REPORT

SECOND INTERNATIONAL PROGRAMME ON

Students' Satellite Mission 2022

28-29 November, 2018
Bengaluru, India

INDIAN TECHNOLOGY CONGRESS

Engineer Your Satellite Launch

Indian Technology Congress Association

75 Student Satellites' Mission 2022

Student Satellites gained prominence globally as a hands-on education tool and has emerged as a trend to build experiential learning and demonstrate enhanced practice-based outcomes.

The inspiration for this activity is the **democratization of space** that is taking place thanks to the advances in multiple domains and the miniaturization of components and systems. For a nation that is growing at a fast pace, student satellite mission presents a unique opportunity to develop innovative public-private partnerships to enhance education at all levels. It is a vehicle for affordable technology development and scientific research, facilitates strengthening the Indian space industry and positions the Indian education system for resilient growth.

Student Satellites offers the unique advantage of shorter development life-cycles, manageable set of requirements resulting in scaled-down complexity, shorter mission life and an acceptable risk of the mission for the Institutions. The development of a satellite goes far beyond the reach of academic Institutions but can be achieved through ITCA's consortium model that has research organizations, industries, entrepreneurs, policy-makers and funding agencies partnering to facilitate achieving the institution's goals of having its satellite in space.

Through collaborations with ITCA's Indo-Israeli Nanosatellite Programme, academic institutions in India will be able to leverage the end-to-end life-cycle expertise including design, development, manufacture, integration, testing, launch services facilitation and satellite operation, thereby building a high-performance Space-Tech ecosystem at the institution.

Partnering Institutions are expected to enhance student skills, employability, International technology culture, entrepreneurship mindset through start-up & collaborative incubations within Institution in partnership with Industry and R&D Organisations. These transferable skills can be utilized by students to achieve success in any engineering project they would be involved in during their extended career.

Technical Sessions

Inaugural Programme

Plenary Session: Small Satellites – Technology and Innovation Ecosystem

INDO-ISRAEL Collaboration Possibilities and Initiatives

Technologies and Development Models for Accelerated Student Satellite Mission

Opportunities for NanoSatellite Applications in a Data-driven Economy

Technical Evaluation & Mission Identification

Business Plan & Funding Opportunities– Interaction and Networking

Developing your own Student Satellite Project

Financing and Capital Structuring Models for Student Satellite Programmes

Valedictory & Signing of LoI/MoU

Programme Highlights

- Twenty Six Institutions are in the collaboration bandwagon including Signing of Letter of Intent (LoI), exchange of Memorandum of Understanding (MoU), mission formalization etc.
- 37 speakers across 7 sessions over two days
- Strengthening Indo-Israel Collaboration in developing 75 Student Satellites Mission 2022
- Launching International exploratory visits and Institutional training activity initiations
- Inaugurated University Space Engineering Consortium (UNISEC) of India and 14 Chapters are established
- Participation of 130 Delegates from partnering institutions
- Decision taken to have more International Programmes outside Bengaluru in collaboration with consortium members

K Shivakumar

Shri Awardee
an - Karnataka Science and
logy Academy and
Director, ISRO Satellite Center

- Build synergy between expertise available in ISRO and academic institutions
- Satellite development is a complex engineering programme
- Important to qualify the satellite before launch to ensure success

Dr Meir Ariel

Director General
The Herzliya Science Center and
Director, Nano Satellite Center
University of Tel Aviv, ISRAEL

- ISRAEL open to build fruitful and productive collaboration and cooperation between Israeli and Indian Universities
- Global space sector operating independently of governments
- Nanosatellites: Representative of new Space! tools for education, Science & Technology
- First European satellite designed by high school students in Israel
- Duchifat 2: Five Israeli High Schools together
- Israeli partnership: Envisioned for Reliable and Space proven HW
- Comprehensive, curated training programme to help build competencies in Space & Satellite Technologies
- Student centric satellite development programme for Institutions encompasses education & training, twinning courses with University of Tel Aviv, establishment of dedicated infrastructure & equipment, and satellite development
- Conducive environment for IP creation and patents

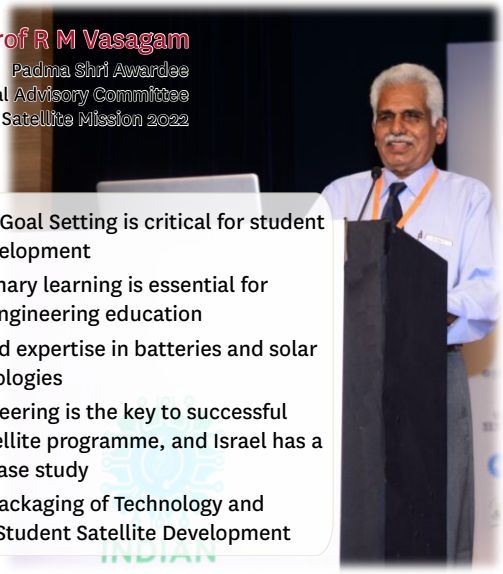
Prof M Krishnaswamy

Project Director-NIUSAT
Noorul Islam Centre for Higher Education, and
Former Programme Director
IRS Satellites, ISRO

- Student satellite development is a multi-disciplinary and complex technology development process
- Satellite requires high reliability of operation, reliability prediction and analysis before launch is essential
- Stringent Process, Quality Control and Inspection procedures are critical
- Management and leadership support and commitment is extremely crucial for project success
- Satellite Building Blocks: On Board Computer, Electrical Power System, Power Distribution Module, On Board VHF / UHF TT&C, Attitude and Orbit Control System
- Validation and Qualification Plan: Assembly Test, Preliminary Integrated Test (PIT), EMI/EMC Test, Vibration Test, Thermo VAC, Final Integrated Test (FIT), Mechanical Test, Launch Base Test (LBT)
- Design and Deployment of Small Satellites requires contemporary design knowledge and Quick Reaction Time
- Small Satellite Formation / Constellation when undertaken in parallel with industry derisks space asset availability

Prof R M Vasagam

Padma Shri Awardee
Chairman, National Advisory Committee
Students' Satellite Mission 2022



- Mission and Goal Setting is critical for student satellite development
- Interdisciplinary learning is essential for successful engineering education
- Need to build expertise in batteries and solar panel technologies
- Frugal Engineering is the key to successful Student Satellite programme, and Israel has a successful case study
- Integrated Packaging of Technology and Funding for Student Satellite Development

Indian Technology Congress Association, a platform for technology adherents working to stimulate multi-disciplinary capabilities in tomorrow's workforce, is collaborating with International Agencies, National Labs and Industry Experts who have contributed immensely in their domains to accelerate the pace of adoption of emerging technologies and innovation taking place at the edge of conventional disciplines of engineering.

Emergence of small satellites are a disruptive with potential to change not just the canvas of adoption of technological advances, but also drive the transformation of education. **"75 Student Satellite Mission 2022"** has further evolved with global participation encompassing many countries. This joint initiative by India and Israel is a path-breaking drive with numerous agencies partnering to see India shining when celebrating 75 years of Indian independence in 2022.

Dr. L.V. Muralikrishna Reddy
President
Indian Technology Congress Association

Dr Y S Rajan

Padma Shri Awardee
Former Distinguished Professor, ISRO/DOS
Former Chairman, BOG, NIT Manipur and
Former Vice-Chancellor,
Punjab Technical University (PTU).

ITCA Collaboration Platform involving industries - a great movement

ITCA Programme integrates Technology landscape and Funding

Space Initiatives are very demanding and need detailed System Design and Interface Definition

Mission definition and payload identification are very critical

Dr K Gopalakrishnan

Secretary General
Indian Technology Congress Association &
Convener, Students' Satellite Mission 2022

Established UNISEC India and initiated 14 Institutional Chapters; Submitted proposal to host the 7th UNISEC Global Meeting in Bengaluru in 2019

Systems Engineering is key for developing quality engineering workforce

Development of contemporary curriculum to build Satellite competency

UNISEC India has extended to support ITCA's 75 Student Satellite Mission

Engineering Model Classroom Satellites of 2U built on COTS Components

Developing a Single Card Satellite with Israeli support within 18 months

Organized contest to shortlist viable mission ideas

Customizable engagement model for Institutions for SmallSat Development including Multiple spinoffs with significant value for Institutional brand building

Mr R K Rajangam

President
Planet Aerospace and
Former Project Director
INSAT-4B, ISRO

Mission management is critical for success of student-centric satellite initiatives

Constellation approach for small satellite development is the new paradigm

Complex State-of-the-art technologies with Interdependent Designs

Spacecraft Architecture: Integrated Approach to both payload systems and platform systems

Major drivers for spacecraft design (3Ps): Payload, Power, Propulsion

Use of standardized hardware simplifies satellite configuration and gives advantage in lead time.

Project teams require 3Ps to succeed: Passion, Patience, and Perseverance

Mr C R Janardhana

Sr. Vice President
Federation of Karnataka Chambers
of Commerce & Industry

Satellite development will help upscale academic programmes through experiential learning

Engineering Fraternity can drive transformation by imagining a future and influencing it by our endeavours in the present

Satellite technology is an agent for social good and development

Dr Enti Ranga Reddy

Founder Fellow-ITCA and
CMD, Legend Technologies

ITCA conceptualized and structured this exciting programme to build capacity in Institutions to pursue interdisciplinary research through successful development and deployment of student satellites

Collaborative ecosystem is essential for success in complex engineering programmes

Mr M Venkata Rao
Member, Executive Committee,
Planet Aerospace and
Former Project Director
(Oceansat and Resourcesat), ISRO

Development of CubeSats with standardized interfaces has been a technology disruption driving nanosatellite development globally

Student Satellites facilitates hands on experience for students in developing hardware, software, systems integration and project management

Nanosatellites has the potential for commercial application and operational services in earth observation & telecommunication

Mr B A Subramani
Director
Educational Relations
AMSAT India

Licensing Procedures for Nanosatellite Communication

Using amateur radio frequencies comes under the category of Amateur radio Satellites

Licensing is essential

Have the flexibility of large number of Ground Stations

Identify payload and migrate to UHF and higher bands

Mr Bharathi G
Deputy General Manager
Work Centre Operations
L&T Defence

Satellite Communication Networks

Revenue generation from the space industry in 2016 is USD 260bn

Satellite Communication Solutions includes both Space and Ground segments with earth stations and TT&C

Estimated SmallSat market is anticipated to be USD 60bn in the next 10-15 years

Mr. Akiba Penkar
Director
TMISAT, ISRAEL

Launched funding programme for 75 Student Satellite Mission with patronage from the Government of ISRAEL

Outline on how it works

"...ITCA Programme integrates technology landscape and funding."

CONNECT - NETWORK - COLLABORATE

Mr C D Shridhara
Director
Ananth Technologies

- Satellite data requirement is likely to grow at 30% CAGR
- Demonstrate key nanosatellite capabilities in data handling, relay telecommunication
- Paradigm shift from single unit production to multiple inline manufacturing
- Trend to bring in synergy across national agencies including Research Organizations, Academia, Industry and Entrepreneurs
- Satellites will be agile and adaptable with flexible payloads
- Role of additive manufacturing in CubeSats

Mr Siharan De
Electronics Components Expert
Planet Aerospace

- Commercial Off the Shelf (COTS) for Nanosatellites
- COTS will boost participation in Nanosatellite programme
- COTS ability to mix and match vendor's products will usher competition and build new companies

Mr. Aravind Kilaru
Exec Member
IET Satellite Systems & Applications Network

- Satellite Systems and Applications can facilitate better communication leading to building smart cities
- Satellite technology can help promote automated vehicles with resulting safe and efficient movement of people, goods and services
- Standardization and Collaboration are key for Success

INDIAN TECHNOLOGY CONGRESS

Glimpses of First International Seminar on **Students' Satellites**

NIMHANS Convention Centre, Bengaluru
05-06 September 2018

- Inauguration by **Honourable Chief Minister of Karnataka Shri H.D. Kumaraswamy**
- Launch of **"75 Students' Satellites Mission 2022"**
- Over **30 National and International Experts** shared their collective wisdom and provided thought-leadership on **Space Technologies**
- Release of **"Compendium of Students' Satellites"**
- Conceived **Indo-Israel Student Satellites' Development Program**
- Establishment of **UNISEC India** and Initiating **Institutional Chapters across India**

UNISEC INDIA
University Space Engineering Consortium

- Launched **Competition for Design of Innovative Payload for Students' Satellites**
- Initiated a Project on **Design and Development of Classroom Satellites** for **Teaching and Training**
- Support Received from **ISRO, Israel Space Agency, Herzliya Science Center, CANEUS, Thumbsat, Cubesat, IEEE, IET, Data Patterns, UNISEC** etc.

The Speaker's Presentations / Programme Photos can be viewed from

https://itca.org.in/satellite.html

Mr Sudip Kar
Co-Founder
D'Vine Research Labs

Small Smart Satellite Bus Satellite in a Box

Vision: 'Satellite for Everyone' and "Satellite in a Box'

Technological advancements facilitate Smartphones to act as a 'Virtual' Earth Station to command and control Nanosats by their respective owners

Mr D S Govindarajan
President
Aniara SpaceCom

Miniaturization and availability of precision technology and reliable COTS, highly capable small satellites can be built with lower capEx

University based small satellite projects have led to establishment of space enterprises

Adopt COTS, Open Source and Interface Standards

All Universities involved in nurturing new Space spinoffs have had a programmatic approach with sustained investments

Mr Amrut Yalagi
Senior Sector Manager-Space
Dept. of International Trade
British Deputy High Commission, Bengaluru

Highlighted on overview of Space Clusters at Harwell, Surrey and Scotland

Unique combination of facilities and key organizations ranging from startups, SMEs to multinationals and publicly funded organizations

Mr V Swaminathan
Director– Marketing
ENTI Innovations Pvt Ltd

Debris Collision Alert System (DeCAS)

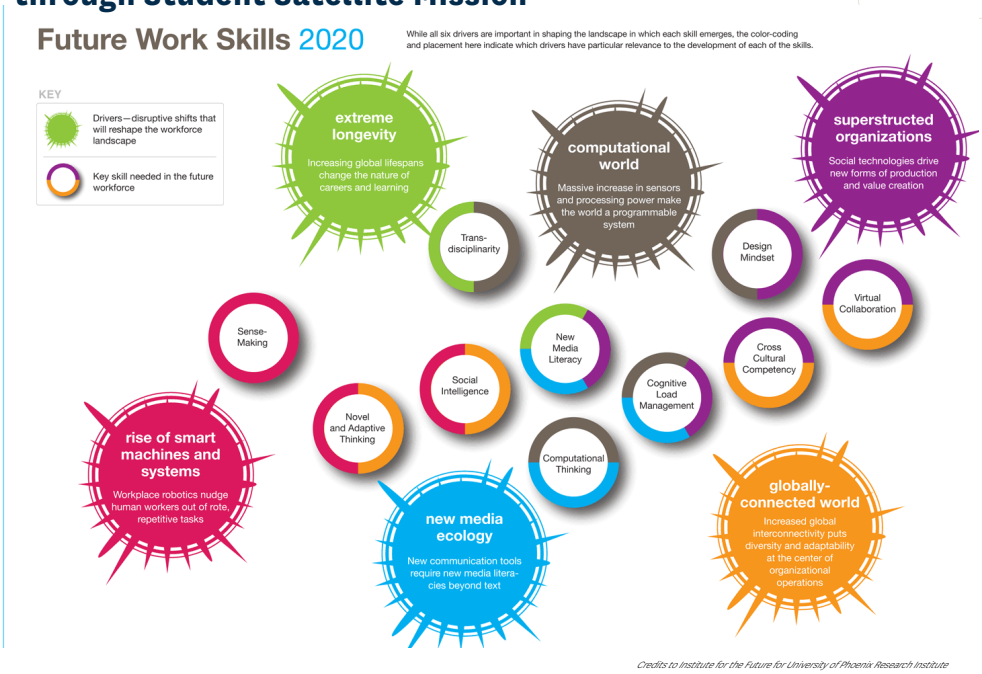
DeCAS: An innovative security system for satellites and space vehicles

Enhanced security for government and population

Compliance with regulation due to an easy to install system for satellite operators and manufacturers

Reduced space insurance premium for satellite companies

Future Work Skills 2020 - Addressed through Student Satellite Mission



Credits to Institute for the Future for University of Phoenix Research Institute

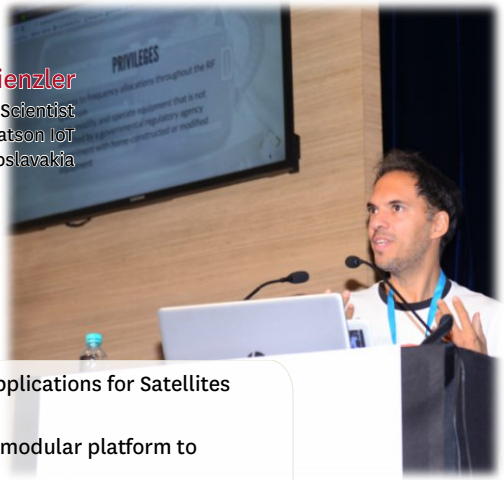
Key Competencies

Systems Engineering
Interdisciplinary Systems
Design Thinking
Project Management
Collaboration
Research & Development

Mr L S Satyamurthy

Vice President, Planet Aerospace;
Former Programme Director
Telemedicine, ISRO

Highlighted the costs of satellite development includes infrastructure (VHF + UHF Ground Station) + costs of qualifying tests & launching



Mr Romeo Kienzler

Chief Data Scientist
IBM Watson IoT
Czechoslavakia

AI-Deep Learning-Data Science Applications for Satellites Projects

SatNOGS provides a scalable and modular platform to communicate with them

Open Source global network of satellite ground-stations

SatNOGS is focused on retrieving signals from LEO satellites in UHF and VHF bands

SatNOGS retrieves status and telemetry signals, data from payloads (experiments) from scientific and research satellites (p.e. magnetospheric experiments), weather data etc.

Prof V K Agarwal

Director, R&D and
Professor Dept of CSE
Dayananda Sagar University

Student satellites are a viable platform for faculty and students to innovate, develop and productize technologies for space domain

Mr. Pratik Mishra

CTO
Rile India Lab

CADCAM Design of CubeSatellite Structure

Optimal flight models can be designed using lightweight materials; with optimized structures providing minimization of mass while facilitating maximization of structural integrity

Ms Pramitha R

ITCA &
Formerly University of Surrey, UK

Open Source Software and COTS Solutions for Accelerated Student Satellite Development Case Study

Stages of Satellite Design

Use of COTS solutions for 1U Satellite Design

Use of Open Source Software for 1U Satellite System Design

Example of the 1U System using Raspberry Pi

Space Radiation mitigation of COTS solutions

Prof. Kumar Abhijeet

Assistant Professor
National Law School of India University

Legal Issues in Small Satellite Launches

Moving into an era of Space Commerce is an amazing learning experience

States parties to International treaties bear responsibility for national activities in outer space and for assuring that the nation's activities are in conformity with OST provisions

Insurance and Indemnity

Registration of Space Objects: Launching State to maintain national register

Compliance with Space Debris Mitigation Guidelines

Notification and Recording of Radio Frequencies used by the satellite at ITU

Prof B Dattaguru

Padma Shri Awardee
Emeritus Professor.
Dept. of Aerospace Engineering
Indian Institute of Science

Academic Institutions need to also look at 'Experiential Learning' or "Teach Using Hands"

Essential that Workforce are trained to pilot the 'Make in India' Mission

Small satellites can be built a affordable lower costs and within shorter time-lines

Smart Materials, Smart Structures, Digital Twin are key paradigms

Mr M V Kannan

Chief Executive Officer
Space Technologies Division
Grintex India Limited and
Member, Executive Committee
Planet Aerospace

Privileged to sign an MoU with ITCA

Systems Engineering is essential with multi-disciplinary approach

Reviews are critical with tracking for closure

Debris management is critical to ensure compliance with International Statutes

"...ITCA Programme integrates Technology Landscape and Funding."

"...With eminent people getting involved, the Students' mission to build 75 satellites by 2022, will definitely happen successfully."

"Indeed it was our privilege and pleasure to take part in the International program organized in an excellent and professional manner."

- Participants Speak

Mr Venugopal Umarji

Engineer - Sales & Applications
SERVOCONTROLS Aerospace India Pvt. Ltd

Desktop Satellite for Classroom

Simulated environment to build and control operational spacecraft

Includes all major satellite subsystems and ground support system

Satellite Development-Aligned to Global Needs

Vardhaman College of Engineering & Technology
Hyderabad

Enti Innovations Pvt Ltd , Bangalore

Excel Engineering College, Namakkal

G. H. Raisoni College of Engineering, Nagpur

Adithya College of Engineering
Surampalem, East Godavari District

Periyar Maniammai Institute of Science & Technology
Thanjavur

Francis Xavier Engineering College
Tirunelveli

Planet Aerospace, Bangalore

SCAD College of Engineering & Technology
Tirunelveli

Signing of Letter of Intent (LoI) and Memorandum of Understanding (MoU) at the Programme

CONSORTIUM MEMBERS & INSTITUTIONS PARTICIPATED

Supporting and Co-Hosting Organizations

Fourthcoming

February 2019

THIRD INTERNATIONAL PROGRAMME ON

75 Students Satellites' Mission 2022

https://itca.org.in/satellite.html

Join ITCA's Consortium... contact

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