

## **ORGANISATION, FUNCTIONS AND DUTIES**

### **A. Organisation**

With the setting up of Indian National Committee for Space Research (INCOSPAR) in 1962, the space activities in the country were initiated. In the same year, the work on Thumba Equatorial Rocket Launching Station (TERLS) near Thiruvananthapuram was also started. Indian Space Research Organisation (ISRO) was established in August 1969. The 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.

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) and the Grant-in-Aid institutions viz. Physical Research Laboratory (PRL), National Atmospheric Research Laboratory (NARL), North Eastern-Space Applications Centre (NE-SAC), Semi-Conductor Laboratory (SCL) and Indian Institute of Space Science and Technology (IIST). The Antrix Corporation, established in 1992 as a government owned company, markets the space products and services.

The establishment of space systems and their applications are coordinated by the national level committees, namely, INSAT Coordination Committee (ICC), Planning Committee on National Natural Resources Management System (PC-NNRMS) and Advisory Committee of on Space Sciences (ADCOS).

The Secretariat of DOS and ISRO Headquarters are located at Antariksh Bhavan in Bangalore. Programme offices at ISRO Headquarters coordinate the programmes like satellite communication, earth observation, launch vehicle, space science, disaster management support, sponsored research scheme, contracts management, international cooperation, safety, reliability, publications and public relations, budget & economic analysis, civil engineering and human resources development. The major establishments of DOS and their area of activities are given in the following paragraphs:

### **Vikram Sarabhai Space Centre (VSSC)**

VSSC at Thiruvananthapuram is the lead centre for the development of satellite launch vehicles and associated technologies. The centre pursues research and development in the fields of aeronautics; avionics; composites; computer and information; control, guidance and simulation; launch vehicle design; mechanical engineering; mechanisms, vehicle integration and testing; propellants, polymers, chemicals and materials; propulsion, propellants; and systems reliability. Programme planning and evaluation, technology transfer and industrial coordination, human resources development, safety and personnel and general administration groups support the centre. The major programmes at VSSC include development of: Polar Satellite Launch Vehicle (PSLV), Geosynchronous Satellite Launch Vehicle (GSLV), Geosynchronous Satellite Launch Vehicle Mk III (GSLV Mk III), Sounding Rockets, Space-capsule Recovery Experiment, Reusable Launch Vehicles and Air Breathing Propulsion.

An Ammonium Perchlorate Experimental Plant (APEP) has been set up by VSSC at Aluva in Kerala. The Space Physics Laboratory at VSSC carries out research in atmospheric and related space sciences.

### **ISRO Satellite Centre (ISAC)**

ISAC, located at Bangalore is the premier Centre for research and development of satellite systems. ISAC is carrying out conceptualisation, design, fabrication, testing and integration and in-orbit commissioning of satellite systems through time bound projects. Cutting edge technologies meeting various mission requirements are developed in the Centre keeping ISAC in the forefront of spacecraft technology frontiers.

ISAC is functionally organized in seven major areas: Mechanical Systems Area, Mission Development Area, Communication and Power Systems Area, Controls and Digital Area, Integration and Checkout Area, Systems Production Area and Reliability and Quality Control Area. Electronic and Mechanical fabrication facilities, Environmental test facilities support the centre in fabrication and testing activities. Programme Planning and Evaluation Group is responsible for all planning and acts as the central coordinating agency and technical secretariat of Director of the Centre. Space Astronomy Group has been involved in optical, X-ray and Gamma ray astronomy research with strong emphasis on instrumentation. Computer & Information Group is responsible for establishment and management of centralised IT infrastructure in ISAC. Three Programme Management Offices coordinate the implementation of the INSAT, IRS & small satellites and satellite navigation programmes.

ISRO Satellite Integration and Test Establishment (ISITE) is equipped with state-of-the-art clean room facilities for spacecraft integration and test facilities including 6.5 meter Thermo Vacuum Chamber, 29 ton Vibration Facility and Compact Antenna Test Facility under one roof.

### **Satish Dhawan Space Centre (SDSC) SHAR**

SDSC SHAR at Sriharikota, with two launch pads, is the main launch centre of ISRO carries out launch operation. The mandate for the centre is (i) to produce solid propellant boosters for the launch vehicle programmes of ISRO, (ii) to provide the infrastructure for qualifying various subsystems & solid rocket motors and carrying out the necessary tests, (iii) to provide launch base infrastructure and (iv) for assembly, integration and launching of satellite launch vehicles and satellites.

SDSC-SHAR has a separate launch pad for launching the sounding rockets. The centre provides necessary launch base infrastructure for sounding rockets of ISRO and for assembly, integration and launch of sounding rockets and the payloads.

As part of GSLV-MK III Project, the Centre has created new facilities/augmented some of the existing facilities viz. solid motor production facilities for processing S200 motor, Launch vehicle integration facilities, New Radars, Mission Control Centre, Static testing facilities, Liquid Propellant and Cryogenic propellant storage and stage servicing facilities, Satellite preparation facility for preparing various satellites.

### **Liquid Propulsion Systems Centre**

LPSC is the premier Centre of ISRO responsible for design, development & realization of Liquid Rocket Engines, Stages and Control Power Plants for Launch Vehicle & Satellite programmes. The centre has built end-to-end capability through the development of state of the art technologies in Earth Storable & Cryogenic propulsion areas and also developed Electric Propulsion Systems for Spacecraft programmes. The centre is also pursuing the development of high thrust semi cryogenic engine for Unified Launch Vehicle (ULV) and Reusable Launch Vehicle (RLV). LPSC activities are organized in two campuses situated at Valiamala and Bangalore with Head quarters situated at Valiamala near Thiruvananthapuram in Kerala.

### **ISRO Propulsion Complex (IPRC)**

ISRO Propulsion Complex (IPRC), Mahendragiri is equipped with the state-of-the-art-facilities necessary for realising the cutting edge propulsion technology products for Indian space research programme. Formerly, IPRC was known as LPSC, Mahendragiri and taking cognisance of the future growth of the space programme of the country and the concomitant expansion at Mahendragiri, it was elevated as IPRC with effect from February 01, 2014.

The activities carried out at IPRC, Mahendragiri are: assembly, integration and testing of earth storable propellant engines, cryogenic engines and stages for launch vehicles; high altitude testing of upper stage engines and spacecraft thrusters as well as testing of its sub systems; production and supply of Cryogenic propellants for Indian Cryogenic rocket programmes, etc.

IPRC is responsible for the supply of Storable Liquid Propellants for ISRO's launch vehicles and satellite programmes. IPRC delivers quality products to meet the zero defect demand of ISRO space programme ensuring high standards of safety and reliability. It also carries out Research & Development (R&D) and Technology Development Programmes (TDP) towards continual improvement of its contribution to Indian space programme.

### **Space Applications Centre (SAC)**

SAC at Ahmedabad is one of the major centre of ISRO dealing with wide variety of themes from payload development to societal applications, thereby creating a synergy of technology, science and societal applications. The Centre is responsible for the development, realisation and qualification of communication, navigation, earth observation and meteorological payloads and related data processing and ground systems. The centre carries out development of ground systems and application activities in the areas of communications, broadcasting, earth observations for remote sensing of natural resources, weather and environmental studies, disaster monitoring/mitigation, etc. It is playing an important role in harnessing space technology for a wide variety of applications for societal benefits.

The Centre also conducts nine-month Post Graduate Diploma courses on Satellite Communication and Meteorology for the students from Asia Pacific region under the aegis of the Centre for Space Science and Technology Education (CSSTEAP), affiliated to the UN. SAC also operates Delhi Earth Station (DES) for satellite communication.

### **Development and Educational Communication Unit (DECU)**

DECU, Ahmedabad is an independent entity, has a definite role in meeting the goals of ISRO in promoting usage of space technology for the benefit of common man. DECU is involved in the conceptualisation, definition, planning, implementation and socio-economic evaluation of space applications. The major activities of DECU include: EDUSAT projects, their implementation and utilisation; Training and Development Communication Channel (TDCC), Village Resource Centres (VRC), Tele-medicine and new satellite communication development and applications.

### **ISRO Telemetry, Tracking and Command Network (ISTRAC)**

ISTRAC provides mission support to low-earth orbit satellites as well as launch vehicle missions. ISTRAC has its headquarters and a multi-mission Spacecraft Control Centre

at Bangalore. It has a network of ground stations at Bangalore, Lucknow, Sriharikota, Port Blair and Thiruvananthapuram in India besides stations at Mauritius, Tromso and Svalbard (Norway) & Troll (Antartica) and Biak (Indonesia). ISTRAC activities are organised into network operations, network augmentation, mission operation and spacecraft health monitoring, communications and computers and control centre facilities and development projects. Programme planning and reliability groups support ISTRAC activities. ISTRAC also operates the Local User Terminal/Mission Control Centre (LUT/MCC) under the international programme for satellite-aided search and rescue.

The Indian Deep Space Network (IDSN), consisting of two large parabolic antennas – one with 18 m diameter and the other 32 m diameter (commissioned during Chandrayaan – 1 mission) at Byalalu village near Bangalore is capable of supporting mission to the moon and beyond.

Research and development in the area of radar systems needed for space programme like tracking radars, wind profile radar and weather radars needed for meteorological applications are also undertaken.

#### **Master Control Facility (MCF)**

MCF at Hassan, Karnataka and Bhopal, Madhya Pradesh monitors and controls all the geo-stationary satellites of ISRO. MCF is responsible for the operations related to initial orbit raising of satellites, in-orbit payload testing, and on-orbit operations throughout the life cycle of these satellites. The operations involve continuous tracking, telemetry and commanding, special operations like eclipse management, station keeping manoeuvres and recovery in case of contingencies. MCF interacts with the user agencies for effective utilisation of the satellite payloads and to minimise the service disturbances during special operations.

#### **ISRO Inertial Systems Unit (IISU)**

IISU at Thiruvananthapuram carries out research and development in inertial sensors and systems and allied satellite elements. IISU is organised into research and development groups in the areas of launch vehicle inertial systems, spacecraft inertial systems, inertial system production and reliability and quality assurance. It has facilities for precision fabrication, assembly, clean room and integration and testing. This unit has the total capability to design, develop, qualify and deliver inertial systems for all the programmes of ISRO.

#### **Laboratory for Electro-Optic Systems (LEOS)**

LEOS at Bangalore is engaged in design, development and production of Electro-Optic sensors and camera optics for satellites and launch vehicles. The sensors include star trackers, earth sensors, sun sensors & processing electronics. Optics Systems include

both reflective and refractive optics for remote sensing and meteorological payloads. Other optical elements developed by LEOS for in-house use include optics for star sensor, optics for Lunar Laser Ranging Instrument (LLRI), optical masks for sun sensors, optical filters and encoders.

LEOS is actively involved in the development of new technologies for present / future satellites. This includes development active pixel sensor star tracker, Charge Coupled Device (CCD) based star tracker, Fiber Optics Gyro, Optical inter satellite link, high resolution camera optics, optical coatings and MEMS devices (magnetometer, accelerometer etc.). LEOS is situated at Peenya Industrial Estate, Bangalore where the first Indian Satellite Aryabhata was fabricated in 1975.

### **National Remote Sensing Centre (NRSC)**

NRSC at Hyderabad is responsible for remote sensing satellite data acquisition and processing, data dissemination, aerial remote sensing and decision support for disaster management. NRSC has a data reception station at Shadnagar near Hyderabad for acquiring data from Indian remote sensing satellites as well as others. The Centre is also engaged in executing remote sensing application projects in collaboration with the users. The Aerial Services & Digital Mapping (ASDM) Area provides end-to-end Aerial Remote Sensing services and value-added solutions for various large scale applications like aerial photography and digital mapping, infrastructure planning, scanner surveys, aeromagnetic surveys, large scale base map, topographic and cadastral level mapping, etc.

Regional Remote Sensing Centres (RRSCs) support various remote sensing tasks specific to their regions as well as at the national level. RRSCs are carrying out application projects encompassing all the fields of natural resources like agriculture and soils, water resources, forestry, oceanography, geology, environment and urban planning. Apart from executing application projects, RRSCs are involved in software development, customisation and packaging specific to user requirements and conducting regular training programmes for users in geospatial technology, particularly digital image processing and GIS applications.

### **Indian Institute of Remote Sensing (Dehra Dun)**

Indian Institute of Remote Sensing at Dehradun is a premier institute with the objective of capacity building in Remote Sensing and Geo-informatics and their applications through education and training programmes at postgraduate level. The Institute also hosts and provides support to the Centre for Space Science and Technology Education in Asia and the Pacific (CSSTE-AP), affiliated to the United Nations. The training and

education programmes of the Institute are designed to meet the requirements of various target/user groups, i.e., for professionals at working, middle and supervisory levels, fresh graduates, researchers, academia, and decision makers. The duration of courses ranges from one week to two years.

The training and education programmes conducted by the Institute are broadly grouped into: Post-graduate Diploma courses, Certificate programmes and Awareness programmes. In addition, IIRS also conducts special programmes for International and National participants on request from different organisations. M.Tech. course of 24 months duration is being conducted in collaboration with Andhra University, Visakhapatnam; and M.Sc. course of 18 months duration being conducted in collaboration with the Faculty of Geo-information Science & Earth Observation (ITC) of the University of Twente (UT), The Netherlands.

### **Physical Research Laboratory (PRL)**

PRL at Ahmedabad, is an autonomous institution supported mainly by DOS. It is a premier institute engaged in basic research in the areas of astronomy and astrophysics, space and atmospheric sciences, geosciences, planetary sciences and exploration and theoretical physics. The activities cover a wide spectrum of research in all these areas.

PRL was the lead centre for science planning of the Chandrayaan-1 mission that led to the path-breaking discovery of the presence of water and hydroxyl molecules on lunar surface.

PRL is also involved in conducting extensive academic programmes for Doctoral and Post Doctoral research and also has an Associate-ship programme for university teachers. It is also entrusted with the management of the Udaipur Solar Observatory (USO).

### **National Atmospheric Research Laboratory (NARL)**

NARL at Gadanki near Tirupati is an autonomous society supported by DOS. It is a centre for atmospheric research with facilities like mesosphere-stratosphere-troposphere radar, LIDAR, lower atmospheric wind profiler, disdrometer, optical rain gauge and automatic weather station along with associated facilities.

NARL is available for national and international scientists to conduct atmospheric research.

### **North Eastern-Space Applications Centre (NE-SAC)**

NE-SAC, located at Shillong, is a joint initiative of DOS and North Eastern Council to provide support to the North Eastern region in using space science and technology for development. The centre has the mandate to develop high technology infrastructure support to enable NE states to adopt space technology inputs for their development. At present, NE-SAC is providing developmental support by undertaking specific projects by utilising space technology inputs – remote sensing, satellite communication and space science.

### **Antrix Corporation Limited**

The Antrix Corporation Limited (ACL), Bangalore is the marketing agency under DOS with access to resources of DOS as well as Indian space industries. ACL markets subsystems and components for satellites, undertakes contracts for building satellites to user specifications, provides launch services and tracking facilities and organises training of manpower and software development.

### **Semi-Conductor Laboratory (SCL)**

The administrative control of Semi-Conductor Complex Limited, Chandigarh, a public sector undertaking under Ministry of Communications and Information Technology (MCIT) was transferred to Department of Space during March 2005. DOS has re-structured SCL company and has registered SCL as a research and development society in November 2005. SCL is entrusted with design and development of Very Large Scale Integration (VLSI) devices and development of systems for telecommunication and space sectors. SCL has facilities for fabrication of micro-electronic devices in 0.8 micron range and Micro Electro Mechanical



Systems (MEMS).

### **Indian Institute of Space Science and Technology (IIST)**

IIST, an institute of excellence, has been established at Thiruvananthapuram during 2007 with the objective of offering high quality education in space science and technology to meet the demands of Indian Space Programme.

The institute offers Bachelors Degree in Space Technology with specialisation in Avionics and Aerospace Engineering and Integrated Masters Programme in Applied Sciences with special emphasis on space related subjects. IIST is a residential institute and is being developed on a picturesque site near Thiruvananthapuram. About 500 students from various parts of the country are pursuing undergraduate and masters courses.

#### **B. Functions and Duties**

The core functions and duties of Department of Space is include:-

- (a) Design, development and realisation and launching of Space Launch Vehicle Systems and Sounding Rockets.
- (b) Design, development and realisation of communication satellites (carrying transponders) for meeting the National Demand towards telecommunications, television broadcasting, security requirements and societal applications.
- (c) Design, development and realisation of satellites and/or space based systems for navigational applications
- (d) Design, development and realisation of Earth Observation Satellites for mapping and monitoring of natural resources, Disaster Management Support and Meteorological services.
- (e) Design, development and realisation of space systems for carrying out research related to space sciences and planetary exploration.
- (f) Implementation of innovative space applications in the domains of natural resources management, disaster management support and several societal applications.
- (g) Undertaking Research and Development activities towards advanced launch vehicles, spacecrafts and ground systems for space missions.
- (h) Operation and maintenance of space assets and critical infrastructural facilities.

- (i) Fostering international co-operation in peaceful uses of outer space including adherence to international charters and treaties.
- (j) Development of Human Resources and capacity building to carryout the space Research Activities.