Capacity building activities in the field of Space in India –
An update

Indian Space Research Organisation (ISRO)
Antariksh Bhavan, New BEL Road,
Bengaluru – 560094,
India.
**Indian Space Programme: Dimensions**

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

**Space Transportation**
- PSLV / GSLV / SSLV
- Reusable LV
- Human Rated LV
- Heavy Lift LV

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

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

**Capacity building**
- Human Resource Development
- Indigenization
- Technical Infrastructure
- International Cooperation
- Industry, Academia, Outreach
AREAS OF CAPACITY BUILDING

01. Academia Research Collaborations
02. Infrastructure Building
03. Industry Promotion
04. International Co-operation
05. Human Resource Development
06. Student Engagement
Indian Institute of Space Science and Technology
A dedicated autonomous institute under Department of Space

Sponsored Research through more than 180 academic institutions carrying out live 250 research projects

Indigenization of Materials & electronic components and devises, composites, additive manufacturing

30 nos. of ISRO cells at premier technical institutions of the country such as IITs, IISc, Central Universities /NITs

Announcement of opportunities for collaborative Advanced Research in disruptive technologies
ACADEMIA RESEARCH

- Sponsored Research of 250 projects with 180 Premier Institutes
- Regional Academic Centres for Space (RAC-S) (6 Nos.)
- Space Technology Cells (STC) (8 Nos.)
- Space Technology Innovation Centre (S-TIC) (6 Nos.)
- Centre of Excellences in Nano sciences
- Faculty & Student Exchange Programme (Nos.)
- ISRO Chairs (Nos.)
ISRO is responsible for building critical, long lead time and capital intensive infrastructure and enable NGE to use them on sharing basis as per the need.
### Quantum Technologies
- Satellite Based Quantum Communication
- Quantum Radar

### Sustainable Space
- Minimise addition, and clearing of debris; protecting the space assets.
  - Self-Eating Rocket
  - Self-Destructing Materials
  - Self-Healing Materials
  - Space Robotic Arm

### Energy Security
- Solution to meet the growing energy demand; enabling energy storage; operation at sub-zero temp.
  - Space Based Solar Power
  - Low Temp. Lithium-ion cells
  - Roll-Out Solar Array

### Artificial Intelligence & Robotics
- Intelligent systems for water security, weather prediction, space-systems health monitoring and space-robotics
  - In-Orbit Integrated Spacecraft Health Management
  - Humanoid Robots
  - Ground Water Level Prediction with Remote Sensing
  - AI-based Weather Prediction

### Solar System Exploration
- Enabling planetary and interplanetary missions, extending human reach to Moon, Mars and beyond.
  - In-Situ Propellant Production at Moon and Mars
  - Reconfigurable Rover
  - Lunar Environmental Simulation Test Facility
Sourcing through Industry: 90% of launch vehicles & 55% in spacecraft subsystems.

500+ Tier-1 & 2 Indian industries contributing to space industry

Transfer 363 technologies to more than 250 industries.

Unlocking of space sector to Non-Government entities.

PSLV productionisation through Industry

Micro satellite bus through industry

Startup encouragement & Mentorship

Industry involvement for infra development and end-to-end space activities.

Policies to ease out business through IN-SPACe mechanism
International Cooperation

<table>
<thead>
<tr>
<th>International MoUs / Agreements signed</th>
<th>252</th>
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<tbody>
<tr>
<td>Cooperating Countries</td>
<td>59</td>
</tr>
<tr>
<td>Total number of international students trained in space science and technologies</td>
<td>2975</td>
</tr>
<tr>
<td>No. of countries trained in small satellite development in UN coordinated programme</td>
<td>60</td>
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Collaborations

- Joint R&D with academia in activities in Data sharing, propulsion systems, HSP, SSA, quantum communication; AI & ML; Big data analysis, Space Solar Power
- Widening ISRO’s ground station networks (for quicker data access; enhanced navigation signals; enhanced TTC support; redundancy; global coverage)
- Creating platforms for inflow of international expertise in newer areas and industry-to-industry collaborations for products and services.
- Startup encouragement and ease of doing business and investments.

Diplomatic Relations

- Strategic ‘Space’ in bilateral/ regional/ multilateral relations
- Sharing data; Opportunity in orbital platform; Establishing Application centres; Training and capacity building building & launching of satellites
- Long-term sustainability of outer space activities; non-proliferation of dual use technologies; space resource utilization…
Human Resource Development

Inhouse Competency Development
- Domain Training through Induction and structure training
- Functional Training – Skill Development trainings
- Behavioral Competency development though Management Development Programs

External Skill Development
- Identifying the skill development councils in Aerospace
- Imparting training to qualified youth on niche domains
- Collaborating with training agencies and academia to train the qualified in their regions.

Organization level Frame Work
- Identifying potential areas of space applications
- Announcing challenges and hackathons.
- Collaborating with talented for building the technologies

Challenges and Hackathons
- Organizing and supporting the conferences on advanced technologies.
- Conducting theme based seminars and works shops for disseminating the technologies

Conferences, Seminars & workshops
Student Engagement

01 Student Satellite Programme
02 Space Challenge Competitions
03 Young Scientist Programme
04 Student Online Competitions
05 Science Fairs & Exhibitions
06 Technical Facility Visits
07 Tinkering Labs
08 Student Projects
09 Internship Trainings
10 World Space Week Celebrations
At UNISPACE + 50 (June 2018: Vienna) India announced a capacity building Programme on Nanosatellite development.

59 Participants from 33 Countries across the Globe
YUVIKA
(Young Scientist Programme for Schools)

Residential training programme for 10th standard students. 150 students across the trained every year in space science, technology and applications.

CSSTEAP
Centre For Space Science And Technology Education In Asia And The Pacific

In response to the UN General Assembly Resolution (45/72 of 11th December, 1990) endorsing the recommendations of UNISPACE-82, established in 1996.
Exhibitions, Competitions, Talks & Space on Wheels
THANK YOU