



INTERNATIONAL TRAINING COURSE ON SMALL SATELLITE MISSIONS

KEY NOTE ADDRESS

by

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**ISRO SATELLITE CENTRE
BANGALORE**

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Indian Space Programme

Satellite Application

Communication Program

Navigation Program

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Interplanetary Mission

Significance of small satellites

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National Space Systems

**Launch
Vehicle**

Spacecraft

**Ground
Systems**



101 missions realized over five decades

Multi Dimensions Of Space

**Academia
R&D Institutions**

**Antrix
Commercial wing**

**Department
Of
Space**

ISRO

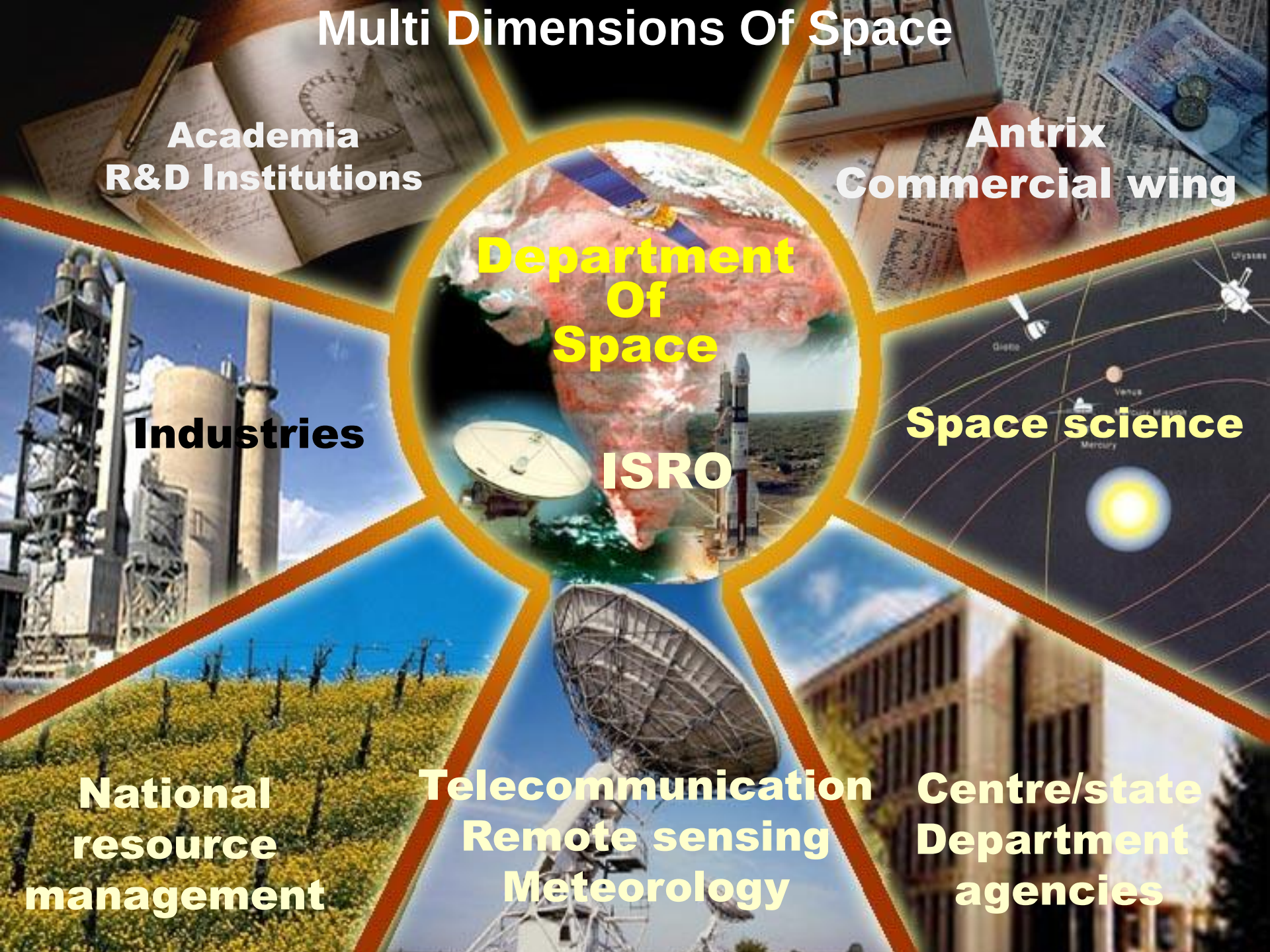
Industries

Space science

**National
resource
management**

**Telecommunication
Remote sensing
Meteorology**

**Centre/state
Department
agencies**



Launch Vehicles



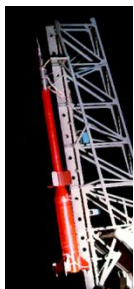
RLV - TD



ASLV



SLV



Sounding
Rocket
Experiments

PSLV



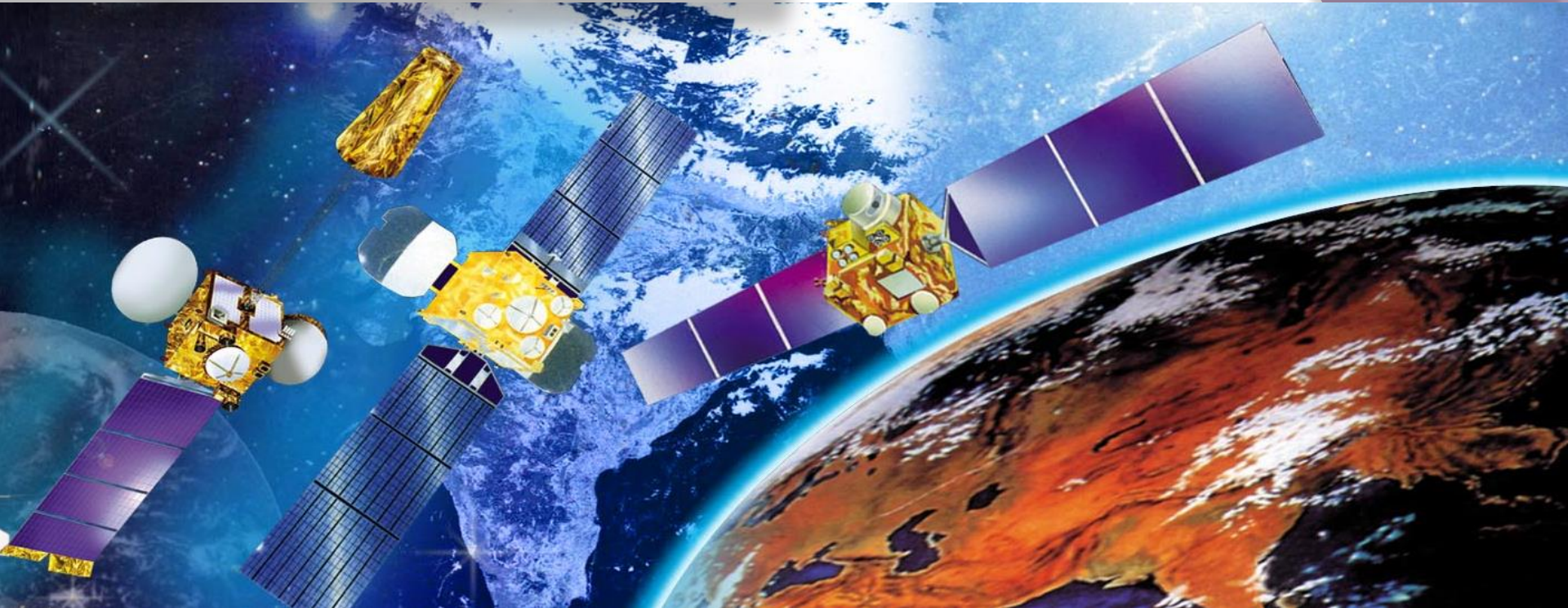
GSLV



GSLV-MKIII



Spacecraft Overview



65 Satellites realized

22 satellites in operation - 11 Communication, 12- Earth Observation & Small Satellites

State of the art facilities

State of the art technologies

Participation / Consultation for Global Satellite Missions

Satellite Applications

Communication & Broadcasting

Navigation

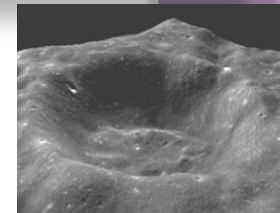
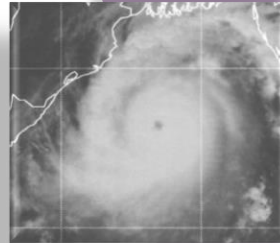
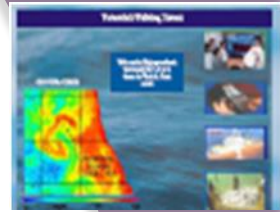
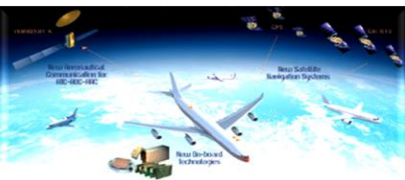
Meteorology

Remote Sensing

Space Science- Planetary Missions

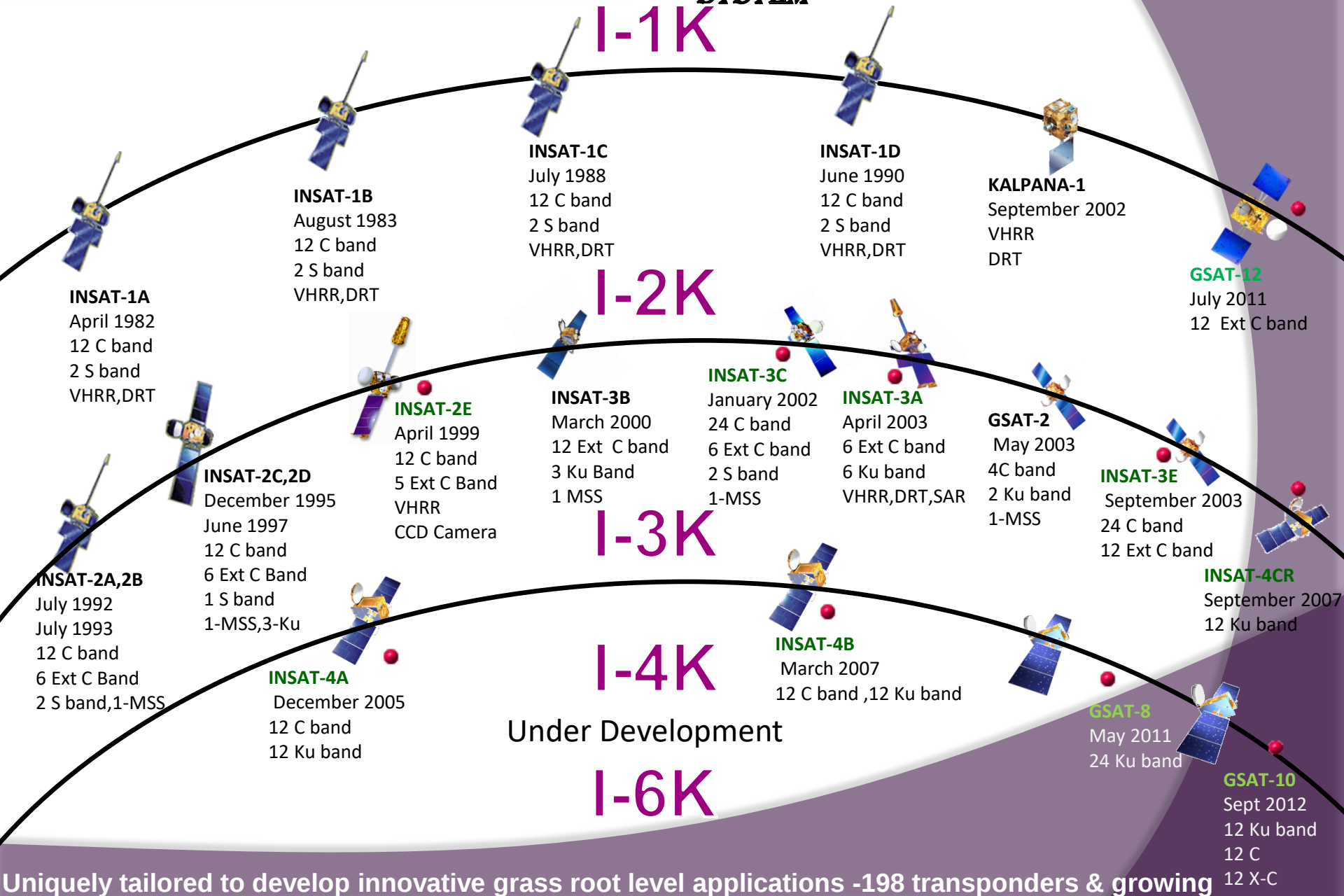
Technology Missions

Human In Space



Communication Satellites

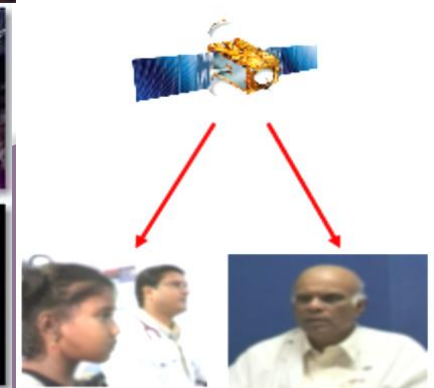
INSAT SYSTEM - WORLD'S LARGEST DOMESTIC SATELLITE COMMUNICATION SYSTEM



Uniquely tailored to develop innovative grass root level applications -198 transponders & growing

Communication Satellite - Application

- Speech Circuits On Trunk Routes
- TV Broadcasting
- Radio Networking
- Business Communications
- VSAT Connectivity
- Tele-education/Training
- Tele-medicine
- Search And Rescue Services
- Meteorology Imaging
- Disaster Warning System
- Data Collection Platforms



Earth Observation Satellites – In orbit



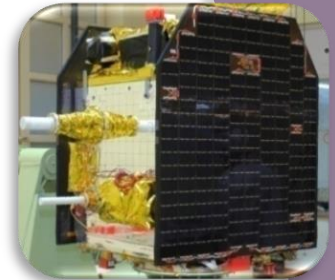
RESOURCESAT-1 & 2



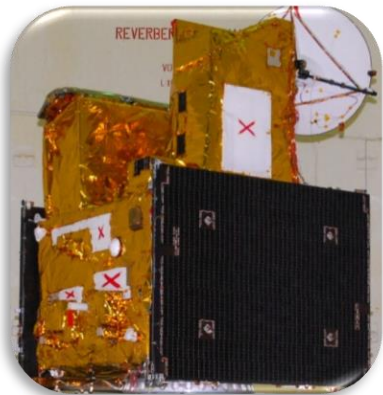
CARTOSAT-1



CARTOSAT-2, 2A ,2B



IMS-1



OCEANSAT-2



YOUTHSAT



MEGHATRAPOIQUES



RISAT-2 & 1

Earth Observation - Application



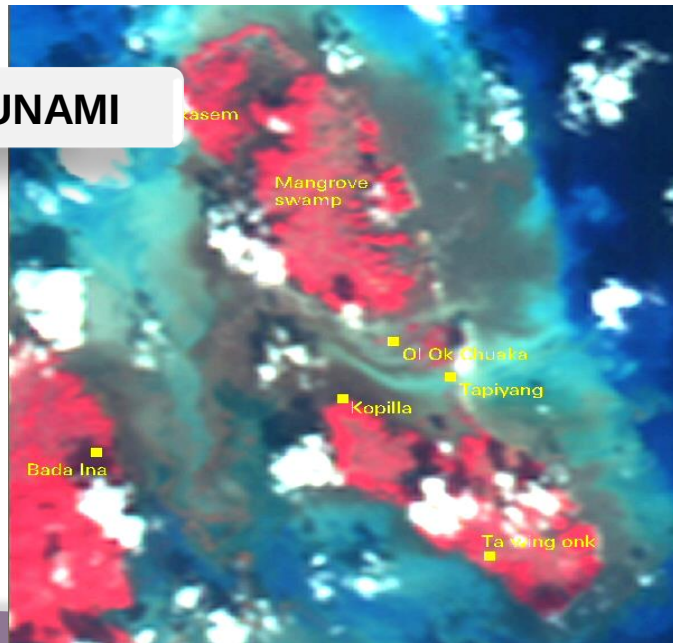
OCEANOGRAPHY	METEOROLOGY & DISASTER MANAGEMENT	CARTOGRAPHY	LAND & WATER RESOURCE MANAGEMENT
Potential Fishing Zone	Hazard Zonation & Warning	Multiple Spot Science Imagery	Crop Yield Forecast
Ocean State Forecast	Decision Support	Village Level Resource Assessment	Prospective Ground Water Zones
Cyclone Trajectory	Mapping & Monitoring	Urban & Infrastructure Planning	Waste Land Mapping
Coastal Water Pollution Monitoring	Search & Rescue	Transportation System Planning	Monitoring Irrigated Commands

Disaster Monitoring

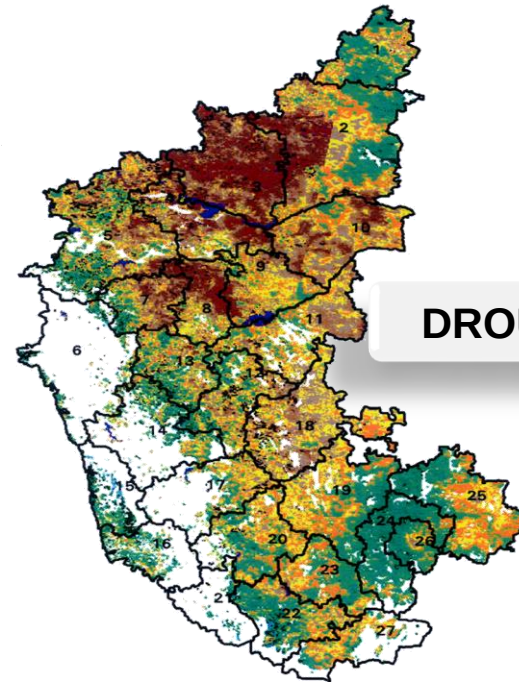
CYCLONE



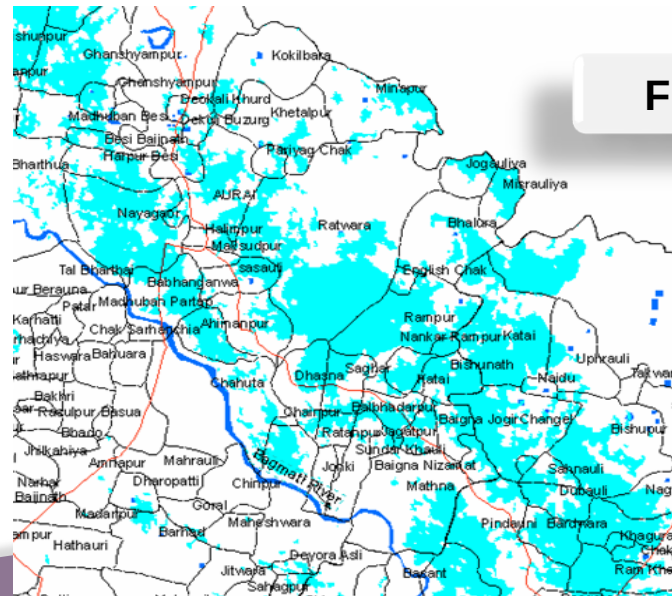
TSUNAMI



DROUGHT



FLOODS

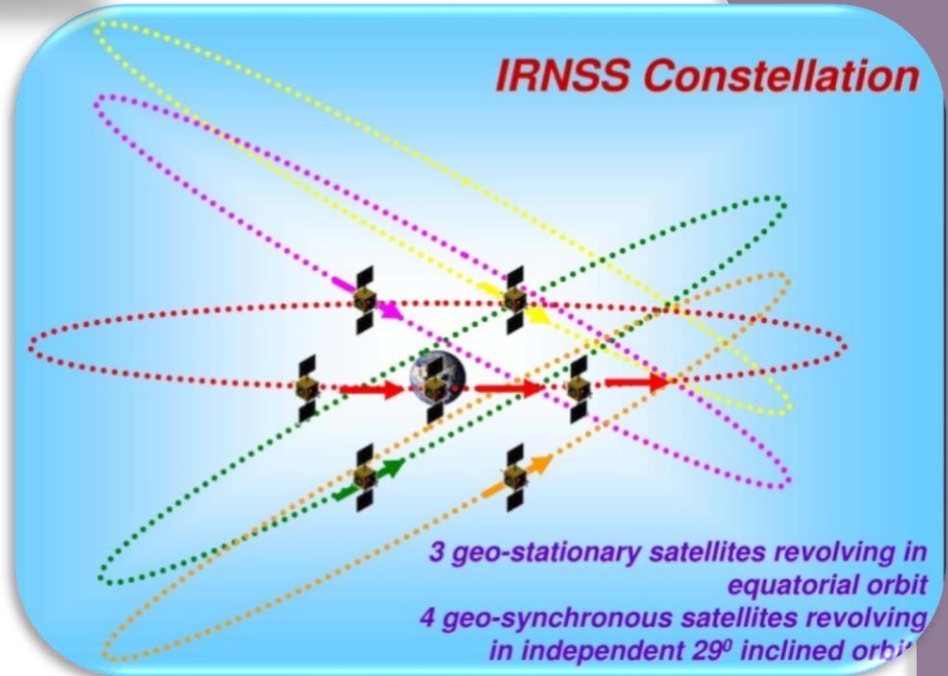


Satellite Technology For Environment Security

- **National Forest Type And Cover Mapping**
- **Snow And Glacier Related Studies**
- **Weather Forecast And Modelling**
- **Bio-diversity Characterisation**



Navigation Programme- Application



NAVIGATION

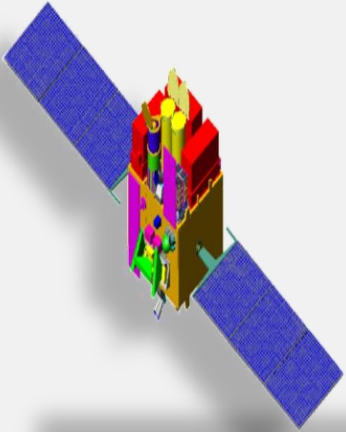
- SPACECRAFT
- AIRCRAFT
- SHIP
- VEHICLE
- FLEET MOVEMENT
- ROUTING/
- ALIGNMENT
- TIMING

SCIENTIFIC RESEARCH

- ATMOSPHERIC STUDIES
- IONOSPHERIC
- SCINTILLATIONS

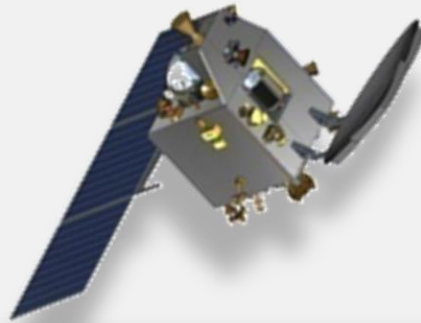


Space Science & Inter Planetary Missions



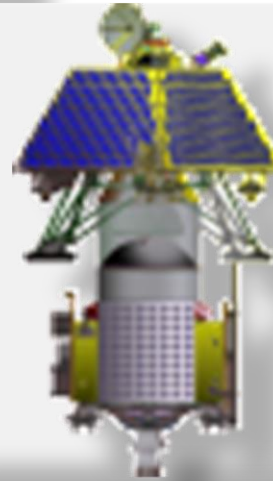
ASTROSAT

**Multi wavelength
Astronomical
Observatory**



MARS ORBITER MISSION

**First Indian
Mission to Mars
Exploration of
Mars surface
features using
specific scientific
instruments**



CHANDRAYAAN-2

**Second Indian
mission to moon for
continued
exploration of moon
Lander craft with
Rover & Orbiter
craft**



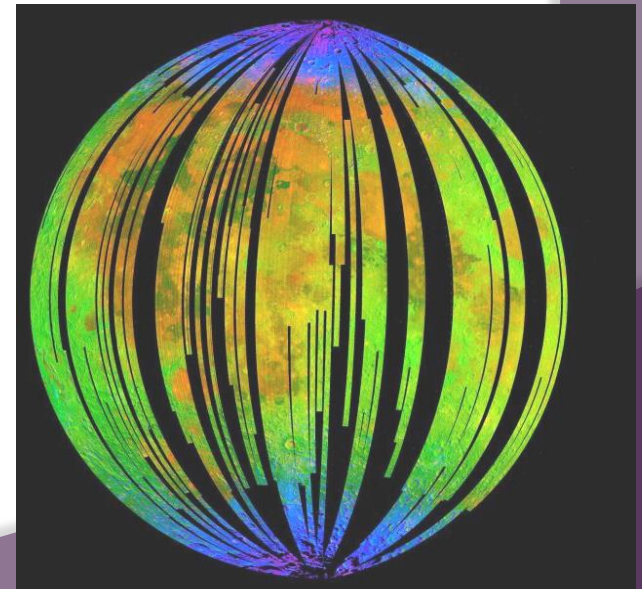
ADITYA

**Observation of
solar corona in
visible bands**

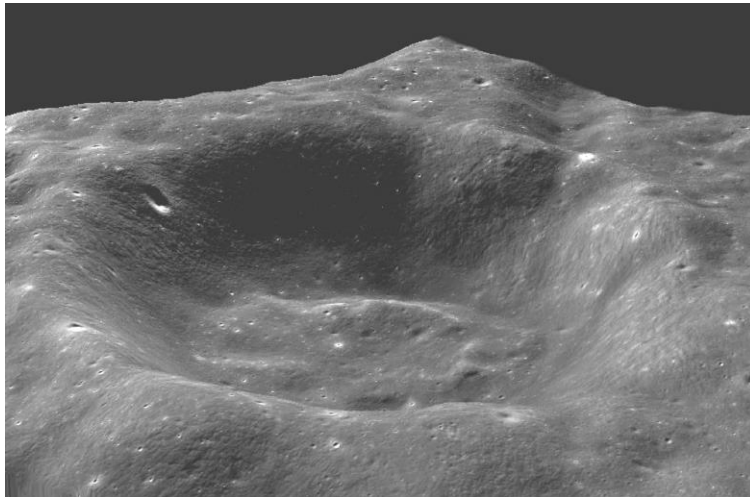
Chandrayaan-1



TRI COLOUR ON MOON



DISCOVERY OF WATER



CRATER ON MOON SURFACE



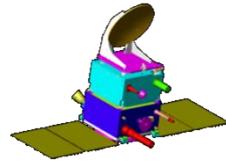
Small Satellites



IRS-P6
1360kg



Cartosat 2
690kg



Saral
400kg



IMS-1
83kg



Nano
10kg



Pico
1kg

Class	Mass (kg)
Large Satellite	>1000
Small Satellite	500 – 1000
Mini Satellite	100 – 500
Micro Satellite	10 – 100
Nano Satellite	1 – 20
Pico Satellite	<1

Small Satellites - Advantages

Low Cost

Technology Demonstration Platform

Relatively Short Development Period

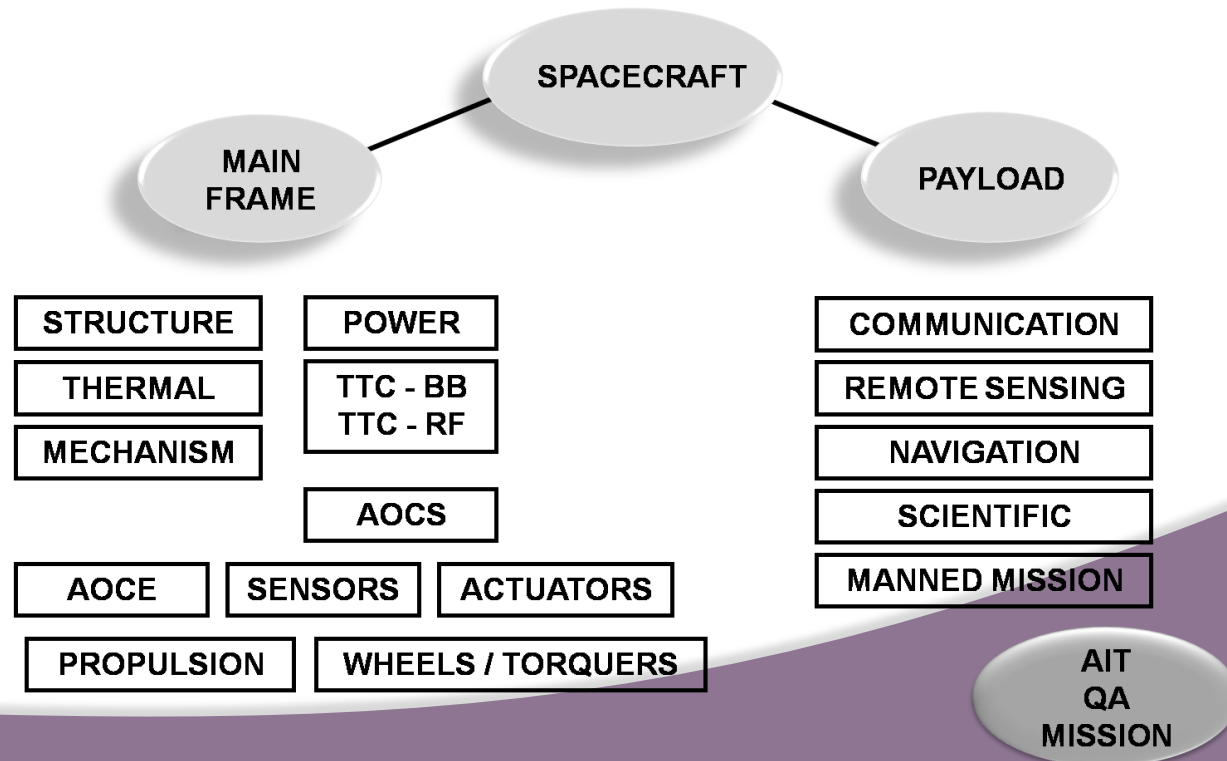
International Cooperation

Short Time To Scientific Results

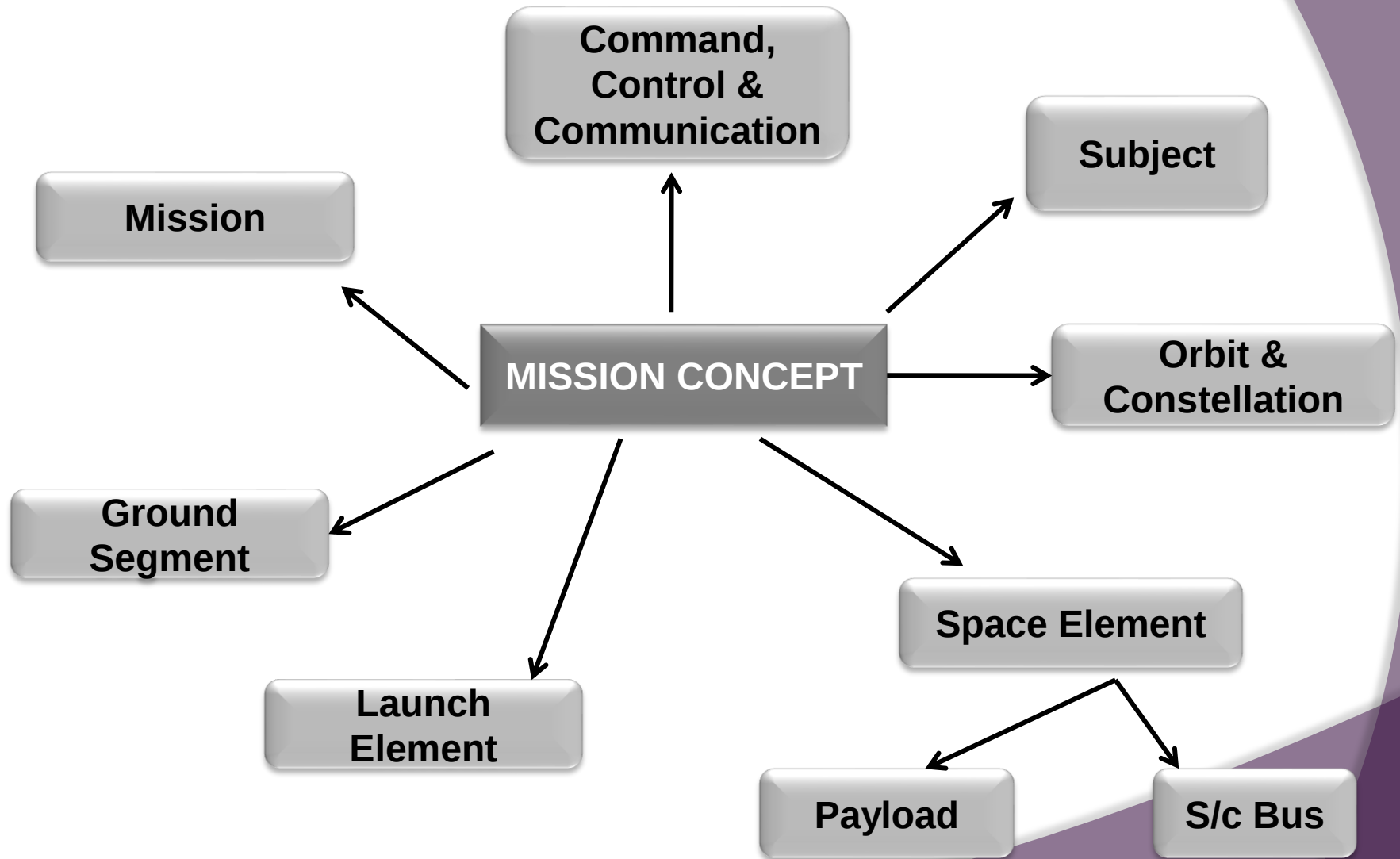
Versatile

Revitalized Scientific Community

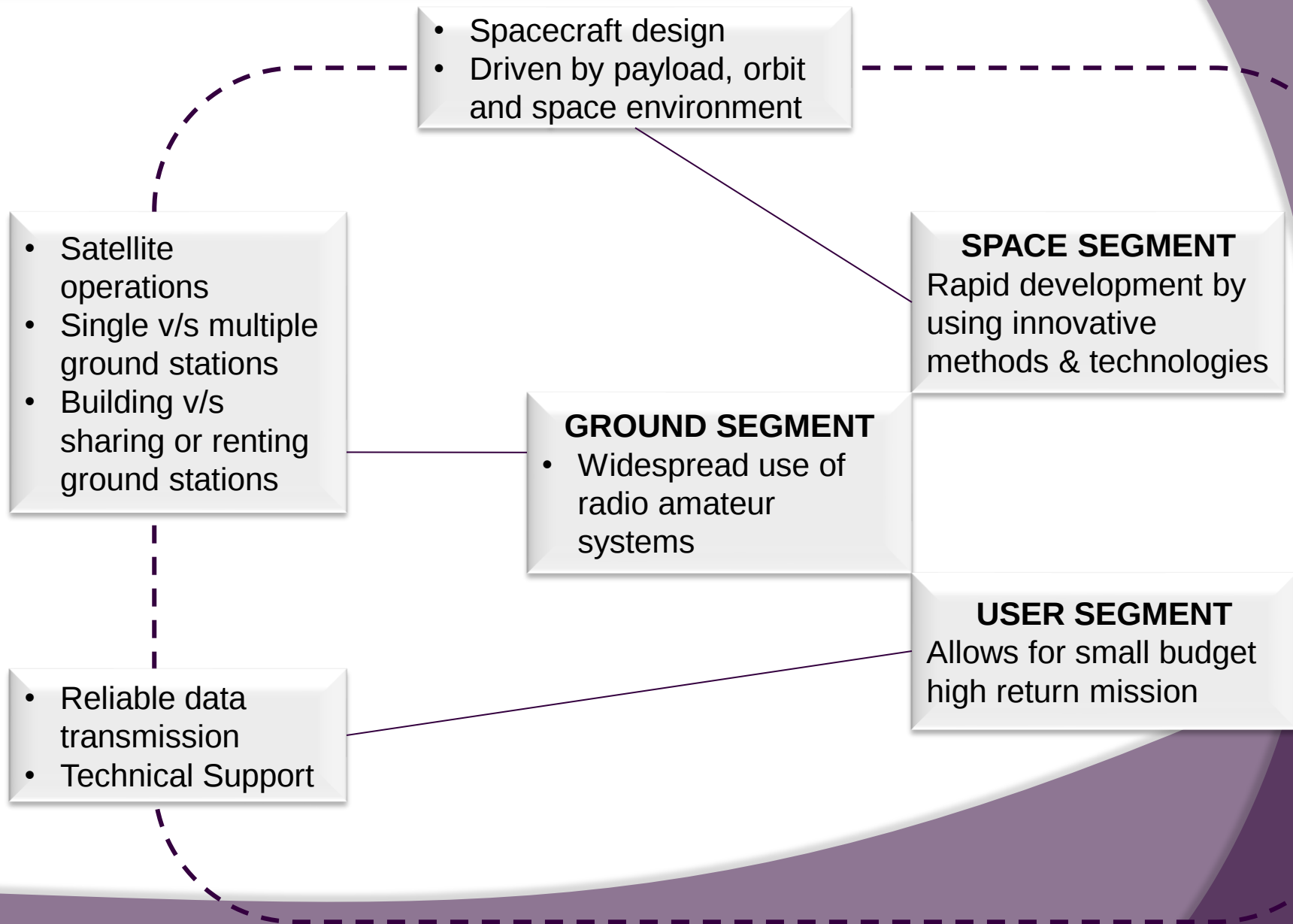
Developing Nations



Challenges In Realisation Of Small Satellites



Challenges In Realisation Of Small Satellites



Small Satellites Bus



IMS-1

Micro Satellites

Satellite mass < 100 kg

Payload mass < 30 kg



IMS-2

Mini Satellites

Satellite mass < 450 kg

Payload mass < 200 kg



IMS – 1 (TWSAT)



IMS-1 bus

Lift Off Mass: 83 Kg

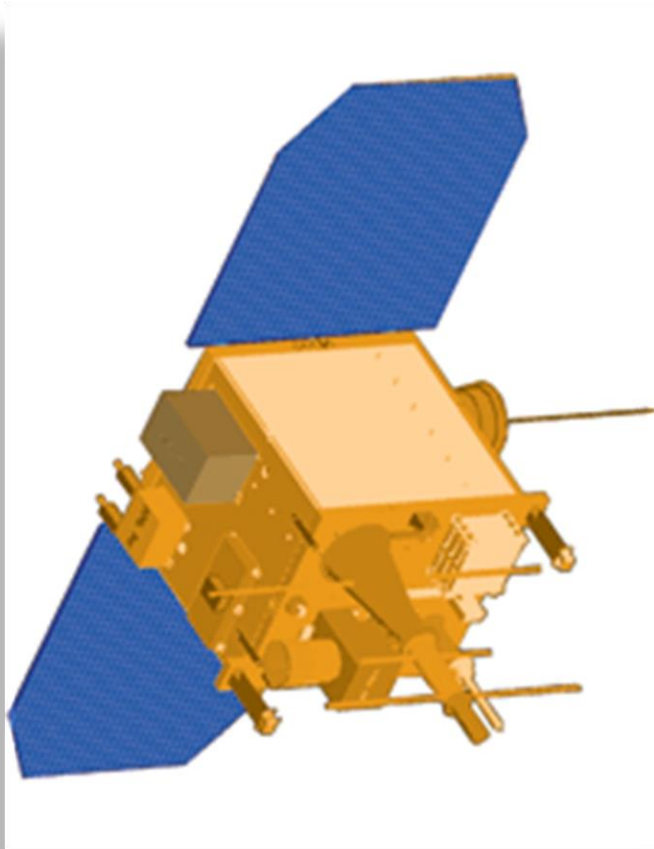
Payloads:

- **4 Band Multi Spectral CCD Camera (MxT)**
- **Hyper Spectral Imager (HySi-T)**

Launched onboard PSLV – C16 on April 28, 2008

Mission life: 2 years

IMS – 2 (YOUTHSAT)



IMS-1 bus

Lift Off Mass: 92 Kg

Payloads:

- SOLRAD – MOSCOW University
- RABIT – SPL, VSSC
- LiVHySi – VSSC & SAC

Launched onboard PSLV – C16 on April 20, 2011

Mission life: 2 years

SARAL



IMS-2 bus. 400- 450 kg class satellite

Payloads:

- **ALTIKA – Ka band altimeter**
- **ARGOS - data collection platform for collecting transmitted data from ocean buoys**

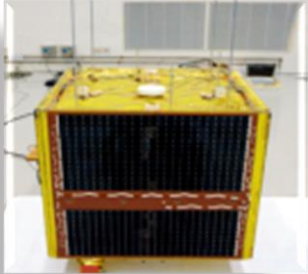
Separate module for payloads

PSLV Launch

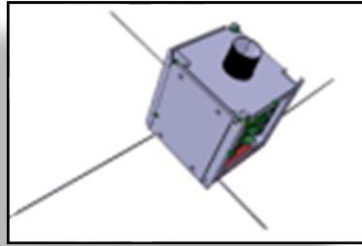
Nominally configured for sun pointing/earth pointing missions

Mission Life : 5 years

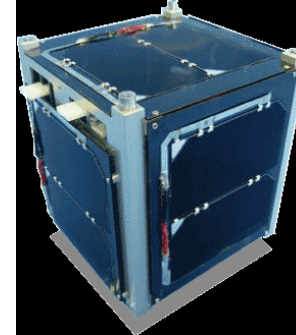
University Satellites Supported By ISRO



ANUSAT



STUDSAT



PRATHAM



SRMSAT- CHENNAI



JUGNU – IIT KANPUR

Small Satellite Features For Constellation

Automation

Inter-satellite linking capability

Inter satellite net-work protocol support

Onboard Payload data processing and disaster detection

Event capturing

On-board Health analysis and decision making

Resource sharing

Seamless communication to ground station

Payload Categories for Small Satellite

Optical remote sensing payloads

Microwave remote sensing payloads

Payloads for Ocean and atmospheric missions like Radiometers, altimeters, aerosol instruments, Lidars etc.,

Stellar / space science payloads

Low earth orbit communication payloads

Constellation missions

Future Road Map

- Miniaturization of spacecraft systems
- Create scientific temper and awareness about space program among younger generation
- Encourage academia for building spacecraft

Small Is Beautiful. With the Invention
Of Small Satellite Space is open for all
from Students to Technocrats. Sky is
the Limit for Endless Applications.

THANK YOU

