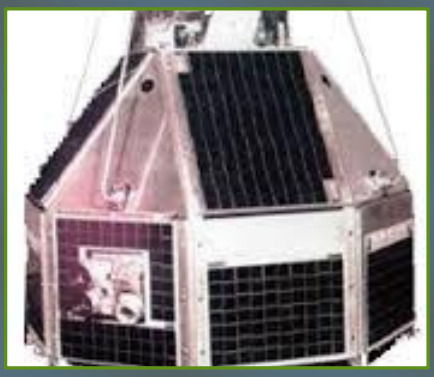
ISRO sent a lunar orbiter, Chandrayaan-1, on 22 October 2008, which discovered lunar water in the form of ice,[18] and the Mars Orbiter Mission, on 5 November 2013, which entered Mars orbit on 24 September 2014, making India the first nation to succeed on its maiden attempt to Mars, as well as the first space agency in Asia to reach Mars orbit.[19] On 18 June 2016, ISRO launched twenty satellites in a single vehicle,[20] and on 15 February 2017, ISRO launched one hundred and four satellites in a single rocket (PSLV-C37), a world record.[21][22] ISRO launched its heaviest rocket, Geosynchronous Satellite Launch Vehicle-Mark III (GSLV-Mk III), on 5 June 2017 and placed a communications satellite GSAT-19 in orbit. With this launch, ISRO became capable of launching 4-tonne heavy satellites into GTO. On 22 July 2019, ISRO launched its second lunar mission Chandrayaan-2 to study the lunar geology and the distribution of lunar water.

INDIAN SATELLITE AND LAUNCH VEHICAL



ARYABHATA

Aryabhata was India's first satellite. It was launched by India on 19 April 1975[2] from Kapustin Yar, a Russian rocket launch and development site in Astrakhan Oblast using a Kosmos-3M launch vehicle. It was built by the Indian Space Research Organisation.



ROHINI

Rohini is a series of satellites launched by the Indian Space Research Organisation (ISRO). The Rohini series consisted of four satellites, each of which was launched by the Satellite Launch Vehicle (SLV)[1] and three of which made it successfully

SLV-3

The Satellite Launch Vehicle or SLV was a small-lift launch vehicle project started in the early 1970s by the Indian Space Research Organisation to develop the technology needed to launch satellites. SLV was intended to reach a height of 400 kilometres (250 mi) and carry a payload of 40 kg (88 lb).[2] The first experimental flight of SLV-3, in August 1979, was a failure.[3] The first successful launch took place on 18 July, 1980.

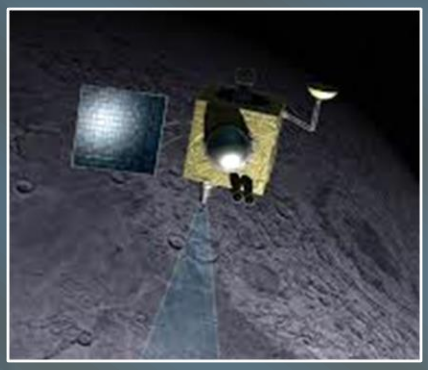
PSLV

The Polar Satellite Launch Vehicle (PSLV) is an expendable medium -lift launch vehicle designed and operated by the Indian Space Research Organisation (ISRO). It was developed to allow India to launch its Indian Remote Sensing (IRS)

GSLV

Geosynchronous Satellite Launch Vehicle (GSLV) is an expendable launch system operated by the Indian Space Research Organisation (ISRO). GSLV was used in thirteen launches from 2001 to 2018, with more launches planned. Even though GSLV Mark III shares the name, it is an entirely different launch vehicle.

CHANDRAYAAN-1



Chandrayaan-1 was the first Indian lunar probe under Chandrayaan program. It was launched by the Indian Space Research Organisation in October 2008 , and operated until August 2009. The mission included a lunar orbiter and an impactor. India launched the spacecraft using a PSLV-XL rocket on 22 October 2008 at 00:52 UTC from Satish Dhawan Space Centre, at Sriharikota , Andhra Pradesh.

CHANDRAYAAN-2

Chandrayaan-2 is the second lunar exploration mission developed by the Indian Space Research Organisation (ISRO), after Chandrayaan-1. As of September 2019, it consists of a lunar orbiter, and also included the Vikram lander, and the Pragyan lunar rover, all of which were developed in India.

PSLV-C37

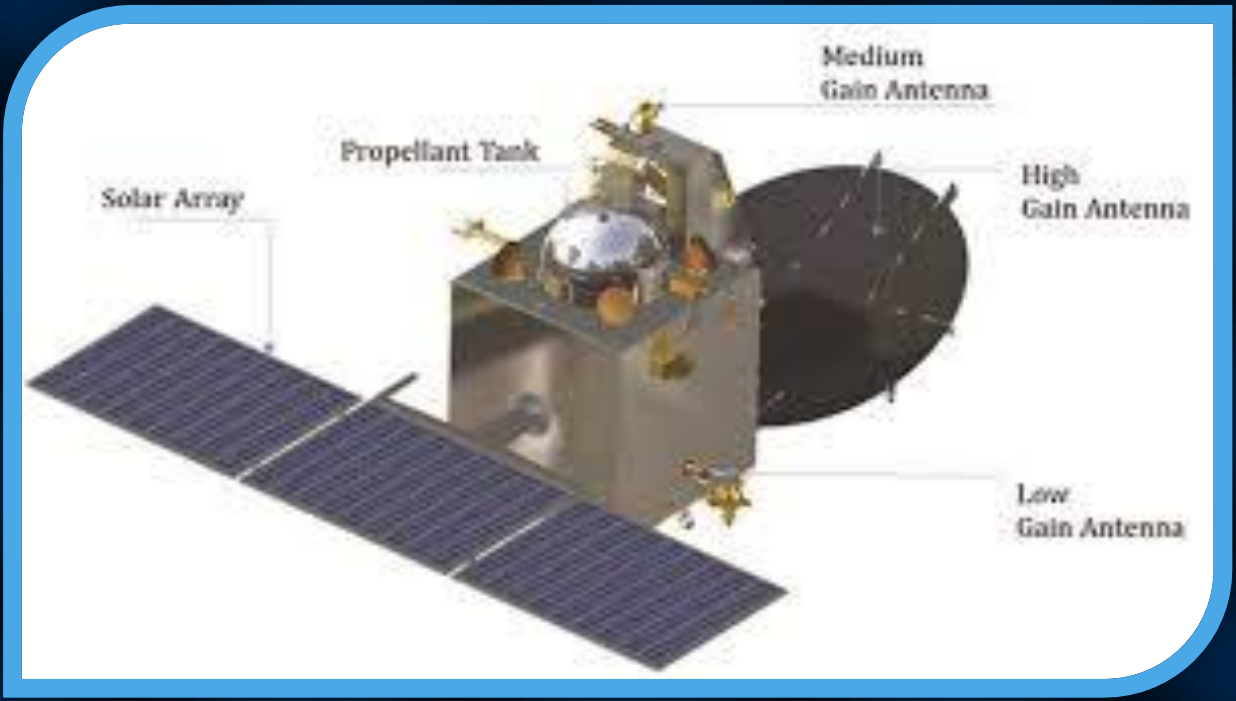
PSLV-C37 was launched from the First Launch Pad of Satish Dhawan Space Centre in Sriharikota at 09:28 IST on 15 February 2017. It was the 39th flight of the PSLV and the sixteenth in the XL configuration.[1] It carried a total of 104 satellites including the primary payload Cartosat-2D.[2][3][4] The launcher started placing the satellites into polar Sun-synchronous orbits one after another after a flight of 16 minutes and 48 seconds.[2][5] It first ejected the satellite Cartosat-2D at an altitude of approximately 510 kilometres (320 mi), with 97.46 degrees inclination,[1] followed by the two ISRO nanosatellites INS-1A and INS-1B.[2][5] It then took 11 minutes for PSLV C-37 to place the remaining 101 "co-passenger" satellites into their intended orbits.[4]

Soon after separation from the launch vehicle, the two solar arrays on board the Cartosat-2D satellite were automatically deployed. Afterwards, ISRO's Telemetry, Tracking and Command Network at Bengaluru took control of the satellite. "In the coming days, the satellite will be brought to its final operational configuration following which it will begin to provide remote sensing services using its panchromatic (black and white) and multispectral (colour) cameras," an ISRO statement read. The mission lasted 29 minutes.[5][1][4]

With this launch, ISRO created a new world record for the largest number of satellites ever launched on a single rocket, surpassing the previous record of Russia, which in 2014 launched 37 satellites using Dnepr rocket.[6][7][8]

Originally, PSLV-C37 was set to launch on 27 January 2017 with 83 satellites. With the addition of twenty more satellites to the payload, the schedule was changed to 15 February 2017.

MANGAKYAAN



The Mars Orbiter Mission (MOM), also called Mangalyaan ("Mars-craft", from Sanskrit: मंगल mangala, "Mars" and यान yāna, "craft, vehicle"),[9][10] is a space probe orbiting Mars since 24 September 2014. It was launched on 5 November 2013 by the Indian Space Research Organisation (ISRO).[11][12][13][14] It is India's first interplanetary mission[15] and it made it the fourth space agency to reach Mars, after Roscosmos, NASA, and the European Space Agency.[16][17] It made India the first Asian nation to reach Martian orbit and the first nation in the world to do so on its maiden attempt.[18][19][20][21]

The Mars Orbiter Mission probe lifted-off from the First Launch Pad at Satish Dhawan Space Centre (Sriharikota Range SHAR), Andhra Pradesh, using a Polar Satellite Launch Vehicle (PSLV) rocket C25 at 09:08 UTC on 5 November 2013.[22] The launch window was approximately 20 days long and started on 28 October 2013.[5] The MOM probe spent about a month in Earth orbit, where it made a series of seven apogee-raising orbital manoeuvres before trans-Mars injection on 30 November 2013 (UTC).[23] After a 298-day transit to Mars, it was put into Mars orbit on 24 September 2014.

The mission is a "technology demonstrator" project to develop the technologies for designing, planning, management, and operations of an interplanetary mission.It carries five scientific instruments. The spacecraft is currently being monitored from the Spacecraft Control Centre at ISRO Telemetry, Tracking and Command Network (ISTRAC) in Bengaluru with support from the Indian Deep Space Network (IDSN) antennae at Bengaluru, Karnataka.

Scientific objectives

The scientific objectives deal with the following major aspects:

Exploration of Mars surface features by studying the morphology, topography and mineralogy

Study the constituents of Martian atmosphere including methane and CO2 using remote sensing techniques

Study the dynamics of the upper atmosphere of Mars, effects of solar wind and radiation and the escape of volatiles to outer space

The mission would also provide multiple opportunities to observe the Martian moon Photos and also offer an opportunity to identify and re-estimate the orbits of asteroids seen during the Martian Transfer Trajectory.

INFORMATION ON SOME INDIAN SATELLITES

THE INSAT SERIES

The Indian National Satellite System (INSAT) is a series of multipurpose geostationary satellites built and launched by ISRO to satisfy the telecommunications, broadcasting, meteorology and search-and-rescue needs of India. Commissioned in 1983, INSAT is the largest domestic communication system in the Asia-Pacific Region. It is a joint venture of the Department of Space, Department of Telecommunications, India Meteorological Department, All India Radio and Doordarshan. The overall coordination and management of INSAT system rests with the Secretary-level INSAT Coordination Committee.

THE IRS SERIES

The Indian Remote Sensing satellites (IRS) are a series of Earth observation satellites, built, launched and maintained by ISRO. The IRS series provides remote sensing services to the country and is the largest collection of remote sensing satellites for civilian use in operation today in the world. All the satellites are placed in polar Sun-synchronous orbit and provide data in a variety of spatial, spectral and temporal resolutions to enable several programmes to be undertaken relevant to national development. The initial versions are composed of the 1 (A, B, C, D) nomenclature. The later versions are named based on their area of application including OceanSat, CartoSat, ResourceSat.

RADAR IMAGING SATELLITES

ISRO currently operates three Radar Imaging Satellites (RISAT). RISAT-1 was launched from Sriharikota Spaceport on 26 April 2012 on board a PSLV. RISAT-1 carries a C band synthetic-aperture radar (SAR) payload, operating in a multi-polarisation and multi-resolution mode and can provide images with coarse, fine and high spatial resolutions.[81] RISAT-2 which was launched in 2009 due to delay with the indigenously developed C band SAR for RISAT-1. The X-band SAR used by RISAT-2 was obtained from IAI in return for launch services for TecSAR satellite.[82] PSLV-C46 launched the third satellite RISAT-2B intended to replace RISAT-2, on 22 May 2019 at 0000 (UTC) from Satish Dhawan Space Centre with an indigenously developed Synthetic Aperture Radar (SAR) operating in X Band.[83] This will be followed by a new series of high-resolution optical surveillance satellites called Cartosat-3 series.

OTHER SATELLITES

ISRO has also launched a set of experimental geostationary satellites known as the GSAT series. Kalpana-1, ISRO's first dedicated meteorological satellite,[85] was launched on a Polar Satellite Launch Vehicle on 12 September 2002.[86] The satellite was originally known as MetSat-1.[87] In February 2003 it was renamed to Kalpana-1 by the Indian prime minister Atal Bihari Vajpayee in memory of Kalpana Chawla – a NASA astronaut of Indian origin who perished in the Space Shuttle Columbia disaster.

ISRO also launched the Indo-French satellite SARAL on 25 February 2013. SARAL (or "Satellite with ARgos and AltiKa") is

a cooperative altimetry technology mission. It is being used for monitoring the oceans' surface and sea levels. AltiKa measures ocean surface topography with an accuracy of 8 mm, against 2.5 cm on average using altimeters, and with a spatial resolution of 2 km.[88][89]

In June 2014, ISRO launched French Earth Observation Satellite SPOT-7 (mass 714 kg) along with Singapore's first nano satellite VELOX-I, Canada's satellite CAN-X5, Germany's satellite AISAT, via the PSLV-C23 launch vehicle. It was ISRO's 4th commercial launch.

SOUTH ASIA SATELLITE

The South Asia Satellite (GSAT-9) is a geosynchronous communications satellite by ISRO for the South Asian Association for Regional Cooperation (SAARC) region. The satellite was launched on 5 May 2017. During the 18th SAARC summit held in Nepal in 2014, Indian prime minister Narendra Modi mooted the idea of a satellite serving the needs of SAARC member nations, part of his 'neighbourhood first' policy. One month after sworn in as the prime minister of India, in June 2014 Modi asked ISRO to develop a SAARC satellite, which can be dedicated as a 'gift' to the neighbours.

It is a satellite for the SAARC region with 12 Ku-band transponders (36 MHz each) and launch using the Indian Geosynchronous Satellite Launch Vehicle GSLV Mk-II. The total cost of launching the satellite is estimated to be about ₹2,350,000,000 (₹2.35 billion). The cost associated with the launch was met by the Government of India.

GAGAN SATELLITE NAVIGATION SYSTEM

The Ministry of Civil Aviation has decided to implement an indigenous Satellite-Based Regional GPS Augmentation System also known as Space-Based Augmentation System (SBAS) as part of the Satellite-Based Communications, Navigation, Surveillance and Air Traffic Management plan for civil aviation. The Indian SBAS system has been given an acronym GAGAN – GPS Aided GEO Augmented Navigation. A national plan for satellite navigation including implementation of Technology Demonstration System over the Indian air space as a proof of concept has been prepared jointly by Airports Authority of India and ISRO. Technology Demonstration System was completed during 2007 by installing eight Indian Reference Stations at eight Indian airports and linked to the Master Control Centre located near Bangalore.

IRNSS SATELLITE NAVIGATION SYSTEM (NAVIC)

IRNSS with an operational name NavIC is an independent regional navigation satellite system developed by India. It is designed to provide accurate position information service to users in India as well as the region extending up to 1500 km from its borders, which is its primary service area. IRNSS provides two types of services, namely, Standard Positioning Service (SPS) and Restricted Service (RS) and provides a position accuracy of better than 20 m in the primary service area.[92] It is an autonomous regional satellite navigation system being developed by Indian Space Research Organisation, which is under total control of Indian government. The requirement of such a navigation system is driven by the fact that access to global navigation systems like GPS is not guaranteed in hostile situations. ISRO initially planned to launch the constellation of satellites between 2012 and 2014 but the project got delayed by nearly two years.

CONCLUSION

I. India being the fast growing economy in world have most of the things in its favour let it be economy, politics, administration, space etc.
II. As ISRO is making major achievement and it will make much more in days to come and for letting it be need more autonomy, more finance(as space research finance had keen reduced in budget 2019-20),more recruitment and a strong political will.
III. I firmly believe that space program should be supported financially as there is need to get together the whole world to improve the communication and fight against the environmental problems.

REFERENCES

I. https://en.wikipedia.org/wiki/Indian_Space_Research_Organisation#Launch_vehicles
II. https://www.isro.gov.in/
III. https://www.facebook.com/ISRO/
IV. https://www.nationalgeographic.com/science/2018/11/dear-mangalyaan-mars-orbiter-mission-india-space/
V. https://www.vssc.gov.in/VSSC/index.php/launchers/gslv-mkiii
VI. https://www.thegeospatial.in/know-about-chandrayaan-2-mission-gslv-mk3
VII. https://www.space.com/40114-chandrayaan-1.html