अन्तरिक्ष भारत

SPACE INDIA

भारतीय अन्तरिक्ष अनुसंधान संगठन

Indian Space Research Organisation

अप्रैल-सितंबर **2010** April–September

The Indian Space Programme

Space activities in the country were initiated with the setting up of Indian National Committee for Space Research (INCOSPAR) in 1962. In the same year, work on Thumba Equatorial Rocket Launching Station (TERLS), near Thiruvananthapuram, was also started. The Indian space programme was institutionalised in November 1969 with the formation of Indian Space Research Organisation (ISRO). Government of India constituted the Space Commission and established the Department of Space (DOS) in June 1972 and brought ISRO under DOS in September 1972.

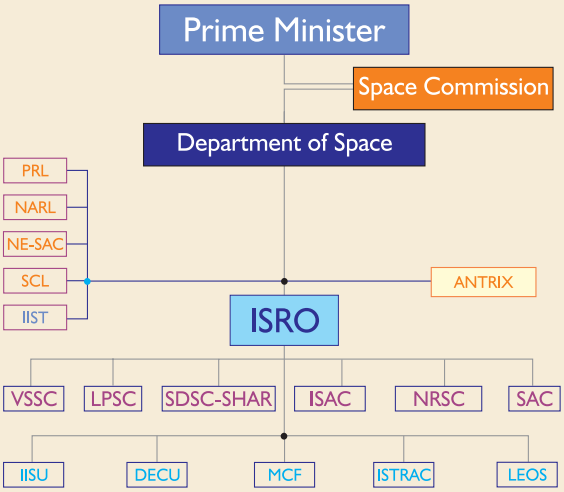
Department of Space (DOS) has the primary responsibility of promoting development of space science, technology and applications towards achieving self reliance and assisting in all round development of the nation. Towards this, DOS has evolved the following programmes:

- Indian National Satellite (INSAT) programme for telecommunications, TV broadcasting, meteorology, developmental education, etc.
- Remote Sensing programme for the application of satellite imagery for various developmental purposes.
- Indigenous capability for design and development of spacecraft and associated technologies for communications, resources survey and space sciences.
- Design and development of launch vehicles with indigenous technology for access to space and orbiting INSAT, IRS spacecraft and space science missions.
- Research and development in space sciences and technologies as well as application programme for national development.

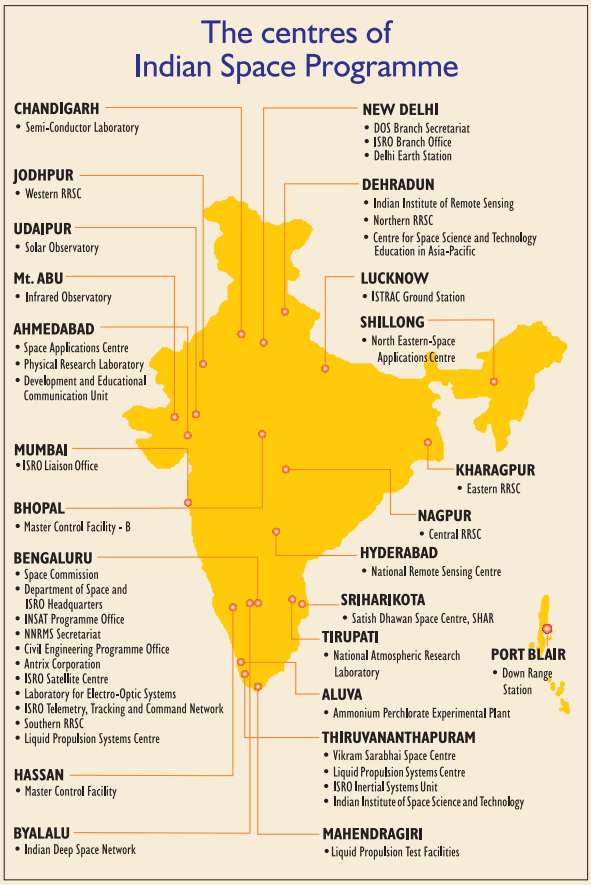
The Space Commission formulates the policies and oversees the implementation of the Indian space programme to promote the development and application of space science and technology for the socio-economic benefit of the country. DOS implements these programmes through, mainly, Indian Space Research Organisation (ISRO), Physical Research Laboratory (PRL), National Atmospheric Research Laboratory (NARL), North Eastern-Space Applications Centre (NE-SAC) and Semi-Conductor Laboratory (SCL). Antrix Corporation, established in 1992 as a government owned company, markets space products and services.

Both the DOS and ISRO Headquarters are located at Bengaluru. The developmental activities are carried out at the Centres and Units spread over the country.

So far, 57 Indian Satellite Missions and 31 Launches from Sriharikota have been conducted.



NRSC: National Remote Sensing Centre **PRL:** Physical Research Laboratory **NARL:** National Atmospheric Research Laboratory **NE-SAC:** North Eastern Space Applications Centre **SCL:** Semi-Conductor Laboratory **ISRO:** Indian Space Research Organisation **Antrix:** Antrix Corporation Limited **VSSC:** Vikram Sarabhai Space Centre **LPSC:** Liquid Propulsion Systems Centre **SDSC:** Satish Dhawan Space Centre **ISAC:** ISRO Satellite Centre **SAC:** Space Applications Centre **IISU:** ISRO Inertial Systems Unit **DECU:** Development and Educational Communication Unit **MCF:** Master Control Facility **ISTRAC:** ISRO Telemetry Tracking and Command Network **LEOS:** Laboratory for Electro-optic Systems **IIST:** Indian Institute of Space Science and Technology



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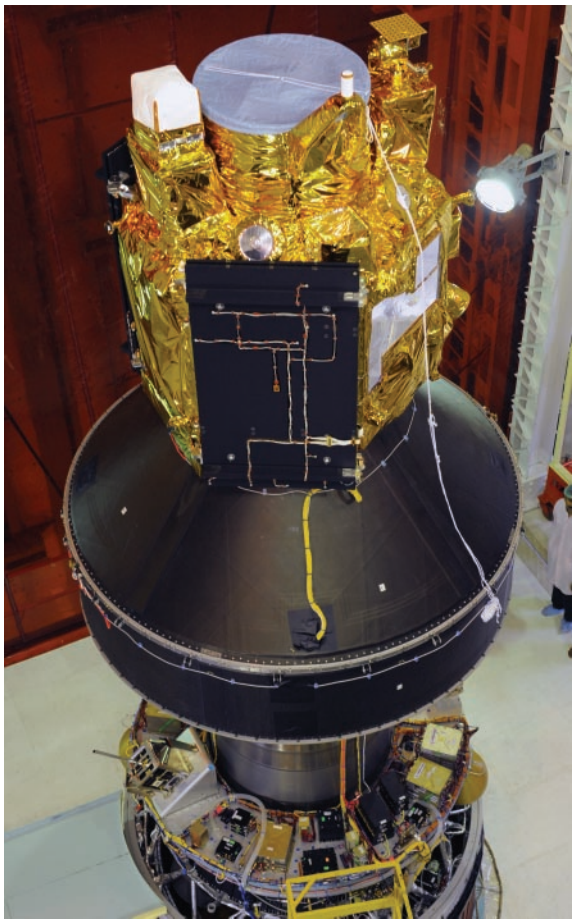
Polar Satellite Launch Vehicle (PSLV-C15) successfully launches CARTOSAT-2B Satellite

India's Polar Satellite Launch Vehicle (PSLV-C15), successfully launched CARTOSAT - 2B from Satish Dhawan Space Centre (SDSC) SHAR, Sriharikota on July 12, 2010. The launch of PSLV - C15 was the sixteenth consecutive successful flight of PSLV.

After a smooth countdown of 51 hrs the vehicle lifted-off from the First Launch Pad at the opening of the launch window at 09.22 hrs (IST). After about 20 minutes of flight time, India's advanced remote sensing satellite CARTOSAT-2B along with four auxiliary satellites was successfully injected into its circular orbit of 637 km with an orbital inclination of 98.1°.

PSLV - C15 in its flight, in addition to CARTOSAT - 2B, carried four auxiliary satellites namely STUDSAT a pico-satellite weighing less than one kg, built jointly by students from a consortium of

Launch of PSLV-C15 from SDSC-SHAR, Sriharikota



CARTOSAT-2B Satellite integrated with PSLV-C15

Dr. K. Radhakrishnan, Chairman, ISRO displaying the model of PSLV-C15

seven engineering colleges form Karnataka and Andhra Pradesh, two nano satellites NLS 6.1 and NLS 6.2 from University of Toronto, Canada and ALSAT-2A, a micro-satellite from Algerian Space Agency.

After completing the initial phase of operations, the camera has been switched on, and images of high quality are being received.

Dr K. Radhakrishnan, Chairman, ISRO showing the imagery from Cartosat-2B to Hon. Prime Minister

Flight testing of the Indigenous Cryogenic Stage in GSLV-D3 Mission

The flight-testing of the indigenous Cryogenic Engine and the Stage conducted in the Geosynchronous Satellite Launch Vehicle GSLV-D3 this afternoon (April 15, 2010) was not successful.

GSLV-D3 on the Launch Pad

GSLV-D3 vehicle lifted off as planned at 16:27 hrs after a countdown procedure lasting for 29 hours. The countdown went off as planned. GSLV-D3 vehicle performance was normal up to the end of the second stage (GS2) till 293 seconds. Afterwards, the Cryogenic Stage was to ignite and burn for about 720 seconds to provide the necessary velocity to inject GSAT-4 Satellite into the intended Geosynchronous Transfer Orbit. The vehicle was seen tumbling, lost altitude and finally splashed down in the sea.

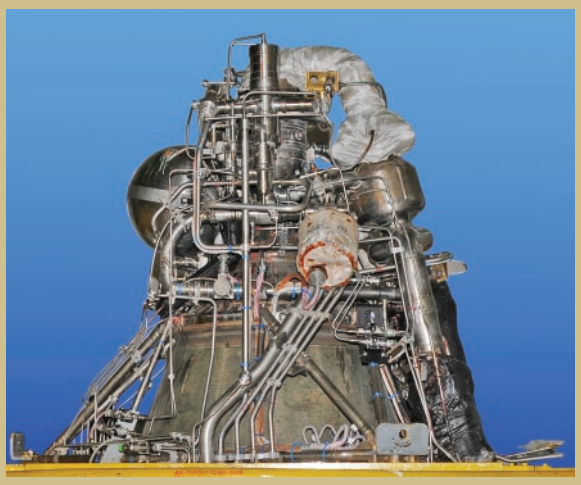
Detailed analysis of the flight data was carried out to find out the exact reasons for the failure and take corrective measures for the subsequent flight test of the indigenous Cryogenic Engine and Stage.

GSLV-D3 Failure Analysis

ISRO had instituted a two-tier process to carry out an in-depth analysis of the flight performance, identify the causes of failure and recommend corrective measures.

The Failure Analysis Committee comprising multi-disciplinary experts completed the analysis and its findings were further reviewed by a National Group of Eminent Experts. These reviews have brought out that:

1. Following a smooth countdown, the lift-off took place at 1627 hrs (IST) as planned. All four liquid strap-on stages (L40), solid core stage (S139), liquid second stage (GS2) functioned normally.
2. The vehicle performance was normal up to the burn-out of GS-2, that is, 293 seconds from lift-off. Altitude, velocity, flight path angle and acceleration profile closely followed the pre-flight predictions. All onboard real time decision-based events were as expected and as per pre-flight simulations.
3. The navigation, guidance and control systems using indigenous onboard computer Vikram 1601 as well as the advanced telemetry system functioned flawlessly. The composite payload fairing of 4 metre diameter inducted first time in this flight, also performed as expected. Performance of all other systems like engine gimbal control systems and stage auxiliary systems was normal.
4. The initial conditions required for the start of the indigenous Cryogenic Upper Stage (CUS) were attained as expected and the CUS start sequence got initiated as planned at 294.06 seconds from lift-off.
5. Ignition of the CUS Main Engine and two Steering Engines have been confirmed as normal, as observed from the vehicle acceleration and different parameters of CUS measured during the flight. Vehicle acceleration was comparable with that of earlier GSLV flights up to 2.2 seconds from start of CUS. However, the thrust build up did not progress as expected due to non-availability of liquid hydrogen (LH2) supply to the thrust chamber of the Main Engine.
6. The above failure is attributed to the anomalous stopping of Fuel Booster Turbo Pump (FBTP). The start-up of FBTP was normal. It reached a maximum speed of 34,800 rpm and continued to function as predicted after the start of CUS. However, the speed of FBTP started dipping after 0.9 seconds and it stopped within the next 0.6 seconds.
7. Two plausible scenarios have been identified for the failure of FBTP, namely, (a) gripping at one of the seal location and seizure of rotor and (b) rupture of turbine casing caused probably due to excessive pressure rise and thermal stresses. A series of confirmatory ground tests are planned.



Indigenously developed Cryogenic Engine

After incorporating necessary corrective measures, the flight testing of Indigenous Cryogenic Upper Stage on GSLV is targeted within a year. In the meantime, the next two GSLVs would fly with the available Russian Cryogenic Stages.

RH 200 Rocket with Students Payload Launched

Thumba Equatorial Rocket Launching Station (TERLS) witnessed another major event - the Technology Demonstrator Flight of the advanced sounding rocket RH 200 from its launch station at Thumba. The rocket was successfully launched at 1550 hrs on July 7, 2010 and achieved its intended altitude of 60 km in 2 minutes.

ISRO has always encouraged students from universities to become partners for payload development. Towards this, students from Vellore Institute of Technology University (VITU), were being guided by Vikram Sarabhai Space Centre to develop a part of the payload as a co-passenger in the RH200 technology demonstrator flight. The students payload comprised of tri-axial accelerometers, power switching module and safe arm relay unit matching the requirements of RH 200 rocket. The tri-axial accelerometer can monitor accelerations in all three directions. The power-switching module is for the power control of the payload. The faculty and students of VITU has taken keen interest during the development and test activities of these payloads at various work centres.

Flight of RH-200 Rocket from Thumba

The students of the Indian Institute of Space Technology (IIST) are also progressing well in their attempt to make the first indigenous students rocket with the support of the experts from VSSC. In its continued endeavour to handhold the student community, ISRO has included a picosatellite designed by undergraduate students across India, in its forthcoming PSLV-C15 mission. The major objective of this project is to provide hands-on experience in frontier areas of Space technology such as the design, fabrication and realization of a space mission at a reduced cost.

After the successful flight of the Advanced Technology Vehicle ATV D01, this is a major step to demonstrate the performance of super capacitors in flight pyro systems activation. The flight successfully tested the super capacitor developed by VSSC.

So far TERLS has recorded 2291 flights of sounding rockets and this is the 395th flight of RH 200 rocket. During January, 2010 the RH 200

along with RH 300 MkII and RH 560 MkII rockets made a history with first ever sounding rocket launch campaign with six flights in a day and five flights within a span of 3 hrs 40 minutes from TERLS and within a minimum 2 minutes between flights and tracking two rockets one after the other using the same radar in two minutes time gap. These deployments were for studying solar eclipse effects on atmospheric regions.

Shri S Ramakrishnan takes over as Director, Liquid Propulsion Systems Centre

Shri S Ramakrishnan, Distinguished Scientist of ISRO and hitherto Director (Projects), Vikram Sarabhai Space Centre (VSSC), Thiruvananthapuram, assumed the office of Director, Liquid Propulsion Systems Centre, Thiruvananthapuram on May 31, 2010. He took over the charge from Shri. MKG Nair, the outgoing Director.

Shri Ramakrishnan has made significant contribution to the launch vehicle technology in the country starting from the very first SLV-3 project. After obtaining M. Tech degree from IIT, Chennai, Shri Ramakrishnan joined VSSC in 1972. He played a key role in the development of PSLV and was responsible for development of liquid propulsion stages and their interfacing with vehicle and launch operations.

Under his leadership as Project Director, PSLV Continuation programme (PSLV-C1 to C4), operationalisation of PSLV and enhancing the payload capability from 900 kg to 1500 kg was accomplished. As Project Director, GSLV Mark III, Shri Ramakrishnan steered the Project during the crucial phase of design, engineering and realisation of first-off hardware for development test.

As Director (Projects) at VSSC and Chairman, Project Management Council, he provided technical guidance and programmatic direction to ISRO Launch Vehicle Projects as well as new developmental activities.

Shri Ramakrishnan played a lead role in the formulation of Indian Human Spaceflight (HSP) project and completion of system concept reviews.

Shri Ramakrishnan is the recipient of many prestigious awards including ISRO Performance Excellence Award during 2006 in recognition of his contribution to Indian Space Programme in the area of satellite launch vehicles, Astronautical Society of India award for contributions to Rockets and Related Technologies development and Dr. Biren Roy award from Aeronautical Society of India in recognition of his role in the operationalisation of PSLV launches and entering into commercial launch services. Government of India conferred Shri Ramakrishnan with Padmashree during 2003.

ISRO bags Globe Sustainability Research Award

ANTRIX Corporation Ltd./RRSSC-B, ISRO has been conferred with the most prestigious Globe Sustainability Research Award 2010 by the Globe Forum, Stockholm, Sweden. Globe award is an international award founded by Globe Forum, with the purpose of fostering sustainable development in the society. The award was conferred on ANTRIX/ RRSSC-B for its outstanding contribution to improve sustainable livelihoods amongst rural poor while reducing their vulnerability to climate risks. ANTRIX/ RRSSC-B, ISRO demonstrated the use of space technology and Information Technology (IT) solutions to effectively reach out to grassroots through Sujala Watershed development programme in Karnataka which was implemented during 2002-09 in five districts.

The Chairman of the Jury that selected ANTRIX Corporation Ltd./RRSSC-B, ISRO for this prestigious award, Prof Mohan Munasinghe, Winner of Nobel Peace Prize 2007 and Vice-Chair of the UN Intergovernmental Panel on Climate Change (IPCC), opined that ANTRIX Corporation Ltd./ RRSSC-B, ISRO fully deserved the Globe Sustainability

Mr P G Diwakar & Dr B K Ranganath of ISRO with Prof Mohan Munasinghe along with the award

Award for its exceptional contribution through innovative use of space technology for Watershed development in India, which has yielded significant benefits with respect to all the three aspects of sustainable development economic, social and environmental.

Payloads for Chandrayaan-2 Mission Finalised

Chandrayaan-2, India's second mission to moon, is being targeted for launch during 2013. Chandrayaan-2 will have an orbiter (satellite), a lander and a rover. Chandrayaan-2 is planned to be launched onboard Geosynchronous Satellite Launch Vehicle (GSLV) from Satish Dhawan Space Centre, Sriharikota. While the lander will be provided by Russia, the orbiter and the rover are being built by ISRO.

The payloads to be flown onboard Chandrayaan-2 (orbiter and rover) have been finalised by a National committee of experts drawn from ISRO centres, academic institutions and R & D laboratories and Chaired by Prof U R Rao, Chairman, Advisory Committee on Space Sciences (ADCOS) and former Chairman of ISRO.

The committee, after detailed deliberations and considering the mission requirements, weight and power available for scientific payloads, has recommended five payloads to be flown on the orbiter of which three are new and two are improved versions of the payloads flown earlier on Chandrayaan-1. The committee has also recommended two scientific payloads on the rover of Chandrayaan-2. Inclusion of additional payloads, if possible within the mission constraints, will be considered at a later date following a detailed review.

The five recommended payloads of Chandrayaan-2 orbiter are:

1. Large Area Soft X-ray Spectrometer (CLASS) from ISRO Satellite Centre (ISAC), Bangalore and Solar X-ray Monitor (XSM) from Physical Research Laboratory (PRL), Ahmedabad for mapping the major elements present on the lunar surface.

2. L and S band Synthetic Aperture Radar (SAR) from Space Applications Centre (SAC), Ahmedabad for probing the first few tens of meters of the lunar surface for the presence of different constituents including water ice. SAR is expected to provide further evidence confirming the presence of water ice below the shadowed regions of the moon.

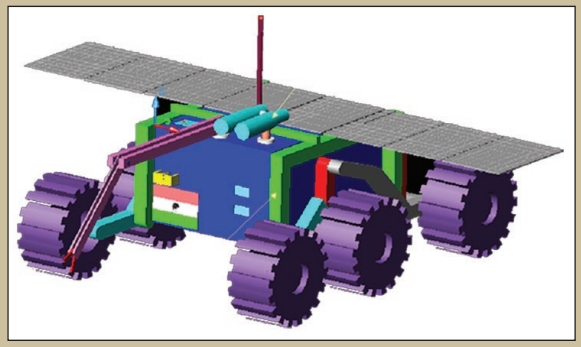
3. Imaging IR Spectrometer (IIRS) from SAC, Ahmedabad for the mapping of lunar surface over a wide wavelength range for the study of minerals, water molecules and hydroxyl present.

4. Neutral Mass Spectrometer (ChACE2) from Space Physics Laboratory (SPL), Thiruvananthapuram to carry out a detailed study of the lunar exosphere.

5. Terrain Mapping Camera2 (TMC2) from SAC, Ahmedabad for preparing a three-dimensional map essential for studying the lunar mineralogy and geology.

The two scientific payloads on Chandrayaan-2 rover are:

1. Laser Induced Breakdown Spectroscope (LIBS) from Laboratory for Electro Optic Systems (LEOS), Bangalore



Rover of Chandrayaan-2

2. Alpha Particle Induced X ray Spectroscope (APIXS) from PRL, Ahmedabad.

Both the instruments are expected to carry out elemental analysis of the lunar surface near the landing site.

Chandrayaan-2 spacecraft weighs about 2,650 kg at lift-off of which the orbiter weight is about 1,400 kg and lander weight is about 1,250 kg. Development of the subsystems of the orbiter and the rover is in progress at ISRO centres in Bangalore, Thiruvananthapuram and Ahmedabad.

Successful Static Testing of L110 Liquid Core Stage of GSLV-Mk III

Static Testing of L110 Liquid Core Stage

Indian Space Research Organisation successfully conducted the second static testing of its liquid core stage (L110) of Geo-synchronous Satellite Launch Vehicle (GSLV-Mk III) for 200 seconds at its Liquid Propulsion Systems Centre (LPSC) test facility at Mahendragiri on September 8, 2010 at 15:50 hrs.

GSLV-Mk III

L110 is one of the heaviest earth storable liquid stages ever developed by ISRO. L110 stage had two high pressure Vikas engines in a clustered configuration. Nearly 500 health parameters were monitored during the test and the initial data acquired indicates its normal performance. This particular test of L110 for its full flight duration of 200 seconds, is a major mile stone in the earth storable liquid rocket programme of ISRO and a significant step forward in the development of GSLV-Mk III launch vehicle.

It may be recalled that GSLV-Mk III, which is currently under advanced stage of development uses two solid strap on boosters (S200), L-110 liquid stage and a cryogenic upper stage C-25.

ISRO to host the 39th Scientific Assembly of COSPAR

The Indian Space Research Organisation (ISRO) is hosting the 39th Scientific Assembly of Committee on Space Research (COSPAR) at Mysore during July 14 – 22, 2012. The international Council for Science founded COSPAR in 1958. Establishment of COSPAR coincided with the launch of the first artificial satellite Sputnik-1 and therewith the beginning of the space age. COSPAR has its headquarters in Paris, France and Dr. Giovanni F Bignami is the current president of COSPAR. Dr. Bignami is the Chairman of European Space Agency's Scientific Advisory Council.

The Objectives of COSPAR are of pure scientific interest without the influence of political considerations. It aims at scientific research in space at an international level, with an emphasis on exchange of results, information and opinions, and to provide a forum, open to all scientists, for the discussion of problems that may affect scientific space research. To achieve

these objectives, COSPAR holds Scientific Assemblies every two years. During the scientific assembly sessions, the participants will present latest projects and results in posters or oral presentations.

COSPAR's first Space Science Symposium was organised in Nice, France in January 1960. ISRO had earlier hosted the COSPAR conference in 1979 at Bangalore. The Mysore Congress is the 39th Scientific Assembly of COSPAR.

The 39th scientific assembly of COSPAR will be held at Global Education Centre, Infosys Campus in Mysore during July 14-22, 2012. Prof. U R Rao, Chairman, PRL Council and former Chairman, ISRO has been elected as the Chairman, Programme Committee of COSPAR. About 3000 scientists from more than 50 countries are expected to participate in this mega science event.

Global Education Centre, Infosys Campus at Mysore

Bhuvan
Gateway to Indian Earth Observation

Vision

To evince the distinctiveness of Indian imaging Capabilities through online rendering of multiresolution, multi-temporal and multi-sensor Indian Remote sensing Satellite (IRS) data with value added Services on 3D globe for public good.

Introduction

Bhuvan is an initiative to showcase Indian imaging Capabilities with a focus on Indian region, including Global coverage. It is an ambitious project of ISRO to take Indian images and other value added services

in multiple spatial resolutions to the people through a web geoportal for easy access to information on basic natural resources in the geospatial domain. Bhuvan showcases IRS images in 2D and 3D perspectives with excellent rendering capabilities. It displays satellite images of varying resolutions with respect to earth surface, allowing users to visualize features like cities and important places of interest in different perspectives and with navigation possibilities over India.

The degree of resolution showcased is based on the points of interest and popularity and the entire Indian terrain is covered upto 6 meter spatial resolution for display. With such a content and rich rendering possibilities, the door to net-centric visualization of digital geospatial data with a unique experience of interactive terrain viewing and maneuverability options have been successfully enabled.

Multi-resolution images from IRS satellites are seamlessly organised to depict Natural features on Web geoportal to enable common-man to zoom into specific area of interest at varying resolutions with even vector overlay capability. Bhuvan brings a whole lot of uniqueness in understanding our own natural resources whilst presenting beautiful images and thematic information generated from varieties of geospatial data. Bhuvan also attempts to bring out the importance of multi-temporal data that could help in detecting changes that take place to our natural resources.

Bhuvan is an interactive versatile visualization system that allows user to navigate (or "fly") across the entire globe, view satellite imageries with overlays of administrative boundaries, transport network, geographic features, and numerous other location-specific data points. Users can add their own points of interest and share them with others, chart routes, plot areas, calculate distances, and overlay vectors by choice onto the application. Bhuvan provides online information on land and ocean resources in addition to disaster and others. The ocean information is more specific on potential fishing zones (PFz) powered through the INCOIS services of Ministry of Earth Sciences.

Users can show or hide available layers in any combination. Using the scale and the robust measurement and terrain analysis tools, one could plot mileages, calculate elevation difference and slope angle between two or more points in the 3D view, terrain elevation profile along a path, find places of interest along the way, and link to Web sites to contact those establishments.

How to use Bhuvan?

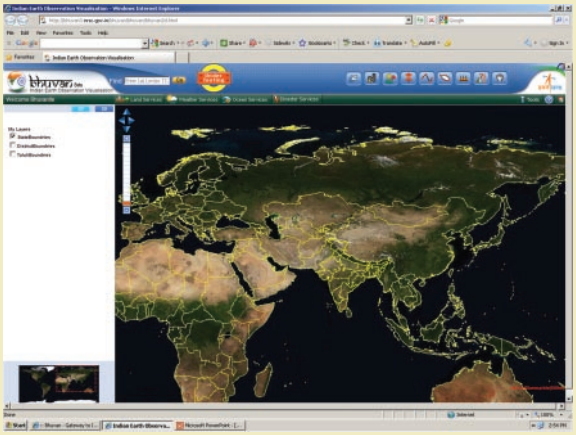
It is a free web based visualization system. By just logging on to www.bhuvan.nrsc.gov.in and

downloading and installing the plug-in (only for first time use), users can access Bhuvan and can fly to locations around the world by either entering the names of places or the latitude, longitude coordinates. Zooming in and out determines the number and kind of features or locations displayed as the resolution changes. As one zooms closer to a built-up area, for instance, smaller details and place names begin to appear automatically. On rendering, the thematic maps and their details are clickable, opening a pop-up window with information about its feature, links to related resources, photos, or other information. Users can change the orientation of the compass points of the map and adjust the aspect, such that the map is shown in any angle from directly above to horizontal. For areas rendered in 3D, adjusting the aspect gives the impression of moving through a real space. Users can add 'Placemarks', which are clickable indicators of particular locations, and create 2D and 3D features, share, collaborate and use powerful urban design tools.

More than just images and maps, Bhuvan lets users create and share personal resources. In addition, the tool allows users to consume OGC complaint map services for viewing, query and analysis, on the fly. Browsing and exploring distant locales, augmented with contributions from other users, presents a compelling opportunity for discovery and learning. Contributing anecdotes, stories, and histories further allows users to communicate in a geographic context.

Bhuvan 2D (Beta)

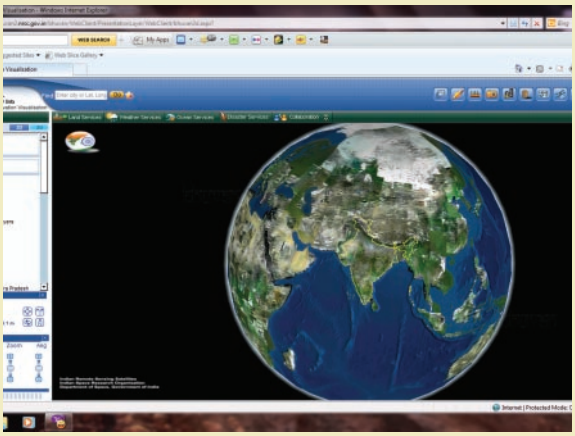
The two dimensional (2D) Bhuvan, a web mapping service application based on OpenLayers open source project, offers powerful, user-friendly mapping technology to organize the satellite and map data along with myriad information geographically with no server-side dependencies in an easy way.



Bhuvan 2D is a slick, exciting on-line mapping application. It provides a highly responsive, intuitive mapping interface with detailed imagery and map data embedded. Some of its functional capabilities include map navigation, map panning, drawing line, point, polygon, overview map, linear and areal measurement. These capabilities combine to make Bhuvan 2D a compelling product.

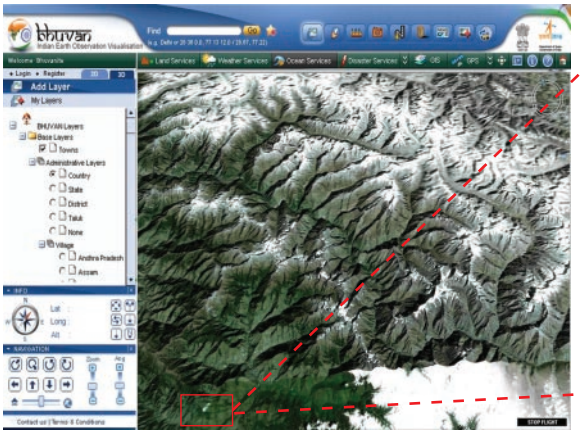
Bhuvan 3D

Bhuvan 3D showcases images in a Multi-sensor, Multiplatform and a Multi-temporal domain. It lets you access, explore and visualize IRS image and a bundle of rich thematic information in 3D landscape.

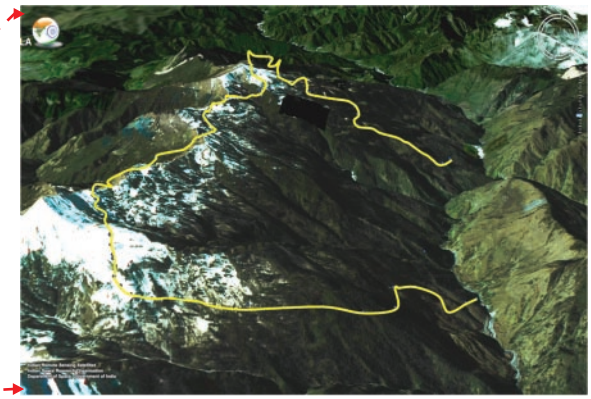


On Bhuvan 3D, users can fly to different locations on the terrain and experience unparalleled 3D navigation.

3D Bhuvan has many unique featured and easy to use interface, where user can virtually experience the physical characteristics of the terrain, especially the Indian landscape. The urban design tools are a magic galore. Here you can virtually build roads, junctions and traffic lights in an urban setting. Experience all this just on Bhuvan 3D. A typical example of using GPS while trekking/ mountain climbing mapped back to Bhuvan 3D is illustrated in the next page.



Use of Bhuvan for trekking related activities



GPS points mapped while trekking; this could be used by other enthusiastic trekkers

Basic Features of Bhuvan

- Access, explore and visualize 2D and 3D image data along with rich value added services
- Visualize multi-resolution, multi-sensor, multi temporal IRS image data
- Superpose administrative boundaries of choice on images as required up to village level.
- Visualization of AWS (Automatic Weather Stations) data/information in a graphic view and use tabular weather data of user choice
- Fly to locations (to fly from the current location directly to the selected location)
- Heads-Up Display (HUD) navigation controls (tilt slider, north indicator, opacity, compass ring, zoom slider)
- Navigation using the 3D view pop-up menu (fly-in, fly out, jump in, jump around, view point)
- 3D fly through (3D view to fly to locations, objects in the terrain, and navigate freely using the mouse or keyboard)
- Drawing 2D objects (text labels, polylines, polygons, rectangles, 2D arrows, circles, ellipse)
- Drawing 3D objects (placing of expressive 3D models, 2D polygons, boxes)
- Snapshot creation (copies the 3D view to a floating window and allows to save to an external file)
- Measurement tools (horizontal distance, aerial distance, vertical distance)
- Shadow analysis (it sets the sun position based on the given time creating shadows and effects the lighting on the terrain)
- Urban Design Tools (to build roads, junctions and traffic lights in an urban setting)
- Contour map (displays a colorized terrain map and contour lines)
- Terrain profile (displays the terrain elevation profile along a path)
- Draw tools (creates simple markers, free hand lines, urban designs)
- Navigation map (to jump to and view locations in the 3D India)
- Metadata for satellite images.

Bhuvan Celebrates First Anniversary

Interview with Dr. B. N. Suresh, Director, IIST

Dr. B. N. Suresh in office

Dr. BN Suresh, founder Director, Indian Institute of Space Science and Technology [IIST] relinquished office recently after rendering glorious service of three years. On this occasion, Dr. Suresh spoke to Sri S. Satish, Director P&PR, ISRO Hqs and shared his views on IIST. Excerpts:

1. Sir, why did ISRO decide to set up an Academic Institute and what are the objectives of setting up of IIST?

ISRO is in pursuit of excellence in space technology and applications to meet the National needs. In addition to these important tasks, ISRO has an ambitious road map for the next 20 years with advanced projects like interplanetary exploration beyond moon, human space mission, heavy lift launch vehicle, advanced spacecraft etc. The development of such complex technologies demands quality human resources. Over a period of time a need was strongly felt to generate quality human resources with sufficient training in these specialized areas of space science and technology. Therefore it was decided to establish a top class Academic Institution under Department of Space with the main objective of generating such quality human capital for ISRO. It was also decided to admit young and bright students immediately after their schooling based on all India examination and provide them the specialized education in science and engineering with more focus to Space Science and Technology aspects.

2. Will you please highlight the unique features of IIST and how is it different from other educational institutes offering similar programmes?

IIST is Asia's first space Institute to offer the complete range of under graduate, post graduate, doctoral, and post doctoral programmes with specific focus to space science, technology and applications under one roof. In addition to the regular

Cultural Programme by students of IIST

curriculum, courses will have specialized modules tailored to space science and technologies. IIST also focuses on high end research activities linking with the space programmes of the country and related innovative ventures. Students at IIST will have unique opportunities to do their internships and projects at the sophisticated laboratories of ISRO centres and units.

3. How can one join IIST and what is the Admission criteria for joining IIST?

Any student in India who has passed 12th standard and meeting the stipulated conditions of IIST can apply. IIST started conducting its own entrance examination from 2010 onwards for admissions. The criteria for admission is stipulated in detail in the website http://www.iist.ac.in

4. How do you see the role of IIST, its students, and faculty in Indian Space Programme?

IIST is only three years old as of now and in this short span the Institute has made significant progress in almost all areas of its operation like education, research, development of infrastructure and advanced facilities. Already it has got approval for developing centres of excellence in four different disciplines. I am very confident that with the kind of curriculum we have developed and with the kind of exposure to various activities of space, IIST students are fully equipped to undertake the challenging programmes of ISRO in the coming years. We have young and dynamic faculty members with a student teacher ratio of 7 to 8. Research activities have a major thrust at institute. Already several research projects have been initiated and 18 doctoral students have already registered.

5. What are the new initiatives like collaborative programmes with Indian academic institutions, industries, foreign institutions etc.?

Several initiatives have been taken with respect to collaborative programmes and already MoUs have been signed with world renowned Institutions like Ecole Polytechnique, France, Universities Space Research Association (USRA) of USA which has the affiliation with over 107 universities in different parts of the globe. Discussions are on with a few more prominent Institutions both in India and abroad and some of them will be finalized soon.

Class room in progress at IIST

6. You had worked for about four decades and was an integral part of all major projects, what was your experience during transition from R&D to academic field?

It has been a rewarding experience for me to work in an academic Institution and get associated with the task of Institution building as its founder Director. My experience for the last four decades in the development of space vehicles has immensely helped in several areas in shaping the Institute to the present level. It has also been a great learning experience for me with regard to development of curriculum, establishment of state of the art laboratories and advanced infrastructure at the Institute. It also provided a unique opportunity to interact with the prominent academicians all over the globe.

Thank you very much Sir

Madhurai as seen by Cartosat-2B