TARANG

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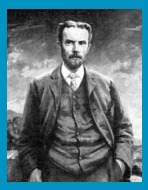
IEEE Microwave Theory and Techniques Society (MTT-S)

RECAP OF PREVIOUS EVENT :

INAUGURAL OF IEEE MICROWAVE THEORY AND TECHNIQUES SOCIETY STUDENT CHAPTER - 02/03/2019

IEEE MTT-S Student Chapter was inaugurated with motive to be efficacious in scientific, technical and industrial activities in the field of EM, RF and Microwave engineering contributing to the advancement of present and future wireless communications. The chief guest and guest of honor attended to the event were present and past IEEE MTT-S chairs. Principal, HOD, Prof. P. Nageshwar Rao, Head IQAC and IEEE Advisor Prof. M.A. Jabbar were the other eminent professors who graced the event. Principal, HOD, IEEE advisor addressed the students and gave the importance of joining IEEE and the benefits of joining as members in the organization. MTT-S Student advisor motivated the students about the field of Microwaves, antennas and their applications in present wireless field. Discussed about society's wide range of publications, conferences, about importance of research and networking opportunities to the students. Later the dignitaries released newsletter of the MTT-S student chapter "TARANG" and IEEE Approval Letter for the formation of student chapter.



Electric and magnetic forces. May they live for ever, and never be forgot, if only to remind us that the science of electromag -netics, in spite of the abstract nature of its theory, involving quantities whose nature is entirely unknown at the present, is really and truly founded on the observations of real Newtonian forces, electric and magnetic respectively.

-Oliver Heaviside

A technical presentation on "Antennas, Probes & Devices for EMI-EMC Applications" was given by Mr. Sandeep Satav, IEEE MTT-S Chair, Scientist-G, Head, EMI- EMC Centre, DRSS, Research Centre Imarat, DRDO, Min. of Defence, Hyderabad. The technical talk gave more practical insights in the field of EMI/EMC. The gist of his talk was my electronic system is intended for functioning in its given electromagnetic environment. Electromagnetic interference (EMI) is a disturbance that interrupts or degrades the performance of an electronic system do to electromagnetic energy generated within the system and/or by an outside source. Electromagnetic compatibility (EMC) is concerned with the prevention of EMI, it ensures electronics will function correctly when operating in a given environment. The talk entitled as above introduces the subject topic along with its standards. The talk was very informative and ignited the student mind to carry out student projects like TEM cells, current probes, Nano satellites and etc...

-Prof. N. Uma Maheshwar Rao

ISRO's Journey from Ist to 107th Satellite!

India has been successfully launching satellites of many types since 1975. These satellites have been launched from various vehicles, including American, Russian and European rockets apart from Indian rockets. The organisation responsible for India's space program is Indian Space Research Organisation (ISRO) and it shoulders the bulk of the responsibility of designing, building, launching and operating these satellites.

India has launched 107 satellites since 1975. Indian Space Research Organization (ISRO) is responsible for India's Space Program. In February 2017, ISRO has created a new record by launching 104 satellites in one go. Out of these 104 satellites, only 3 of these were Indian Satellites. These were launched by Polar Satellite Launch Vehicle (PSLV) - C37 on 15 th February 2017.

ISRO's first satellite, Aryabhata, was launched by the Soviet Union on April 19, 1975. Rohini, the first satellite to be placed in orbit by an Indian-made launch vehicle (the Satellite Launch Vehicle 3), was launched on July 18, 1980. ISRO has launched several space systems, including the Indian National Satellite (INSAT) system for telecommunication, television broadcasting, meteorology, and disaster warning and the Indian Remote Sensing (IRS) satellites for resource monitoring and management. The first INSAT was launched in 1988, and the program expanded to include geosynchronous satellites called GSAT. The first IRS satellite was also launched in 1988, and the program developed more-specialized satellites, including the Radar Imaging Satellite-1 (RISAT-1, launched in 2012) and the Satellite with Argos and Altika (SARAL, launched in 2013), a joint Indian-French mission that measures ocean wave heights. ISRO subsequently developed three other rockets: the Polar Satellite Launch Vehicle (PSLV) for putting satellites into polar orbit, the Geostationary Space Launch Vehicle (GSLV) for placing satellites into geostationary orbit, and a heavy-lift version of the GSLV called the GSLV Mark III or LVM. Those rockets launched communications satellites, Earth-observation satellites, and, in 2008, Chandrayaan-1, India'sfirst mission to the Moon. ISRO plans to put astronauts into orbit in 2021

- SAI VANDANA VISALAKSHI

Indian Satellites: Important Facts and News Every Indian Must Know!

* ISRO was formed by Dr. Vikram Sarabhai on 15th August 1969.

* A.P.J. Abdul Kalam was the director of India's first Indigenous Satellite Launch Vehicle (SLV-3).

* The first Indian Satellite, Aryabhatta was named after an Indian astronomer and mathematician.

* Prime Minister, Indira Gandhi named the first Indian Satellite as Aryabhatta.

* ISRO's Mars mission is the cheapest mission so far with just Rs. 450 Crores (Rs. 12/km).

* ISRO's mission to Mars was the only mission to reach the Mars in the first attempt.

* ISRO has set a national record of launching a rocket carrying 20 satellites out of which 13 were from US.

* ISRO is one of the six space agencies in the world with the capability to build and launch satellites from its own soil.

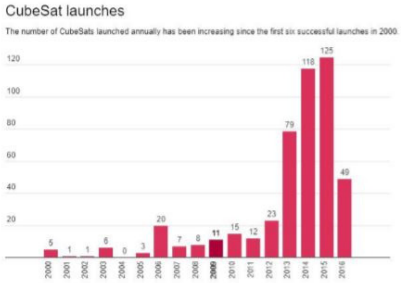
What I view life like is about energy. Everything is about energy - everything. We physically are little units of electrical energy, and we vibrate and project electromagnetic thought.

- Jhon Trudell

Everything we know about the universe is studied by using telescopes or other instruments that look at visible light, infrared, ultraviolet or X-ray - different wavelengths of electromagnetic interactions. Only 4 percent of what's in the universe gives off electromagnetic radiation, so we don't have any handle on the rest.

- Barry Barish

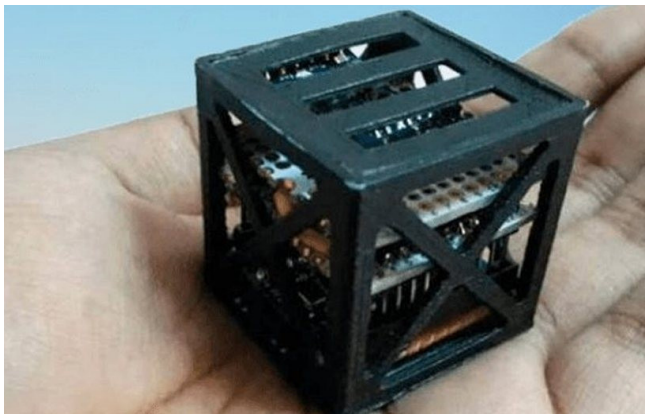
The Tiny Sats Revolution



As we know the world is living on communication, communication is being upgraded from a room size satellite to Rubik's cubesize satellites. The TinySat's are most preferable because of their physical size, cost, etc..and these are currently orbitingaround 200 milesabove Earth, collecting dataabout our planet andthe universe. These TinySat's s are poised to change the way we do science from space. The generally used tinySat'sare CubeSat's and NanoSatellites.

CubeSats:

The "Cube" here simply refers to the satellite's shape. The most common CubeSat (the so-called "1U" satellite)is a 10 cm (roughly 4 inches)cube size. These compact bodies of the minute satellites are able to house sensors and communications receivers/transmitters that enable operators to study the Earth from space, as well as space around the Earth. They're primarily designed for Low Earth Orbit (LEO) – an easily accessible region of space from around 200 to 800 miles above the earth because they're so small and light, it costs much less to get a CubeSat into Earth orbit than a traditional communication or GPS satellite. Since CubeSatscan be built with commercial off-the-shelf parts, their development made space exploration accessible to many people and organizations, especially students, colleges and universities.



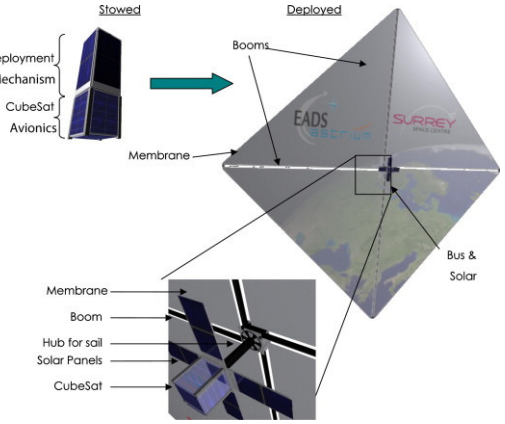
Nano Satellites:

Nano satellites are one of the smaller end of the spectrum, weighing between one and 10 kilograms and averaging the size of a loaf of bread. They can do almost everything a conventional satellite does, and that too at a fraction of the cost. The nano and micro satellite market is estimated to grow from $702.4 million in 2014 to $1,887.1 million in 2019. Reducing weight, size and energy characteristics of micro, mini and nano satellites is a major challenge before space professionals. In fact, it is the prohibitive cost of building large satellites and putting them into orbit, that has proved to be a "push factor" for the development of micro, mini and nano satellites for the students who can work on these satellites.

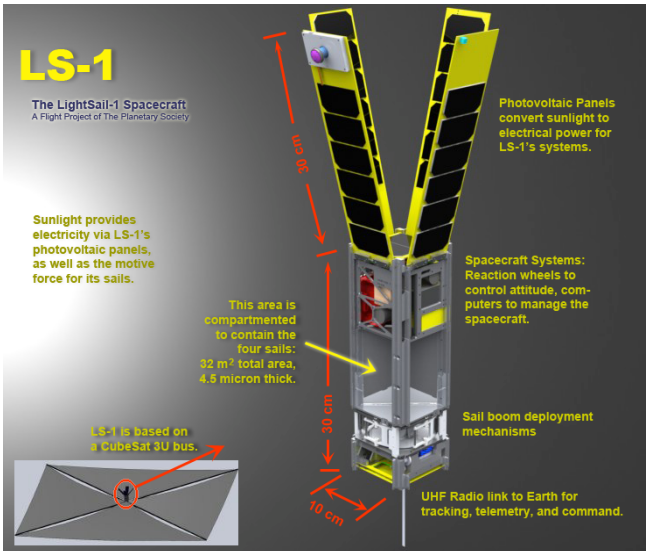
The two Indian nano satellites (Kalam Sat,PISAT,STUDSAT,etc..) have been successfully launched successfully by the ISRO. The worlds smallest satellite is KalamSat which is built by Indian Students. ISRO and all other space agencies are working for the satellites which can provide the payload with the smaller size, and high power, high-speed communication. It's safe to say, in the future, small satellites are going to play a big role.

- A. NAGARAJU

Cubesat Application: Solar Sail



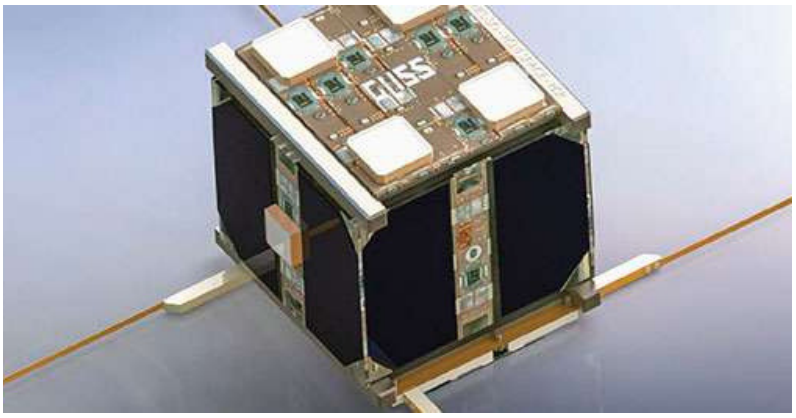
The solar sail is a sail-like device that is made of lightweight and highly reflective material and attached to a spacecraft to harness the radiation pressure of the solar wind and light for propulsion. Also, known as LightSail solar sail. Nowadays, solar sails have shown great potential for both applications with low cost and research. Its complete system would collect solar energy in space, convert it to microwaves, and transmit the microwave radiation to Earth where it would be captured by a ground antenna and transformed into usable electricity. Space-based solar power (SBSP) or SSP is a system for the collection of solar power in space for use on Earth. SBSP differs from the usual method of solar power collection in that the solar panels used to collect the energy would reside on a satellite in orbit, often referred to as a solar power satellite, rather than on Earth's surface. In space, collection of the Sun's energy is unaffected by the day/night cycle, weather, seasons. It does not emit greenhouse gases and works regardless of cloud cover, daylight, or wind speed. It does not provide easy targets for terrorists and does not require environment problematic mining operations. Space solar power can be exported to virtually any place in the world, and its energy can be converted for local needs and can also be used for desalination of seawater. On 25th June 2019 LightSail 2 satellite was launched which was developed by the planetary society, a US organization that promotes space exploration which was co-founded by the legendary astronomer Carl Sagan in 1980. But the idea itself has been around for a lot longer than that. Solar sails were an accessory on India's INSAT 2A and 3A.

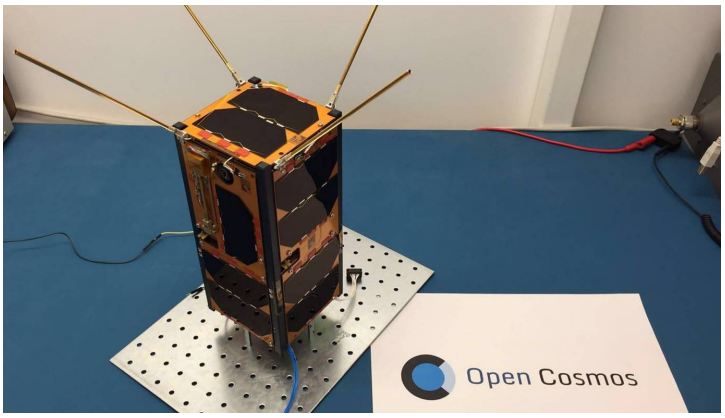


The JAXA (Japan Aerospace Exploration Agency), on May 21, 2010, launched the solar sail IKAROS (Interplanetary Kite-craft Accelerated by Radiation of the Sun) currently operating successfully in space. It is the solar sail in action with more success actually in the space. A major critical operation of deploying the 14m long solar sail and boom on the North face of INSAT-2E was successfully completed on April 12, 1999, by ISRO. The LightSail 2 launched by NASA has used the energy of photons from solar flares to rotate itself around in the deep vacuum of space. The future trend may completely rely on solar sail propellant concept as Solar Sails Could Propel Future Spaceships with No Engines, Fuel or Solar Panels.

- TARUNI REDDY

SMALL SATELLITES -A GLIMPSE



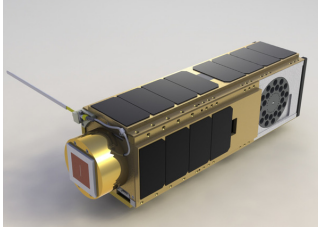


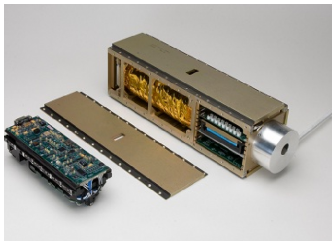
Like your mobiles, satellites are also getting smaller and better. Nano satellites are those satellites that are just about the size of your shoe box. But, they can do almost everything a conventional satellite does,and that too at a fraction of the cost. The big bang theory of small sat's can be attributed to fast-changing technology trends cutting down gestation periods. The industry is responding to the subsequent profit vulnerability by making smaller spacecrafts quickly, deploying them even more swiftly and getting data from them rapidly.To be clear, not all small satellites are, well, small satellites.

A spacecraft that weighs between 100 to 500 kg's is called a mini-satellite. If it weighs between ten to 100 kgs, you would call it a micro satellite. A nano satellite's mass range is between 1 and 10 kg's. And if your spacecraft weighs between 100 grams and 1 kg, it would be called a pico satellite. That's not all! We even have a name for satellites that weigh less than 100 grams. They are known as femto satellites.Research firm,Markets has predicted a bullish future for the small satellite industry. The nano and micro satellite market is estimated to grow from $702.4 million in 2014 to $1,887.1 million in 2019. A study by Northern Sky Research predicts earth observation as the primary driver behind this growth. This is because earth observation market suffers from data poverty in many industry verticals, like agriculture, disaster management, forestry and wildlife. The research firm believes that a staggering 40 percent of the nano and micro satellites, which are to be launched by the end of year 2024, will be for earth observation applications.

It's safe to say, in the future, small satellites are going to play a big role.

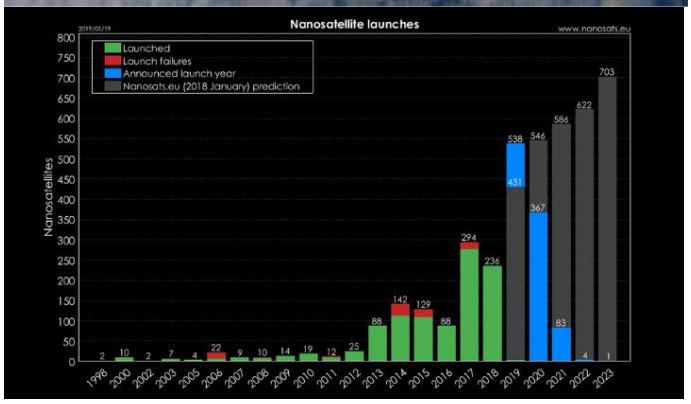
- PAVAN SAI





Nano Student Sats-A Comparative Study

An artificial satellite is an object that has been intentionally placed into orbit. These satellites are used for communication, earth-observation, navigation, space-telescopes, military, etc. Based on their mass they are classified as large, medium-sized, mini, micro, nano, pico, femto. Nano satellites have great scope in space technology because of their miniaturized size which allow for cheaper designs as well as ease of mass production. These satellites weigh around 1kg to 10kg. satellites are often placed in low earth orbits and are launched in groups called "swarms." In this type of system, each satellite operates in a manner similar to a repeater in a cellular communications system. Some miniaturized satellites are placed in elongated (elliptical) orbits. They are well-suited for use in proprietary wireless communications networks, as well as for scientific observation, data gathering and the Global Positioning System (GPS). Over 1100 nanosatellites have been launched as of January 2019. Satellite technology is not only confined to large organizations but there are some notable student satellite projects which contributed in understanding our earth's geography and space. Many Universities have made their contributions in space research. A typical CubeSat launch cost is estimated at $40,000 by NASA. Even if the University is capable of preparing a satellite, it requires a source to launch the satellite. The last ten years have seen a tremendous increase in the number of student-built satellite projects. The main outcome of these programs has been student training and low-cost space access for the University space community. These are the student-built satellites that were launched between 1980 and 2003



Launched, planned and predicted nano satellites as of January 2019

Indian student satellite programs:

PROJECT	LAUNCH VEHICLE	University	Dimensions	Mass	Duration	USE
NIUSAT	PSLV-C38	Noorul Isalm University	35cm x 35cm x 37cm	15kg	Launched on June 23, 2017	agriculture and disaster management support applications
PRATHAM	PSLV-C35	Indian Institute of Technology Bombay	30.5cm X 33.5cm X 46.6cm	10.15kg	4months	count electrons in the Earth's ionosphere
PISAT	PSLV-C35	PES Institute of Technology	254mm x 256mm x 181mm	5kg	Launched on September 26, 2016	Remote sensing
SATHYABAMASAT	PSLV-C34	SATHYABAMA University	100 mm x 100 mm x 227 mm	1.288kg	5years	collect data on greenhouse gases
SWAYAM (pico-sat)	PSLV-C34	College of Engineering , Pune	10cm X 10cm X 11.35 cm	990grams	Launched on June 22, 2016	point to point packet communication
SRMSAT	PSLV-C18	SRM University	286mm x 286mm x 294mm	10kg	12months (planned)	earth observation satellite
JUGNU (cube-sat)	PSLV-C18	Indian Institute of Technology Kanpur	34cm x 10cm x 10cm	3kg	Launched on 12 october, 2011	remote sensing
STUDSAT (pico-sat)	PSLV-C15	(Various)	10cm × 10cm × 13.5cm	95grams	Launched On 12 July 2010	promoting space technology
ANUSAT	PSLV-C12	Anna University	600mm x 600mm x 600mm	40kg	2years	Digital Communication using Store & Forward Techniques

Foreign student satellite programs:

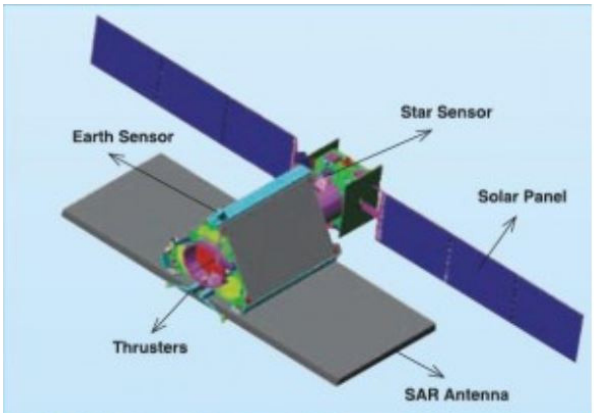
PROJECT	University	Dimensions	Mass	Mission duration	USE
ION	University of Illinois (USA)	10cm x 10cm x 21.5cm	2kg	lost in the failure of the Dnepr launch	Perform oxygen intensity measurements in ionosphere and test CMOS camera
QUAKESAT	Stanford University (USA)	10cm x 10cm x 30cm	5kg	24months (active)	Earthquake detection
UNITE	University of Southern Indiana (USA)	10cm x 10cm x 30cm	4kg	Deployed in january,2019 from iss	measures plasma in the lower ionosphere
EcAMSAT	Santa Clara University(USA)	10cm x 20cm x 30cm	10.7kg	>120days (active)	Biological research
CanX-2	University of Toronto Institute for Aerospace Studies(Canada)	10cm x 10cm x 34cm	3.5kg	Deployed in 2008(active)	Ionospheric research

We are racing in the advancement of technology. Many organizations including students are coming forward to contribute to space technology. We Indians hold the record for launching 103 nano-satellites using a single rocket PSLV-C37 (Cartosat-2D and 103 nano-satellites). We hold the record for preparing the world's smallest satellite KALAMSAT. The pace at which we are developing nano-satellites could make our lives better and even more accessible to technology.

It is estimated that around 75 student satellites may fly to space by 2022 including V-sat. Though our progress is good, only a few student-satellite programs are successfully implemented. This might be because of the complexity in handling disruptive technology, economic and technical factors. But compared to other countries we have a high success rate in launching and operating satellites built by students. ISRO has a success rate of 95 % to date. It has launched 71 spacecraft into various orbits which include some notable payloads such as the Mars Orbiter Mission and the Chandrayaan mission. ISRO is known for its low-cost space missions with a very good success rate. It is developing indigenously built oxygen breathing rocket and reusable thrusters which is a boosting factor.

-AKANA SAI SOHITH

ADVANCES IN INDIAN SPACE RESEARCH -AN EXEMPLARY IN EARTH'S OBSERVATION SATELLITES



The RADARSAT Constellation Mission (RCM) is a three spacecraft fleet of earth observational satellites by the Canadian space agency and RISAT (Radar Imaging Satellite) Constellation is a series of satellites by ISRO.

Each of these Constellation missions focuses on aiding their own country in various fields. The RCM focuses on providing effective solutions to Canadians in three main areas: 1. Maritime surveillance, 2.Disaster management, 3.Ecosystem monitoring. Similar to RCM the RISAT series focuses on improving surveillance capabilities in India in areas like 1. Ecosystem, 2. Military, 3. Disaster management. But the main reason for launching RISAT is Military Surveillance.

The most important and common feature of these two Constellation Satellites is that they are "All Weather Satellites" because they use the "SAR" technology (synthetic aperture radar). It will emit the radar signal to Earth's surface and receive back its echo to generate valuable data. These satellites can continue to give information no matter what the weather condition may be.

The RCM has launched on 12 June 2019 on board a Falcon 9 rocket with a launch mass of 4,200kg (Three Satellites together). Whereas the RISAT-2B(latest in RISAT series) was launched on 22 May 2019 on board a PSLV-C46. The PSLV-C46 had a 615 kg RISAT and PSLV lofts 50 tonnes to space by launching 354 satellites, including national, student and foreign satellites.

Both RCM and RISAT missions are Geocentric and are placed in the Sun-synchronous orbit. With RCM being at an Altitude of 600km and RISAT at an Altitude of 555km.

India has been working on Earth observation Satellites since 1979 (Bhaskara I), way before CSA. The RISAT mission though similar to RADARSAT does more in less than RADARSAT by CSA. With the launch of our latest satellite RISAT-2B, ISRO has announced that there will be many more satellites in the near future itself.

- SAI VANDANA VISALAKSHI

FACTOID

- ***Skylab: First U.S. Space Station. The Skylab Orbital Workshop experienced a failure that led to a replacement shield to protect against solar heating. Skylab was the first space station operated by the United States. It spent six years orbiting Earth until its decaying orbit caused it to re-enter the atmosphere.***

Committee