Indian Space Reach Organisation: Capacity-building academic activities for space technology and its applications

30th Workshop on Space Technology for Socio-Economic Benefits:
"Challenges and Capacity-building Opportunities for Emerging Space Nations“

30th September 2023

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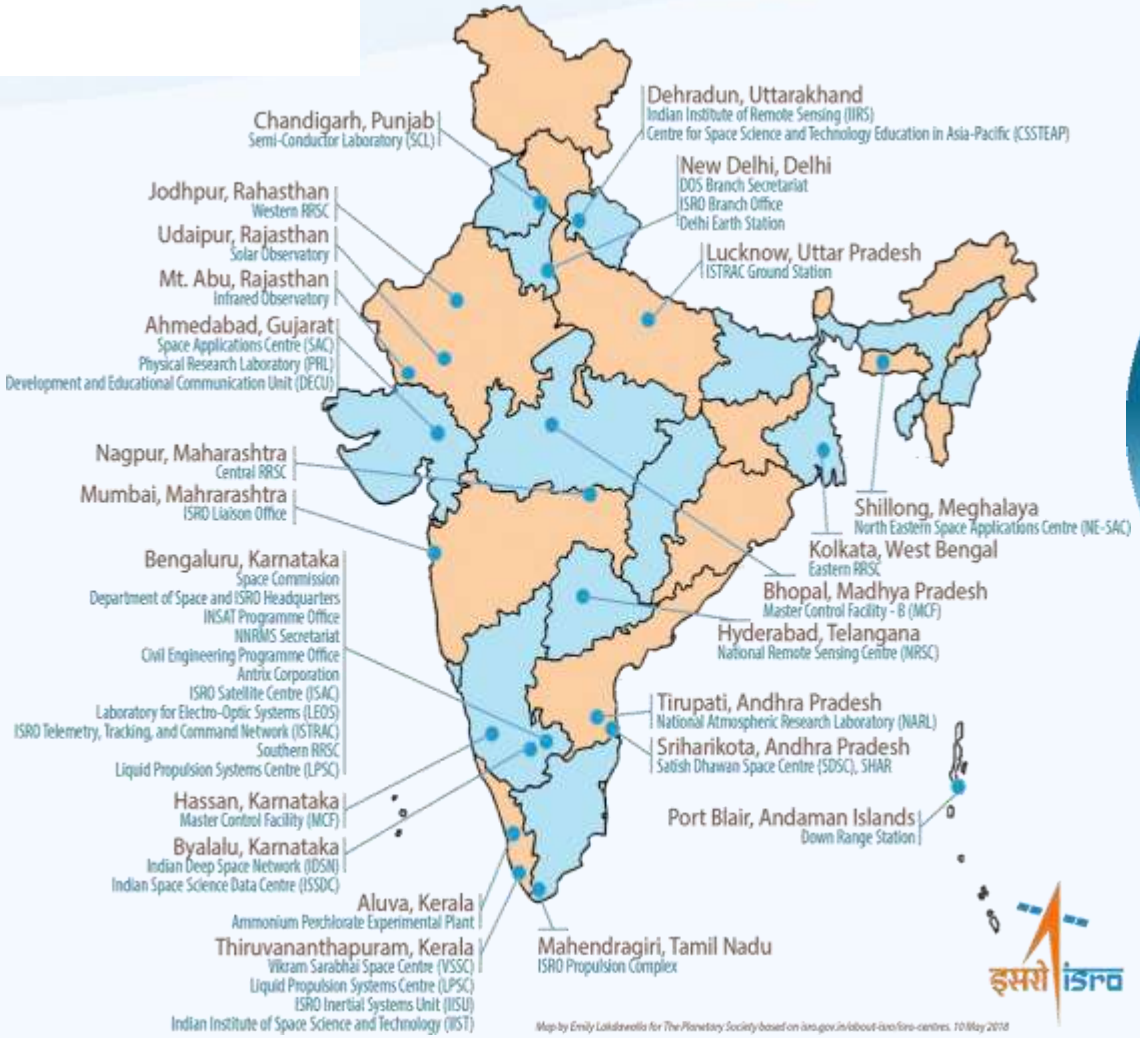
Indian Space EcoSystem

ISRO & It's technical ecosystem
~ Across the country



INDUSTRY

450+ MSME

50+ Large companies

START-UPS

100+ Start-ups

ACADEMIA

5 RAC-S

6 STIC

9 STC

300+ Sponsored Research

PARTNERS

Govt. Ministries

State Government

Departments

Indian Space Programme: Dimensions

Vision: Harness space technology for national development, while pursuing space science research and planetary exploration

Space Transportation
- PSLV
- GSLV,
- Reusable LV
- Modular LV and Gaganyaan

Space Infrastructure
- Earth Observation
- Communication
- Navigation
- Space Science & Planetary Missions

Capacity building
- Human Resource Development
- Indigenization
- Technical Infrastructure
- International Cooperation
- Industry, Academia,
- Outreach

Space Applications
- Socio economic Security, Sustainable Development, DRR & Governance
- Synergistic Applications (EO, SatCom & Navigation)

ISRO Capacity Building through training, education and research

Capacity Building through training, education and research in the field of Remote Sensing, Geographic Information System (GIS) technology and applications.

.....for ensuring efficient utilization of Earth Observation (EO) Systems and ISRO's forthcoming initiatives in the areas of Natural Resource Survey, Earth and Atmospheric Sciences and Disaster Management.

EDUCATION FOR ACQUIRING KNOWLEDGE AND TRANSLATING THIS INTO PRACTICAL APPLICATIONS FOR SOLVING REAL-WORLD PROBLEMS

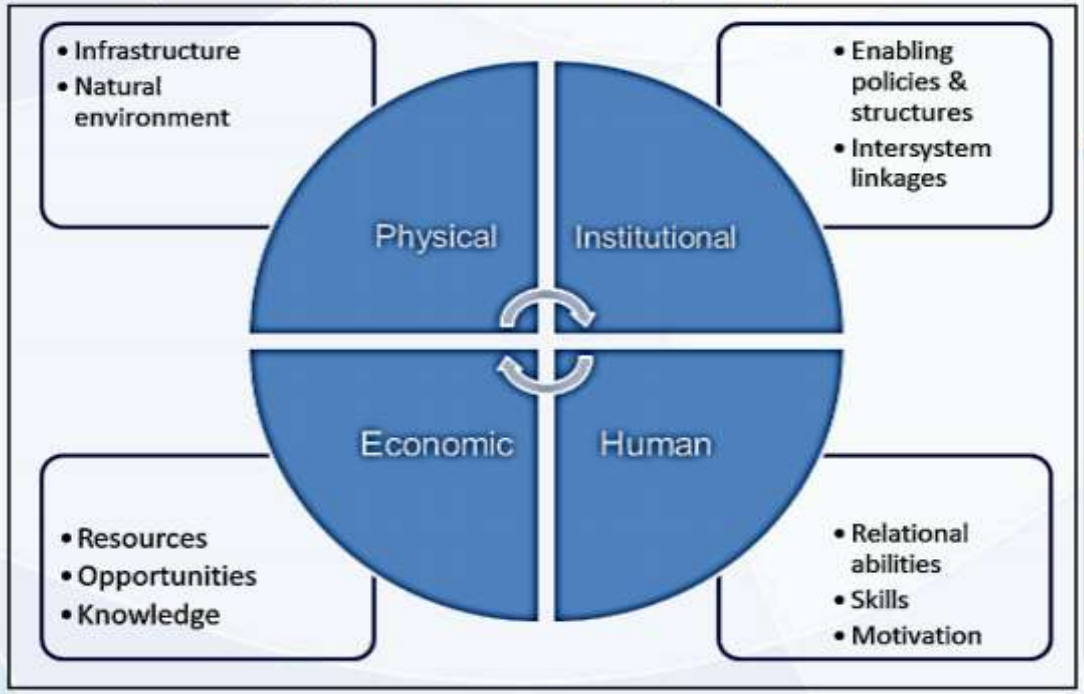
Capacity Building @ ISRO/DOS

ISRO Institutions for Capacity Building

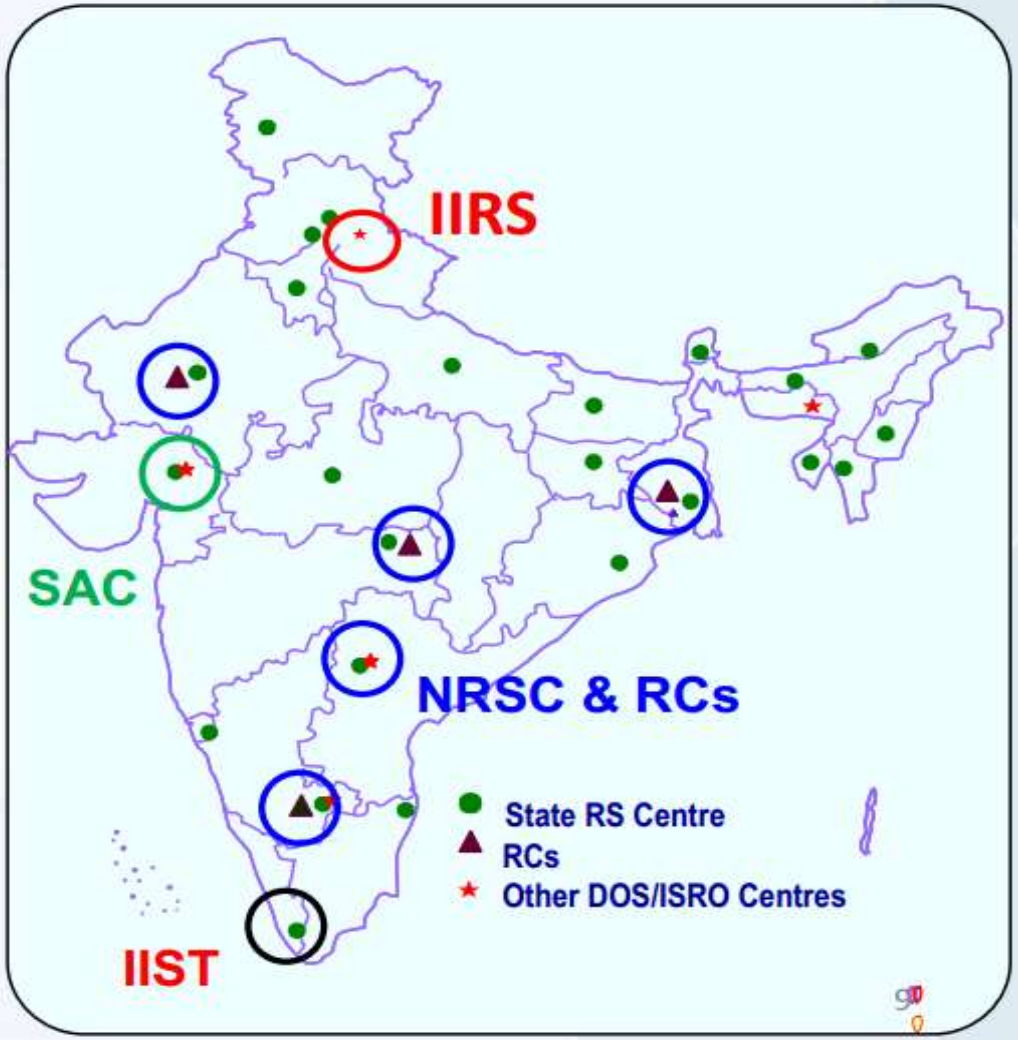
CBPO, ISRO HQ

UR Rao Satellite Centre, VSSC, SDSC SHAR

- Indian Institute of Remote Sensing (IIRS)
- Indian Institute of Space Science & Technology (IIST)
- National Remote Sensing Centre (NRSC)
- Space Application Centre (SAC)



ISRO's Capitals to achieve programs



Academic Courses

Under the DOS, the Indian Institute of space technology IIST, the Indian Institute of Remote Sensing (IIRS) and few other centres offer academic courses for Indian students. Courses cover graduate, postgraduate and doctoral degrees.

Indian Institute of Remote Sensing (IIRS) at Dehradun

IIRS 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.

Academic Collaboration

DA-IICT, Gandhinagar, Anand Agriculture University (AAU), Anand, and Indian Institute of Remote Sensing (IIRS), ISRO, Dehradun are jointly offering a two-year "M.Sc. program in Agriculture Analytics." DA-IICT, AAU and IIRS are the premier universities/ Institutes in ICT, Agriculture, and Space Technology domain, respectively.

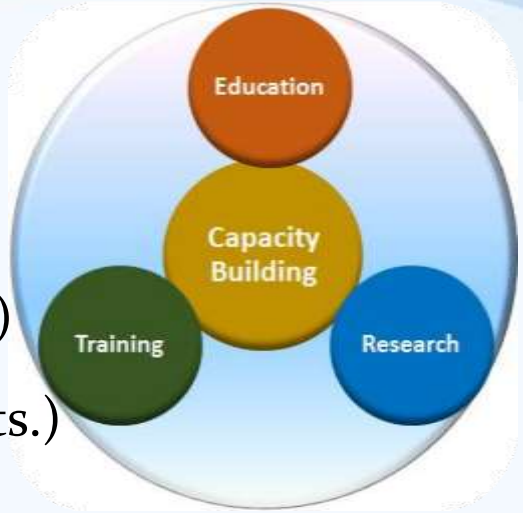
Indian Institute of Space Science and Technology (IIST), Thiruvananthapuram

IIST, Asia's first Space University, was established at Thiruvananthapuram in 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 undergraduate, postgraduate, doctoral and post-doctoral programmes in broad areas of space science, technology and applications.

IIRS Capacity building through education, training & research

- **M .Tech. in RS & GIS** (9 Specializations)
- **M.Sc. in Geo-information Science & EO** (JEP with University of Twente, The Netherlands)
- **PG Diploma** (1 year, 10 Specializations) ; **8-weeks Certificate Course** (ITEC/ MEA)
- **Decision Makers Course** (1 week) ; **Special /Tailor made Courses** (for User Depts.)



- Distance Learning Programme
  - **Live & Interactive courses**
  - **Massive Online Open Courses**

- State Remote Sensing Applications Centres and many Academic institutions offer education & training programs in geospatial technology & its applications

Capacity Building in space technology and its applications : International Programmes

Centre for Space Science & Technology Education in Asia and the Pacific (CSSTEAP)

PG: Remote Sensing & GIS (RS & GIS) Every Year

PG: Satellite Communication (SATCOM) & Global Navigation Satellite Systems (GNSS) Alternate Year

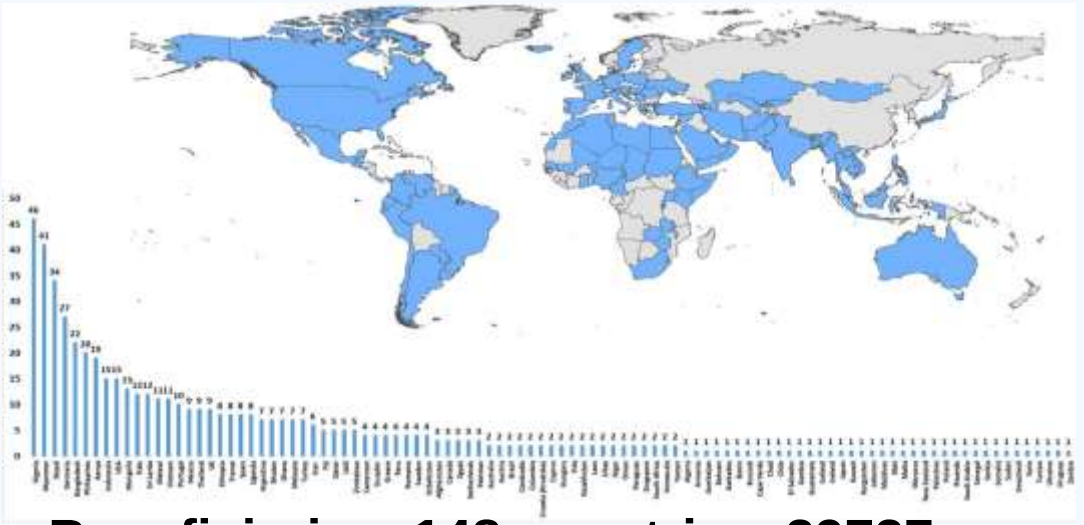
PG: Satellite Meteorology & Global Climate (SATMET) Alternate Year

PG: Space and Atmospheric Sciences (SAS) Alternate Year

Short Courses on RS&GIS, Small Satellite Missions (every year) and user demand based courses

2831 participants from 36 countries benefitted through 61 PG courses & 68 Short courses

MOOC on Geospatial Applications for Disaster Risk Management



Beneficiaries: 148 countries, 29727 participants

- **4-Year B.Tech. (Aerospace Engineering)**
- **4-Year B.Tech. (Electronics and Communication Engineering (Avionics))**
- **5-Year Dual Degree (B.Tech. + Master of Science/Master of Technology)**

The Dual Degree Programme is a 5-year (10 Semesters) Programme. On successful completion, the students are awarded a B.Tech. degree in Engineering Physics and a Master of Science/ M.Tech. degree in one of the following four postgraduate streams:

- Master of Science in Astronomy and Astrophysics
- Master of Science in Solid State Physics
- M.Tech. in Earth System Science
- M.Tech. in Optical Engineering

Students will be allotted their postgraduate streams at the end of the sixth semester based on their preference and academic performance upto sixth semester. The seat matrix specifying minimum and/ or maximum for each of the streams will be notified to the students during the sixth semester.

Bhuvan

Bhuvan is a Geoportal of Indian Space Research Organisation (ISRO), hosted through URL https://bhuvan.nrsc.gov.in.

It Provides services and applications related to satellite remote sensing data for public use. Bhuvan Services are offered by NRSC

One-stop versatile
Web based Earth Observation
Data Products & Services

Bhuvan – Gateway to Indian Earth Observation

- Explore, experience, visualise and analyse Indian Remote Sensing (IRS) images
- Rapid access to 3D geospatial data powered with real-time data sharing and collaboration providing a true Common Operating Picture
- Rich Thematic Datasets to visualise and consume as Open Geospatial Consortium (OGC) web services enabling interoperability
- Visualise different layers, explore Geoprocessing, and feel empowered with Bhuvan 2D having no dependencies
- Access to Bhuvan, the Earth Browser through smartphones
- NRSC Open EO Data Archive (NOEDA) to browse and download satellite data and products

Vision

To evince the distinctiveness of Indian Earth Observation(EO) capabilities through online rendering of multi-resolution, multi-temporal and multi-sensor IRS imagery overlaying value added thematic information on 2D/3D virtual globe, providing satellite data and products for download and consume thematic datasets as OGC web services towards online Geoprocessing, whilst serving for societal good.

Visualisation of Earth Observation Data and Archival System (VEDAS) - https://vedas.sac.gov.in

VEDAS provides platform to motivate young researchers and academia to showcase their spatiotemporal analytical skill using Indian EO data and build geo-spatial applications.

The site Salient features of VEDAS are:

- Provides platform for Research & training to Academia
- Data visualisation and graphical analysis on web
- Geo-processing tools for analysis on web
- Integrate Web Map Service from various sources

MOSDAC

Features:

- Multi Mission Satellite Data Repository
- In-situ and CAL-VAL data hosting
- NRT dissemination as open data
- Forecast & Alerts dissemination
- Tools & Utilities
- Research and Training programs

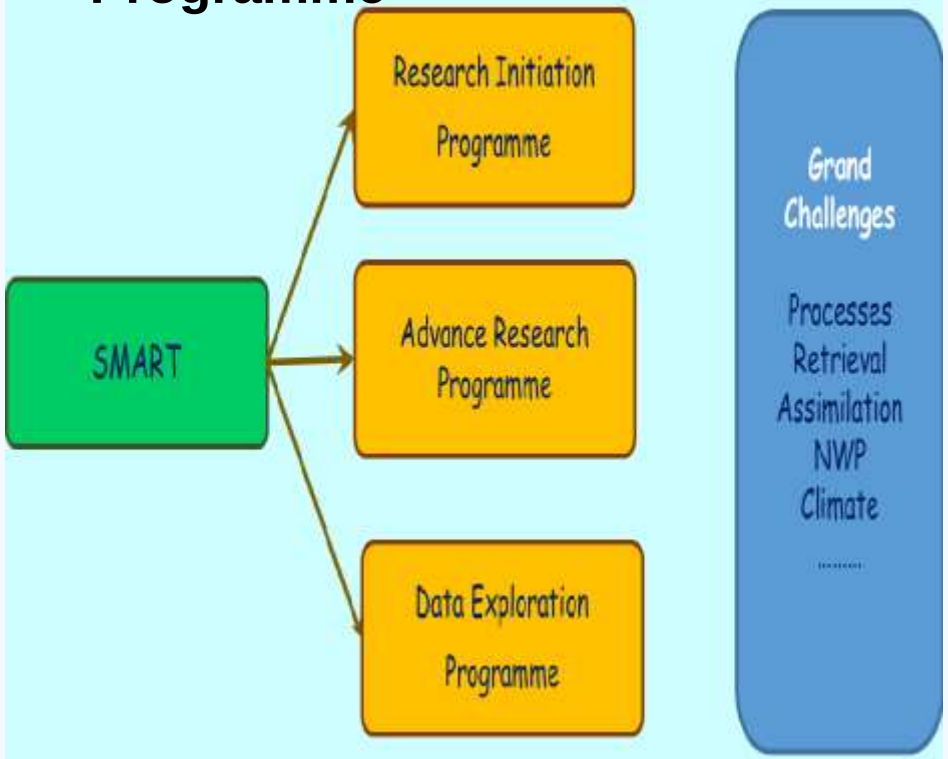
Services:

- Weather and Ocean State Forecast
- Nowcast, Current Events, Past Events
- Advisories
- Visualization
- Met Applications
- Ocean Applications

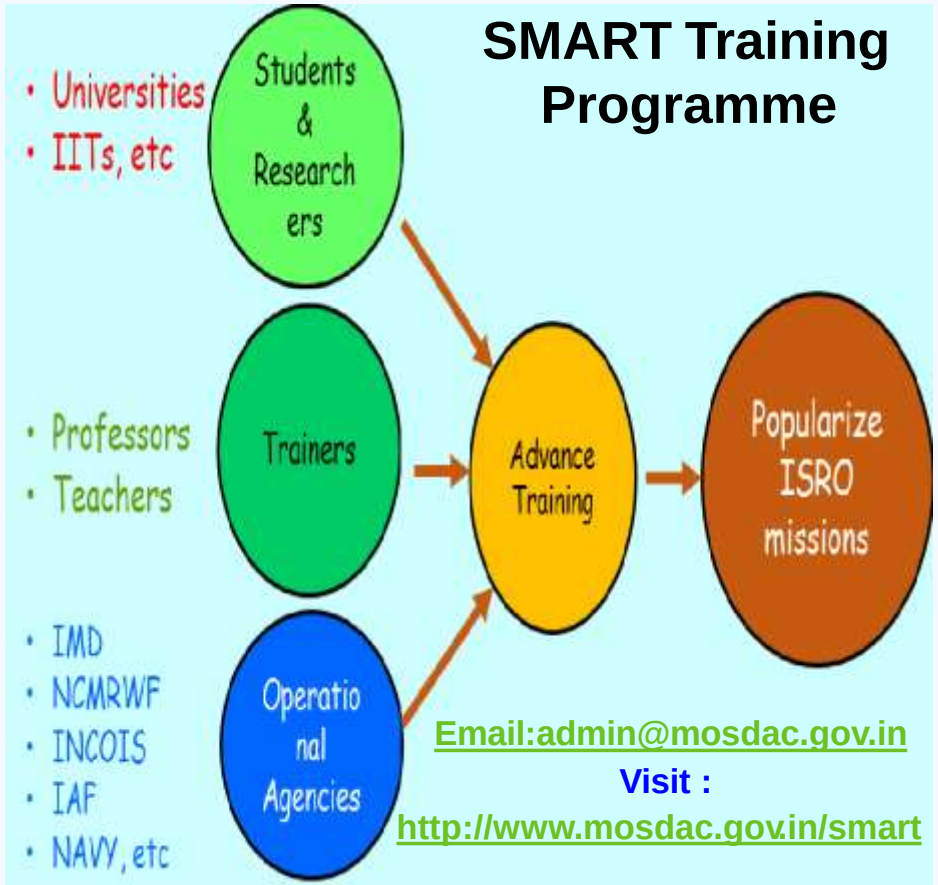
Satellite Meteorological and OceAnographic Research and Training

ISRO's initiative to promote research in Satellite Meteorology and Oceanography among students, academics & researchers using MOSDAC data

SMART Research Programme



SMART Training Programme



Email:admin@mosdac.gov.in

Visit :

http://www.mosdac.gov.in/smart

- ✓ Long duration 1-9 months - challenging research
- ✓ Data handling & Visualization support with Expert guidance

- ✓ Short-term 3-5 days - advanced training
- ✓ About 5 times a year in Satellite Met. & Oceanography

At UNISPACE+50 (June 2018; Vienna), India announced a capacity building programme on Nanosatellites development named

UNNATI (UNispace Nanosatellite Assembly &Training by ISRO)

Objectives:

- To offer a simplified and increased exposure to satellite fabrication technologies, as part of the UNISPACE initiative
- To provide theoretical course on satellite technology
- To provide intensive course on nano satellite realisation, covering mission aspects, design, fabrication, assembly, integration & testing
- To provide hands-on training to assemble, integrate and test a nano satellite

Contents:

- ❑ Theoretical coursework on Basics of Satellite Technology & its application followed by specific module on Nano Satellite mission
- ❑ Hands-on experience on Nano Satellites Assembly Integration & Testing

UNNATI: Batch-III

The third batch of the programme was successfully conducted during15th October– 15th December2022 covering 31 participants from 19countries

Argentina
Armenia
Bhutan
Chile
Dominican Republic
Ecuador
El Salvador
Ethiopia
Fiji
Mexico
Nicaragua
Panama
Papua New Guinea
Philippines
Singapore
Slovakia
Sudan
United Arab Emirates
Uzbekistan

Batch 1: Jan-March 2019

29 Participants from 17 Countries

Algeria, Argentina, Azerbaijan, Bhutan, Brazil, Chile, Egypt, Indonesia, Kazakhstan, Malaysia, Mexico, Mongolia, Morocco, Myanmar, Oman, Panama & Portugal

Batch 2: Oct-Dec 2019

30 Participants from 16 Countries

Bahrain, Bangladesh, Belarus, Bolivia, Brunei, Colombia, Kenya, Mauritius, Nepal, Nigeria, Peru, South Korea, Sri Lanka, Thailand, Tunisia & Vietnam

S T A R T An online Space Science & Technology AwaReness Training programme, a new initiative of ISRO/DoS

Eligibility: Students of post-graduate / under-graduate courses on physical sciences/ technology from Indian academic institutes

Entry through registration: (i) Registration at Nodal Centre- Eligible students belonging to nodal centres and (ii) Direct registration of individuals with PG/UG in any course.

Provision for Public to watch the live sessions through ISRO-YouTube without registration

Aim: To attract the youngsters to the fields of space science and technology, by creating an overall awareness of the different facets of space science and technology.

First START programme was conducted during 20th July to 7th August 2023

- More than 250 Academic Institutes hosted START as nodal centres through Expression of Interest
- More than 35,000 participants, spreading across the country, registered and participated
- Certificate of merit and participation would be provided to eligible candidates

Major Topics

- India's Space Exploration Endeavour
- Geosphere-Biosphere-Atmosphere interaction
- Solar System
- Comparative Planetology
- Space Weather
- Astronomy & Astrophysics
- Rockets to access near Earth Space

https://jigyasa.iirs.gov.in/START

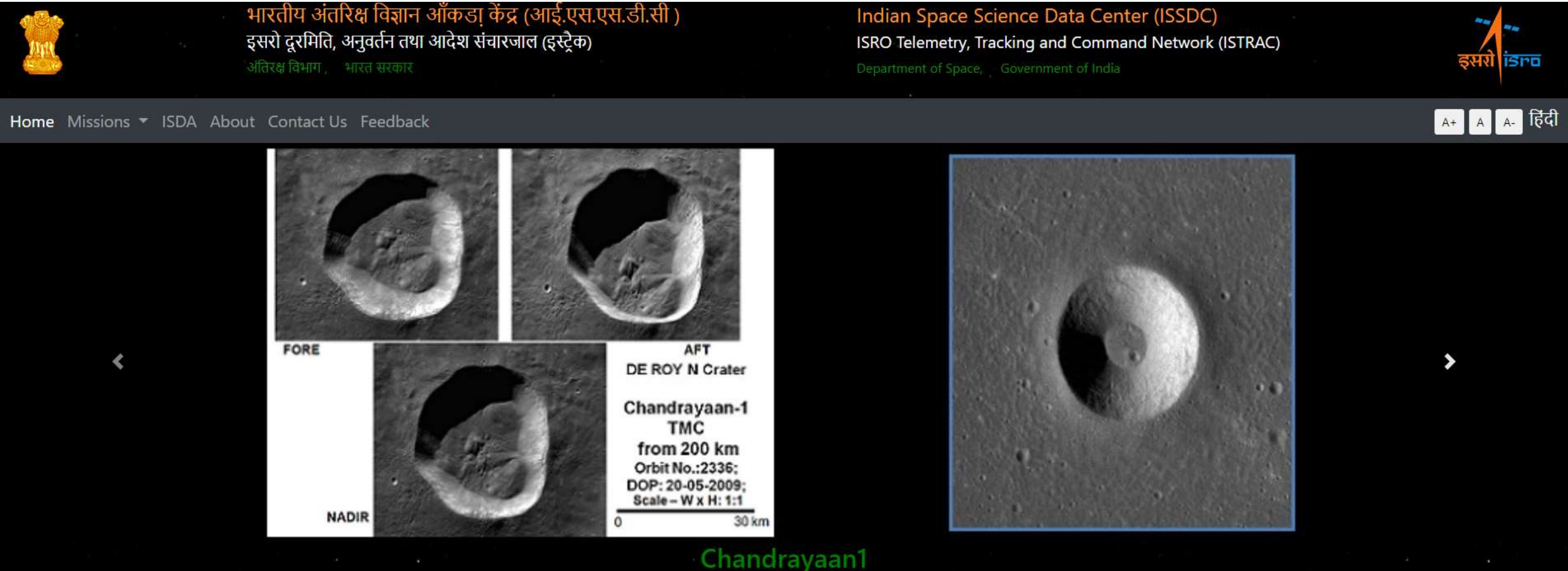
- Scientific Payload Development for Solar System Exploration
- Mission Design for Space Exploration
- Astrobiology
- Chemistry in Space Science
- Chemistry in Space Technology
- Indian Space Exploration Programme
- Research Opportunities in Space Science & Technology

Indian Space Science Data Center (ISSDC)

•ISSDC is the primary data center for the payload data archives of Indian Space Science Missions.

•This data center, located at the IDSN campus in Bangalore, is responsible for the Ingest, Processing, Archive, and Dissemination of the payload data and related ancillary data for Space Science missions

•The primary users of this facility will be the principal investigators of the science payloads. In addition to them, the data will be made accessible to scientists from other institutions and also to the general public.



ISRO Capacity Building - Academia

ISRO encourages research activities at Academia.

Recognising the need for a broader academic interface with institutions across the country to strengthen the involvement of academia for ISRO programmes.

These initiatives include:

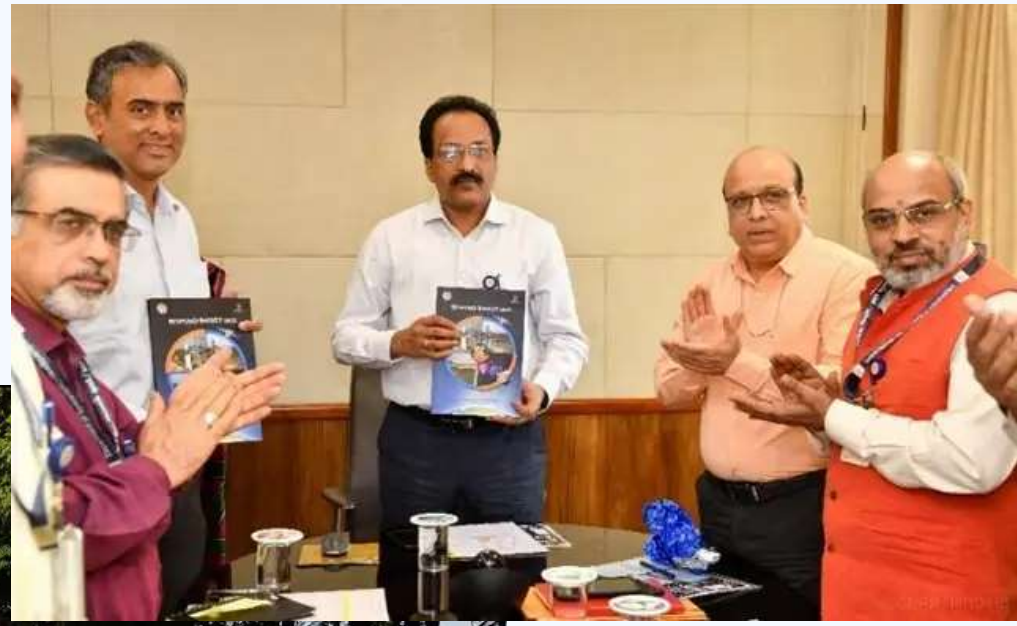
- **Sponsored Research (RESPOND)**
- **Regional Academic Centres for Space [RAC-S]**
- **Space Technology Incubation Centres [S-TICs]**
- **Space Technology Cells [STC]**
- **Space Innovation Centre**
- **ISRO Chairs**
- **Centre of Excellence on Advanced Mechanics of Materials**
- **Satish Dhawan Centre for Space Science**
- **Centre for Nano Science & Engineering (CeNSE)**

Each of the above programmes is uniquely designed to achieve a specific objective, such as encouraging students towards entrepreneurship [S-TIC], motivating Academicians to tackle challenging problems [ISRO Chairs] and raising the overall research aptitude of an institute in space domain [RAC-S].

ISRO Academia Day

Common platform to Academia as well as the scientific community of ISRO to share their knowledge, experience and create awareness about the research opportunities available in ISRO for the promotion of Space Science & Technology, Education and Research.

RESPOND Basket containing 195 research topics from all ISRO centres.
Academia across the country is expected to submit proposals for entering into joint research.
Online portal “i-GRASP” for the submission of research proposals including grant-in-aid management



Sponsored Research: Overview

ISRO started the RESPOND (Sponsored Research) programme in the 1970s

The objective of encouraging academia to participate and contribute in various Space related research activities.

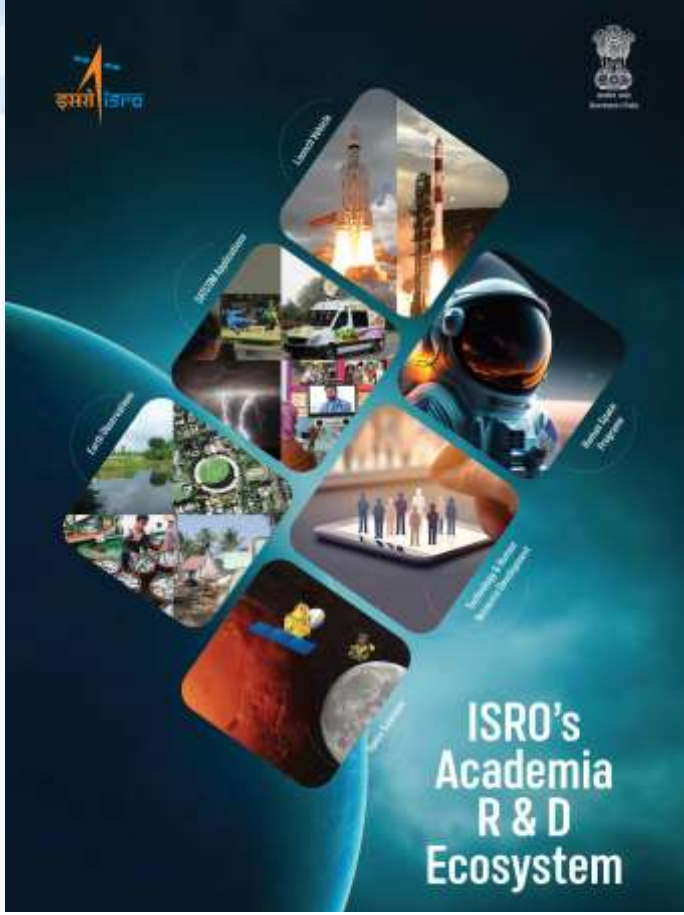
Under RESPOND, projects are taken up by Universities/Academic Institutions in the areas of relevance to Space Programme.

ISRO has evolved the RESPOND programme through which necessary financial and technical support is provided to academia in India for conducting research and development activities related to Space Science, Space Technology and Space Applications.

The flagship programme of ISRO to promote the extra-mural research in emerging areas of Space at Academia.

To enable the faculty of Universities/ Institutes to prepare suitable proposals of relevance to space programme, a detailed list have been evolved as per major programmes of ISRO, by the various centres of ISRO and published annually.

RESPOND programme is mutually beneficial to ISRO and Academia, wherein the rich talent of Academia/ faculty is being harnessed to support the Nation's Space programme.



Space Tutor: The Space Tutor Programme that Aims To Collaborate With Startups / NGOs Involved in STEM Activities To Promote Space Education

In tune with changing times, ISRO needs to play a vibrant role in ensuring the disseminating the enriched knowledge in space domain.

Several NGOs/ educational institutions have come up with their own framework, wherein interested students are encouraged to register with them and learn about space science & technology.

Many of these agencies have “modules”, consisting of books and lab-works, co-existing with the regular classroom curriculum.

Besides, there are digital content creators and online educators, making use of social media and mobile applications, striving to make the classrooms virtual.

Student Satellites:

ISRO involves educational institutions by its activities like making satellites for communication, remote sensing and astronomy.

Development of Payload (by Universities/Institutions)
The Development of payloads may comprise of detectors, electronics and associated algorithms, which can be an experimental piggy back payload on the ISRO's on-going (Small or operational) satellite projects.

Data Handing and data transmission is done by ISRO as the part of satellite bus.
After launch ISRO will acquire payload data and disseminate it to Universities/ institutions further processing and analysis.

Satellite Design & Fabrication by Universities/Institutions
Under this option Universities have to design, fabricate, test the satellite Bus & Payload and deliver the integrated spacecraft for launch. Technical guidance in designing, fabrication and testing will be provided by ISRO.

Some critical materials for the space mission also will be provided by ISRO.

The designs and test results will be reviewed by ISRO team.

Under this option more than one University/Institution may participate. One among them will be the focal point for the ISRO. After launch, the collected data will be archived and disseminated by university/Institution(s).

Outreach

- Strengthen the **ISRO – Academia –Industry**
- Focus on **un-represented locations**
- Attract and nurture the young academia with innovative ideas/ research aptitude
- Over 150 technology Transfers to users

YUva VIgyani KAryakram (YUVIKA)

Space Technology Incubation Centres (+4)
Regional Academic Centres – Space (+5)
Space Museums (+7)
Space galleries at National Museums (+25)
Satish Dhawan Research Centre for Space Sciences

Outreach

The Department of space has been engaging students, academicians, enthusiasts and all other stakeholders in its programmes. On regular basis the outreach programmes are conducted on the creations of national science Day and world space week.

Major centres have got space exhibitions that visitors can visit on working days.

- **IIRS conducts E-learning programmes on various topics and themes.**
- **PRL Open House Exhibition**
- **Science Express**
- **Outreach at NRSC**
- **World Space Week Celebrations by VSSC, SDSC SHAR, IPRC, NRSC, SAC, IIRS**
- **World Space Week**
- **Space Theme and The launch viewer's gallery at SDSC SHAR**
- **National Science Day at URSC**
- **National Space Science Symposium: Space Science Outreach**
- **Space On Wheels**

YUVIKA - YUva VIgyani KAryakram (Young Scientist Programme)

Indian Space Research Organisation is organising a special programme for School Children called "Young Scientist Programme" "YUva VIgyani KAryakram",

YUVIKA, to impart basic knowledge on Space Technology, Space Science and Space Applications to the younger students in emerging trends in space science and technology.

ISRO has chalked out this programme to "Catch them young". The programme is also expected to encourage more students to pursue in Science, Technology, Engineering and Mathematics (STEM) based research /career

YUVIKA-2023 - It was a two-week residential programme for the high school students.

Around 337 students from all 28 states and 8 union territories underwent the programme from May 15 - 26, 2023 at seven ISRO / DoS Centres viz. VSSC, Thiruvananthapuram, SAC, Ahmedabad, URSC, Bengaluru, SDSC-SHAR, Sriharikota, NRSC, Hyderabad, IIRS, Dehradun and NE-SAC Shillong.

Public Outreach

- State of the Visitor Complex -The Space Theme Park with Launch view gallery, Rocket Garden, Space Theatre and Space Museum is under realisation.
- Bus Tour to Heritage Zone for ASLV & SLV Complex
- Bus Tour to Active Launch pads for SLP & FLP
- 10000 people at a time can witness the launch.

Glimpses of Launch View Gallery (14,780 Public Witnessed)

VIKRAM SARABHAI CENTENARY PROGRAMME
at APPA PUBLIC SCHOOL, KALABURAGI (GULBARGA) on 18.02.2020

Space On Wheels

Glimpses of Launch View Gallery (10,800 Public Witnessed)

WSW-2022 Glimpses

WSW-2022 Reached out to 88,000 Students & Public at 8 venues.

Thank You

Regional Academic Centres for Space [RAC-S]

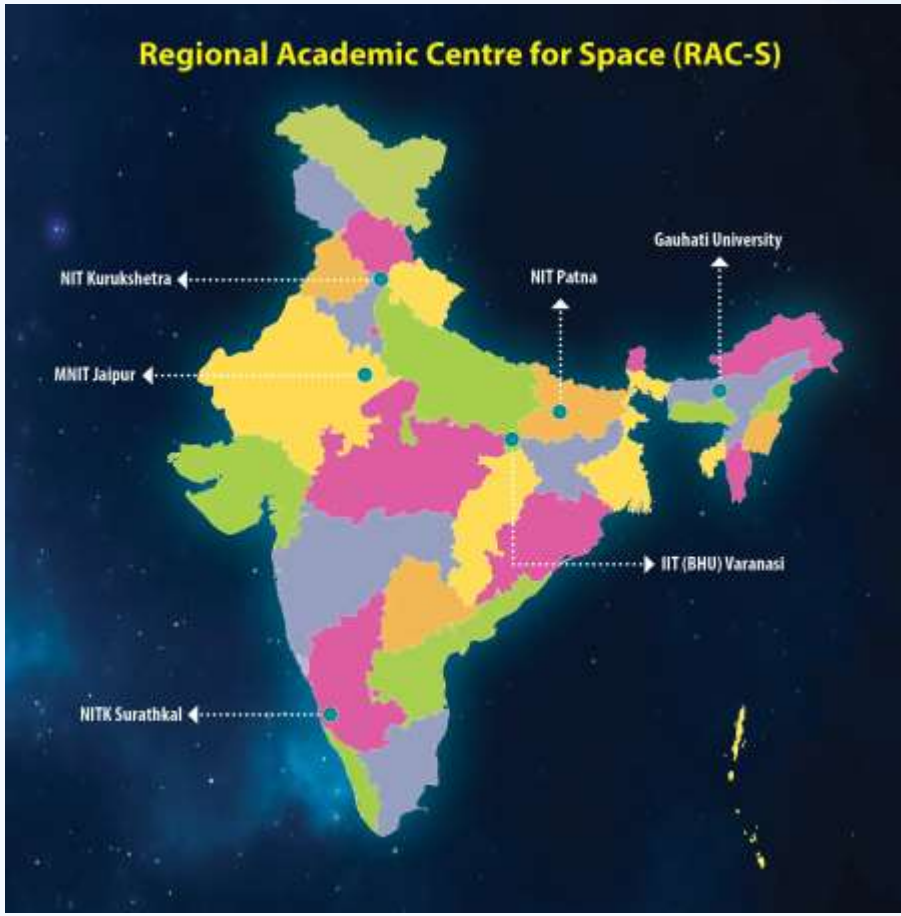
Regional Academic Centre for Space (RAC-S) is a regional level to pursue advanced research for future technological and programmatic needs of the Indian Space Programme and act as a facilitator for the promotion of space technology activities in the region.

The selected institute for the establishment of RAC-S will coordinate the research activities and will act as the lead centre.

RAC-S will also engage other institutes of excellence in the area of Science and Technology in the region to take part in the research and development activities of the centre.

The lead centre will become an ambassador for capacity building, awareness creation and R & D activities of ISRO, in the region.

- 6 RAC-S are operational at six zones of India.

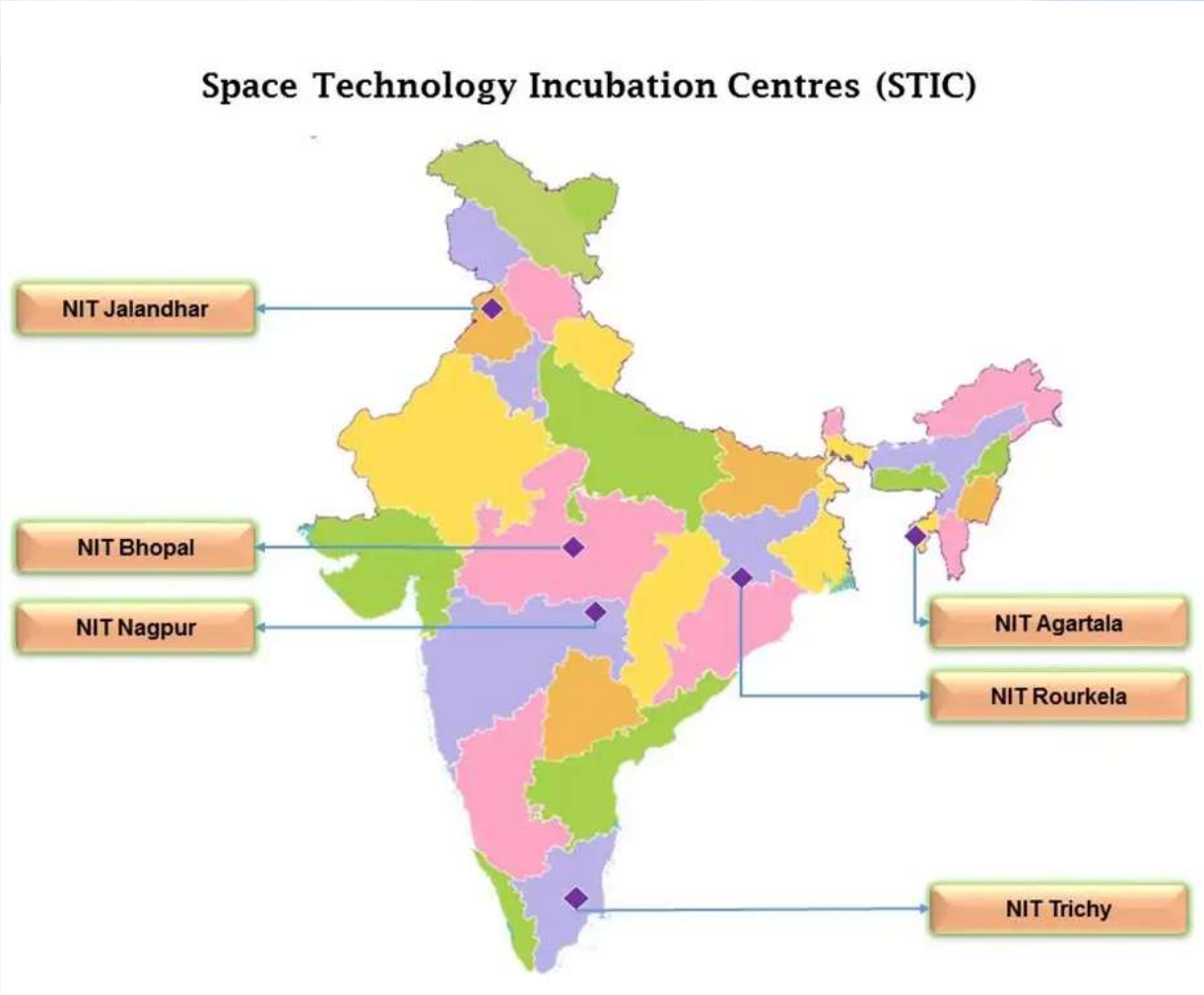


Space Technology Incubation Centers:

To attract and nurture the young academia with innovative ideas / research aptitude for carrying out research and developing the Academia–Industry ecosystem for Space Technology

ISRO has set-up a Space Technology Incubation Centre in 6 regions of our Country viz. Central, East, North, North-East, South and West.

This will enable the young academia to realize their innovative ideas / research aptitude into space grade components/elements which can be utilized for space applications, and guide them towards setting-up the future start-ups.



Space Technology Cells:

ISRO has set up Space Technology Cells at premiere institutions like

Indian Institutes of Technology (IITs) - Bombay, Kanpur, Kharagpur, Madras, Roorkee, Guwahati and Delhi; Indian Institute of Science (IISc), Bangalore and Joint Research Programme (JRP) with Savitribai Phule Pune University (SPPU) to carry out research activities in the areas of space technology and applications.

These STCs and JRP are guided by Joint Policy Committees (JPC) chaired by Director/Vice Chancellor of the respective institution and with members from ISRO/DOS (Senior Scientists/Engineers) & the respective institution.

The joint policy committee, duly assisted by technical/ scientific committee at nine ISRO-STC cells in IITs and IISc, reviews and suitable proposals are approved for taking up research.