Indian Remote Sensing Satellite System

The space rendezvous of India started under the aegis of Department of space, GOI as "Indian Space Research Organisation (ISRO)" which was founded in 1969 to develop an independent indigenous Indian space program with its headquarter at Bengaluru. ISRO's chief executive is designated as chairman, who is also chairman of the Indian government's Space Commission and the secretary of the Department of Space. The Indian Space Research Organisation (ISRO) operates through a network of centres. Satellite sensors and payloads/platforms are developed at the Space Applications Centre in Ahmadabad. Satellites are designed, developed, assembled, and tested at the U R Rao Satellite Centre (formerly known as the ISRO Satellite Centre) in Bangalore. Launch vehicles are developed at the Vikram Sarabhai Space Centre in Thiruvananthapuram. Launches take place at the Satish Dhawan Space Centre on Sriharikota Island, near Chennai. The Master Control Facilities for geostationary satellite station keeping are located at Hassan and Bhopal. Reception and processing facilities for remote-sensing data are at the National Remote Sensing Centre in Hyderabad. ISRO's commercial arm is Antrix Corporation, which has its headquarters in Bangaluru.

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The first artificial satellite India, Aryabhata, (named after the eminent Indian astronomer and mathematician) was successfully launched by the than Soviet Union's Kosmos-3M rocket on April 19, 1975 from Kapustin Yar . Rohini, the first Indian satellite to be placed in orbit by an Indigenous Satellite launch vehicle (Satellite Launch Vehicle 3), was launched on July 18, 1980. ISRO has launched several Satellite systems to space, including the Indian National Satellite (INSAT) system, for information and telecommunication, television broadcasting, meteorology, disaster warning and response, and the Indian Remote Sensing (IRS) satellites for natural resource monitoring and management. The first INSAT satellite by India was launched in the year 1988, and the INSAT program was extended to include geosynchronous satellites called GSAT. The first Indian Remote Sensing Satellite (IRS) was also launched in the year 1988, and the IRS program developed more-specialized satellites, which includes RISAT-1(Radar Imaging Satellite-1, launched in 2012) and the Satellite with Argos and Altika (SARAL, launched in 2013), a joint Indo-French mission that measures ocean wave heights. ISRO subsequently developed three other launch vehicles: the Polar Satellite Launch Vehicle (PSLV) for launching satellites into polar / near polar orbit, the Geostationary Satellite Launch Vehicle (GSLV) for launching satellites into geostationary orbit, and a heavy lift version of the GSLV called the GSLV Mark III or LVM. Those rockets launched communications satellites and Earth-observation satellites as well as missions to the Moon (Chandrayaan-1 in 2008; Chandrayaan-2 in 2019) and Mars (Mars Orbiter Mission, 2013).

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Source: https://www.britannica.com/topic/Indian-Space-Research-Organisation#ref1246277

Starting from Bhaskara-I, the First Experimental Earth Observation Remote Sensing Satellite built in India and launched from Vostok, Russia (former USSR), in 1979 to the latest Cartosat 2 Series satellite launched (by indigenous PSLV) in 2018 a variety of sensors are operating in visible, infrared, thermal and microwave spectral regions, including hyper-spectral sensors to acquire digital data at spatial resolutions ranging from 1 km to a meter have been built and launched indigenously along with satellites of developed nations. Indian Space Research Organisation (ISRO) on 15 February 2017 in a single launch successfully fixed 104 satellites in orbits; out of these 3 satellites were Indian and rest were of the developed countries mainly the USA.

IRS-1A, the first of the series of indigenous state-of-art operating remote sensing satellites, was successfully launched into a polar sun-synchronous orbit on March 17, 1988 from Cosmodrome at Baikonur in former USSR. The successful launch of IRS-1A depicted the maturity of satellite to address the various requirements for managing natural resources of the nation. Its LISS-I sensor had a spatial resolution of 72.5 meters with a swath of 148 km on ground. LISS-II had two separate imaging sensors, LISS-II A and LISS-II B, with spatial resolution of 36.25 meters each and

mounted on the spacecraft in such a way to provide a composite swath of 146.98 km on ground.

It was followed by the IRS-1B, an identical satellite, launched by same vehicle and from the same place on August 29, 1991. IRS-P2 satellite was launched (after the failure of IRS-P1 mission on September 20, 1993) by indigenous launch vehicle PSLV-D2 (P series is named after PSLV) on October 15, 1994 with only LISS-II sensor. LISS-I and LISS-II sensors provided useful data for applications in the fields of land use land cover mapping, agriculture, forestry, hydrology, pedology, oceanography, geology, natural resource management, disaster monitoring, and cartography. To further improve the quality of data IRS-1C and 1D, identical satellites, were launched with three sensors – LISS-III, PAN (panchromatic) camera and a Wide Field Sensor (WiFS) with spatial resolutions of 23.5 m, 5.8 m and 188 m, respectively. In addition to fulfilling the general requirements, theme based IRS missions, for applications like natural resource management (RESOURCESAT series and RISAT series), ocean and atmospheric studies (OCEANSAT series, MeghaTropiques and SARAL) and large scale mapping i.e. detailed mapping applications (CARTOSAT series) have been introduced and well established.

Source: Jitender Saroha, IRS Satellites: History, Characteristics and Applications, in IJRAR- International Journal of Research and Analytical Reviews, [VOLUME 5 I ISSUE 4 I OCT. – DEC. 2018] pp 815-820

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Today, the constellation of Indian Earth Observation (EO) Satellites/Remote Sensing Satellites with imaging capabilities in visible, infrared, thermal infrared and microwave bands of the electromagnetic spectrum (EMS), including hyper-spectral sensors, have helped the country in achieving major operational applications. The sensors have been providing spatial resolution ranging from 1 km to better than 1m; temporal resolution from 22 days to every 15 minutes and radiometric resolution ranging from 7 bit to 12 bit, which has notably helped in applications at significant levels. In the coming years, the Indian Earth Observation satellites are heading towards further enhanced technologies, taking lessions of the learnings/achievements made in the past years, while addressing newer Remote Sensing requirements and the technological advancements.

Source: https://www.isro.gov.in/saga-of-indian-remote-sensing-satellite-system

List of Earth Observation Satellites Launched by India

Sl. No.	Satellite	Launch Date	Launch Mass	Launch Vehicle	Orbit	Application
1	EOS-01	Nov 07, 2020		PSLV-C49/EOS-01	LEO	Disaster Management System, Earth Observation
2	RISAT-2BR1	Dec 11, 2019	628 Kg	PSLV-C48/RISAT-2BR1	LEO	Disaster Management System,

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						Earth Observation
3	Cartosat-3	Nov 27, 2019		PSLV-C47 / Cartosat-3 Mission	SSPO	Earth Observation
4	RISAT-2B	May 22, 2019	615 Kg	PSLV-C46 Mission	LEO	Disaster Management System, Earth Observation
5	HysIS	Nov 29, 2018		PSLV-C43 / HysIS Mission	SSPO	Earth Observation
6	Cartosat-2 Series Satellite	Jan 12, 2018	710 Kg	PSLV-C40/Cartosat-2 Series Satellite Mission	SSPO	Earth Observation
7	Cartosat-2 Series Satellite	Jun 23, 2017	712 kg	PSLV-C38 / Cartosat-2 Series Satellite	SSPO	Earth Observation
8	Cartosat -2 Series Satellite	Feb 15, 2017	714 kg	PSLV-C37 / Cartosat -2 Series Satellite	SSPO	Earth Observation
9	RESOURCESAT-2A	Dec 07, 2016	1235 kg	PSLV-C36 / RESOURCESAT-2A	SSPO	Earth Observation
10	SCATSAT-1	Sep 26, 2016	371 kg	PSLV-C35 / SCATSAT-1	SSPO	Climate & Environment
11	INSAT-3DR	Sep 08, 2016	2211 kg	GSLV-F05 / INSAT-3DR	GSO	Climate & Environment, Disaster Management System
12	CARTOSAT-2 Series Satellite	Jun 22, 2016	737.5 kg	PSLV-C34 / CARTOSAT-2 Series Satellite	SSPO	Earth Observation
13	INSAT-3D	Jul 26, 2013	2060 Kg	Ariane-5 VA-214	GSO	Climate & Environment, Disaster Management System
14	SARAL	Feb 25, 2013	407 kg	PSLV-C20/SARAL	SSPO	Climate & Environment, Earth

						Observation
15	RISAT-1	Apr 26, 2012	1858 kg	PSLV-C19/RISAT-1	SSPO	Earth Observation
16	Megha-Tropiques	Oct 12, 2011	1000 kg	PSLV-C18/Megha-Tropiques	SSPO	Climate & Environment, Earth Observation
17	RESOURCESAT-2	Apr 20, 2011	1206 kg	PSLV-C16/RESOURCESAT-2	SSPO	Earth Observation
18	CARTOSAT-2B	Jul 12, 2010	694 kg	PSLV-C15/CARTOSAT-2B	SSPO	Earth Observation
19	Oceansat-2	Sep 23, 2009	960 kg	PSLV-C14 / OCEANSAT-2	SSPO	Climate & Environment, Earth Observation
20	RISAT-2	Apr 20, 2009	300 kg	PSLV-C12 / RISAT-2	SSPO	Earth Observation
21	IMS-1	Apr 28, 2008	83 kg	PSLV-C9 / CARTOSAT – 2A	SSPO	Earth Observation
22	CARTOSAT – 2A	Apr 28, 2008	690 Kg	PSLV-C9 / CARTOSAT – 2A	SSPO	Earth Observation
23	CARTOSAT-2	Jan 10, 2007	650 kg	PSLV-C7 / CARTOSAT-2 / SRE-1	SSPO	Earth Observation
24	CARTOSAT-1	May 05, 2005	1560 kg	PSLV-C6/CARTOSAT-1/HAMSAT	SSPO	Earth Observation
25	IRS-P6 / RESOURCESAT-1	Oct 17, 2003	1360 kg	PSLV-C5 /RESOURCESAT-1	SSPO	Earth Observation
26	The Technology Experiment Satellite (TES)	Oct 22, 2001		PSLV-C3 / TES	SSPO	Earth Observation
27	Oceansat(IRS-P4)	May 26, 1999	1050 kg	PSLV-C2/IRS-P4	SSPO	Earth Observation
28	IRS-1D	Sep 29, 1997	1250kg	PSLV-C1 / IRS-1D	SSPO	Earth Observation

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29	IRS-P3	Mar 21, 1996	920 kg	PSLV-D3 / IRS-P3	SSPO	Earth Observation
30	IRS-1C	Dec 28, 1995	1250 kg	Molniya	SSPO	Earth Observation
31	IRS-P2	Oct 15, 1994	804 kg	PSLV-D2	SSPO	Earth Observation
32	IRS-1E	Sep 20, 1993	846 kg	PSLV-D1	LEO	Earth Observation
33	IRS-1B	Aug 29, 1991	975 kg	Vostok	SSPO	Earth Observation
34	SROSS-2	Jul 13, 1988	150 kg	ASLV-D2		Earth Observation, Experimental
35	IRS-1A	Mar 17, 1988	975 kg	Vostok	SSPO	Earth Observation
36	Rohini Satellite RS-D2	Apr 17, 1983	41.5 kg	SLV-3	LEO	Earth Observation
37	Bhaskara-II	Nov 20, 1981	444 kg	C-1 Intercosmos	LEO	Earth Observation, Experimental
38	Rohini Satellite RS-D1	May 31, 1981	38 kg	SLV-3D1	LEO	Earth Observation
39	Bhaskara-I	Jun 07, 1979	442 kg	C-1Intercosmos	LEO	Earth Observation, Experimental

https://www.isro.gov.in/spacecraft/list-of-earth-observation-satellites

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