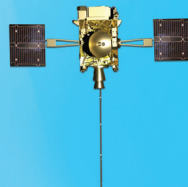
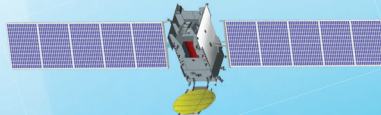
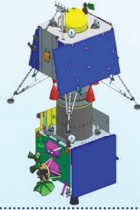


# MARVELS OF INDIAN SATELLITES



**ISRO** over the past six decades has contributed and invested into many successful Space Programmes. The hallmark of Indian Space Programme is the application-oriented focus and the benefits that have accrued to the country through these programmes.

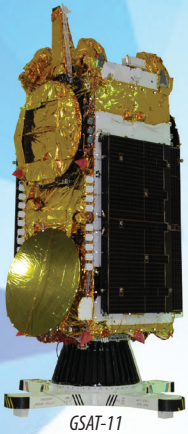
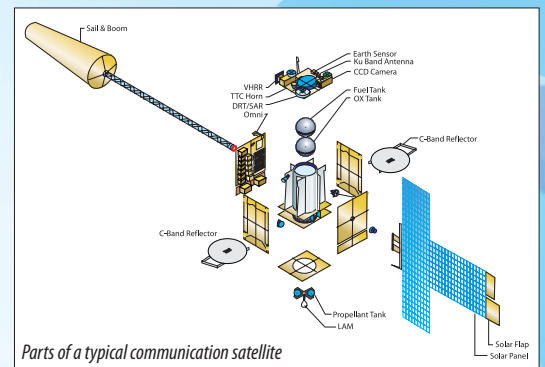
ISRO is a dream planet of late Dr Vikram Sarabhai now a reality living throughout the country in almost every state serving as instrumental centres and infrastructures. The outstanding technological feat of the human race triggered new advanced scientific and technological developments for the betterment for the common man and nation.

The marvels of Indian Satellites are designed and developed by the minds that feed on curiosity and innovation. SITE (Satellite Instructional Television Experiment), the largest mass communications experiment ever carried out in the world. SITE was followed by the Satellite Telecommunication Experimental Project (STEP) in 1977-79. Later, SITE and STEP paved the way for INSAT, the Indian National Satellite System, the backbone of Satellite Communication in India today.

## CONNECTIONS MADE STRONG, LIVE LONG...

### Geostationary Satellites

INSAT (Indian National Satellite System) is one of the largest Domestic Communication Satellite Systems in the Asia-Pacific region with nine operational Communication Satellites placed in Geostationary Orbit. INSAT system provides services with more than 200 transponders in the C, Extended C and Ku-bands to Telecommunications, Television Broadcasting, Satellite Newsgathering, Societal Applications,



GSAT-11



#### Banking & ATM

Virtual Private Network (VPN) of banking and ATM using Satellite Communication Technology for Data Transfer



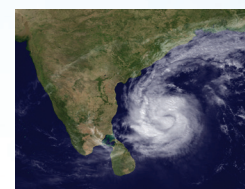
#### Tele-education

Using Edusat Satellite Tele-education to the rural community through television and other networks



#### TV Broadcasting & DTH

Supports Terrestrial and Direct-to-Home Television Services to the Public



#### Weather Forecasting & Cyclone Warning Service

Day to day weather prediction and cyclone alerts to the needy people



#### Telemedicine

Connects the rural hospitals to nearby corporate hospitals/specialists through Satellite link and exchanges data in Video and Image Formats





**News Broadcasting**  
Enables the OB van to connect to the TV studio for broadcasting real-time information



**Radio Broadcasting**  
High fidelity programme channels for national as well as regional radio stations



**Search & Rescue**  
Establishes satellite connectivity to people at remote locations like fishermen and victims of cyclone



**Maitri, Antarctica**  
Connects Maitri station at Antarctica with the real-time through Satellite Network

Weather Forecasting, Disaster Warning and Search & Rescue Operations, Radio Networking, Mobile Satellite Services, Telemedicine, Tele-education, Village Resource Centre (VRC), Direct-to-Home Services (DTH) throughout the country.

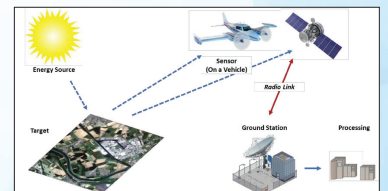
A few satellites in the INSAT System are GSAT-6, 7, 7A, 8, 9, 10, 11, 12, 14, 15, 16, 17, 18, 19, 29, 31, 30, 24 and CMS-01.

## HAWKEYE IN THE SKY!!

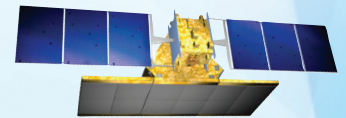
### Earth Observation Satellites

The Indian Remote Sensing (IRS) Satellite System was commissioned with the launch of IRS-1A. India has one of the largest constellations of Operational Remote Sensing Satellites.

A few Earth Observation satellites are OCEANSAT-2, RESOURCESAT-2, MEGHA-TROPIQUES, SARAL, INSAT-3D, RESOURCESAT-2A, SCATSAT-1, INSAT-3DR, CARTOSAT-2E, CARTOSAT-3, RISAT-2BR1, EOS-1, EOS-4, EOS-2, EOS-6, INS-2B, EOS-7, INSAT-3DS.



Schematics showing Principles of Remote Sensing



RISAT-1

ATIONS  
3E  
TELLITE SERVICES  
ATION  
ICES (DTH)  
OURCE CENTRE (VRC)

SEARCH & RESCUE OPERATIONS

**CARTOSAT-2**  
WATER RESOURCES  
COVERING AGRICULTURE

**ENVIRONMENT**  
**SCATSAT-1**  
**FORESTRY**

**RESOURCESAT-1**  
**SARAL**  
URBAN PLANNING

**RISAT-1**  
**INSAT-3D**

RURAL DEVELOPMENT

MEGHA-TROPIQUES

INSAT-3A  
DISASTER MANAGEMENT

MINERAL PROSPECTING  
OCEAN RESOURCES



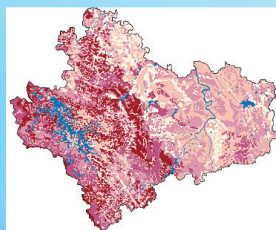
**Agriculture**

- Crop Acreage and Production Estimation
- Crop Condition Assessment



**Water Resources**

- Surface Water Mapping
- Run-off Forecasting
- Reservoir Sedimentation and Drainage Congestion Studies
- Groundwater Potential Zone Mapping



**Soil**

- Soil Mapping
- Land Capability and Irrigability Assessment
- Soil Moisture Estimation



**Ocean Applications**

- Potential Fishing Zone (PFZ) Mapping
- Monitoring of Navigational Channels
- Coastal Zone Mapping
- Coral Reef Mapping



**Land Use / Land Cover**

- Wasteland Mapping
- Urban Sprawl Studies
- Growth Centre Analysis
- Monitoring Water Logged Areas, Salt-affected Areas, Eroded Lands, Shifting Cultivation, etc.





### **Geosciences**

- Geological Mapping
- Geomorphological Mapping
- Mineral Targeting



### **Forests**

- Forest Cover Mapping and Monitoring
- Forest Management Plan
- Biodiversity Conservation
- Environmental Impact Studies
- Grassland Productivity



### **Environment**

- Atmospheric Constituents and Aerosols
- Land-air-ocean Interaction
- Past Climate Data Modelling



### **Disaster Warning & Management**

- Flood Damage Assessment
- Flood Risk Zone Mapping
- Monitoring of Volcanic Eruption and Underground Coal Fire
- Forest Fire and Risk Mapping
- Grassland Productivity

The data collected from these satellites are used for several applications covering Agriculture, Water Resources, Urban Planning, Rural Development, Mineral Prospecting, Environment, Forestry, Ocean Resources and Disaster Management.

The satellites are instrumental in providing necessary data in diversified Spatial, Spectral and Temporal Resolutions required in the nation as well as globally. In the field of Agriculture, IRS data is used for Crop Health Monitoring, Crop Yield Estimation, Groundwater Potential Zone Mapping, Mineral Targeting Tasks etc. Potential Fishing Zone Identification and Coastal Zone Mapping are some of the ocean applications that are also the gifts of IRS.

## **KEEPING THE TRACK...**

### **Navigational Satellites**

#### **NavIC – Indian Regional Navigation Satellite System (IRNSS)**

India became the 4<sup>th</sup> country to offer Space-based Satellite Navigation Services. IRNSS is an

The collage features several key elements: a satellite in the top left; an airplane in flight; a red car; a large blue and white cargo ship; a white bus; and a group of hikers with backpacks. Text overlays include 'GAGAN' in large blue letters, 'NavIC' in blue, 'IRNSS' in red, 'PRECISE TIMING' in yellow, 'FLEET MANAGEMENT' in blue, 'MARINE NAVIGATION' in blue, 'IRNSS-1A' in yellow, and 'VEHICLE TRACKING' written vertically in red on the right side.

Independent Regional Navigation Satellite System being developed by India. It provides two types of Services – Standard Positioning Service (SPS) which is provided to all the users and Restricted Service (RS). RS is an encrypted service provided only to authorised users.

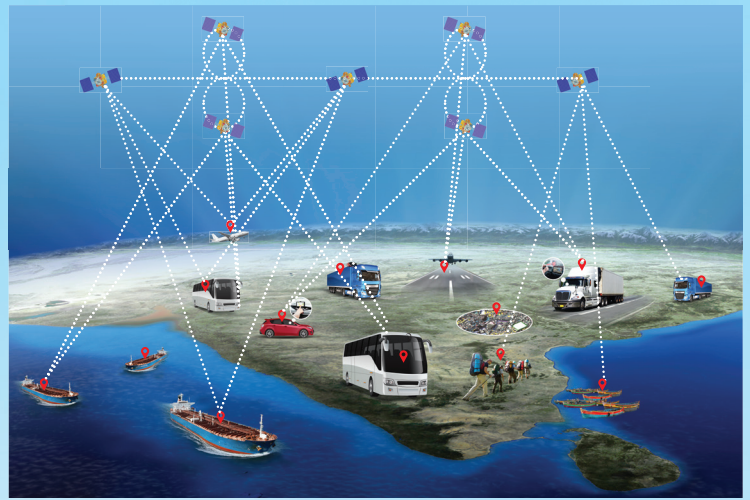
The IRNSS Constellation was named as “NavIC” (Navigation with Indian Constellation) by the Honourable Prime Minister, Narendra Modi and dedicated to the nation on the occasion of the successful launch of the IRNSS-1G Satellite.

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 boundary.



## NavIC Applications

- Terrestrial, Aerial and Marine Navigation
- Disaster Management
- Vehicle Tracking and Fleet Management
- Integration with Mobile Phones
- Precise Timing
- Mapping and Geodetic Data Capture
- Terrestrial Navigation aid for Hikers and Travellers
- Visual and Voice Navigation for Drivers

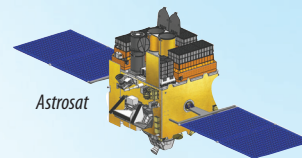


To meet the Civil Aviation requirements, ISRO is working jointly with Airport Authority of India (AAI) in establishing the GPS Aided Geo Augmented Navigation (GAGAN) system to provide better Air Traffic Management over Indian Airspace.

## MISSION UNIVERSE...

### Scientific and Space Exploration

Significant accomplishments in Science and Space Exploration Missions include Chandrayaan-1, Chandrayaan-2, Chandrayaan-3, Mangalyaan, Aditya-L1 and XPoSat are milestones achieved in the field of Space Exploration.



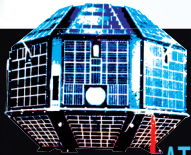
Astrosat



Mangalyaan



Chandrayaan-3



## ARYABHATA

ORBIT CONTROLS

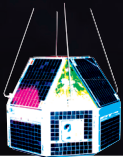
ATMOSPHERIC STUDIES

RECOVERY TECHNOLOGY

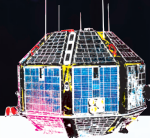
INS-1A

ROHINI SATELLITE RS-1

IMS-2



INS-1B



PAYLOAD DEVELOPMENT



APPLE

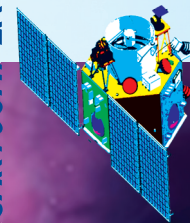
ROHINI TECHNOLOGY PAYLOAD (RTP)

INS-1C

YOUTHSAT



CARTOSAT-2A



SARAL

## THE GAME OF SATELLITES...

### Experimental Satellites

A host of small satellites are mainly for the experimental purposes, innovations or new discoveries done to enhance the existing technology. These experiments include Remote Sensing, Atmospheric Studies, Payload Development, Orbit Controls, Recovery Technology etc.

INS-1A, INS-1B, INS-1C, YOUTHSAT, APPLE, Rohini Satellite RS-1, Rohini Technology Payload (RTP), Aryabhata and many other satellites for the above experimental purposes.



## THE BEST THINGS COME IN SMALL PACKAGES...

### Small Satellites

The Small Satellite project is envisaged to provide a platform for stand-alone payloads for Earth Imaging and Science Missions within a quick turn around time. There are two satellites developed that are versatile in its payload applications;

- Indian Mini Satellite-1 (IMS-1)
- Indian Mini Satellite-2 (IMS) Bus

## HOGWARTS FOR YOUNG SCIENTISTS...

### University / Academic Institute Satellites

ISRO is influencing young minds into the field of astronomy and space science. It is envisioning capable universities to venture into space technology with guidance provided to students. The launch of Chandrayaan-1 has created a lot of interest and buzz in students to take initiatives and step into the world of space.

### Development of Payload & Satellite Design & Fabrication by Universities/Institutions

ISRO's student satellite programme is to encourage various universities and educational institutions for the development of NANO/Pico Satellites – Jugnu, SRMSat, STUDSAT, ANUSAT, SWAYAM, PISAT and other satellites. Design and development of Detectors, Payload Electronics, and Associated Algorithm/Experiments that enhance the application of space services to mankind. With such initiatives from ISRO the future lies in the hands of these young students transforming them from a student into a scientist.

## SATELLITE INTEGRATION, TESTING AND QUALIFICATION...

UR Rao Satellite Centre is responsible for Building and Testing Satellites. URSC is housed with the state-of-the-art facilities for building satellites on end-to-end basis. ISRO Satellite Integration



and Test Establishment (ISITE) is equipped with advanced Clean Room facilities for Spacecraft Integration and Test Facilities including a 6.5 metre Thermo Vacuum Chamber, 29 ton Vibration Facility, Compact Antenna Test Facility and Acoustic Test Facility under one roof. Assembly, Integration and Testing of all Communication and Navigation spacecraft is carried out at ISITE. A dedicated facility for the productionisation of standardised subsystems is established at ISITE.



Capacity Building and Public Outreach (CBPO)

**Indian Space Research Organisation**

Department of Space, Government of India

Antariksh Bhavan, New BEL Road, Bengaluru-560094, India