



75 Students' Satellites Mission

ITCA's Engineering Prowess and Ingenuity



ITCA is a platform that connects bright minds, entrepreneurs, and innovators to faster ideas, concepts and builds NewSpace solutions through the 75 Students' Satellites Mission. We are aligning India's academia to the cutting edge of space technological innovations by designing, developing and launching student-built satellites as part of the mission.

In 2018, ITCA and a few noted space scientists fostered the notion of building SmallSats by students from Indian educational institutions. At the 8th Indian Technology Congress in September 2019, this audacious ambition was transformed into a vision and became the **75 Students' Satellites Mission 2022**. The Mission aims to have students from various universities / institutions build and launch small satellites (SmallSats) into low earth orbit (LEO). It envisioned for 75 satellites being launched to commemorate seventy-five years of Indian independence (Azadi ka Amrit Mahotsav, 1947-2022), with seventy-five notable institutions deploying their student-built SmallSats.

When this mission was first conceived in 2018, it sounded grandiose because space research and development was being led by a few national space agencies and large aerospace heritage corporations, and there were associated technical, cost, and schedule constraints to contend with. Many



countries did not even have their own satellites at the time, and student-built SmallSats were much less prevalent and sometimes unheard of.

In spite of the pandemic, ITCA's SpaceTech teams strived hard over the last three years to make this vision a reality by acquiring skills in SmallSats platforms, across Product Development, Systems Engineering, and Project Management. This engineering endeavour, integrated cutting-edge technologies, aggregated operational insights and innovations across multiple disciplines culminated in the launch of the UNITYSat built by students in February 2021. Along with this success, the participating student teams had immense exposure, working with best-in-class facilities in India and abroad.

This knowledge base was substantial, and it had the potential to generate high-growth start-ups. Two spin-off firms, TSC Technologies in India and TMISAT in Israel, were mentored and incubated by ITCA in 2020 to apply its SpaceTech team's research and rich competencies to large-scale SmallSats development. Thanks to partners who have collaborated in this mission, ITCA has been able to expand the base of participating universities/institutions;

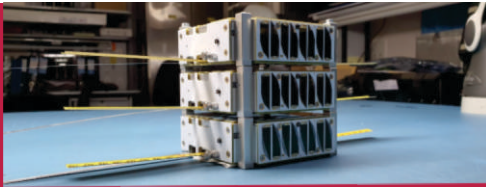


industry and R&D labs in Indian and abroad. The ecosystem has been primed by the continuous innovation taking place, making manufacturing of affordable SmallSats by students a reality.

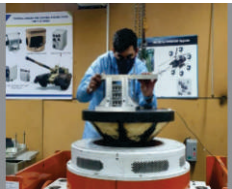
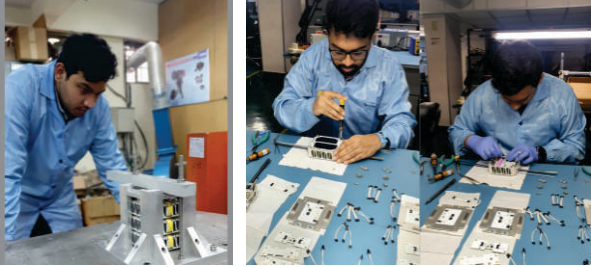
ITCA SpaceTech teams have demonstrated that the coveted 75 Students' Satellites Mission is viable and achievable thanks to breakthrough technologies and productization advances. **ITCA has proven to the nation's scientific and engineering community that Indian students are competent in developing and deploying SmallSats.** This mission is accomplishable because the participating teams were able to build a significant knowledge base in order to address complicated engineering issues, resulting in the building of SmallSats in a shorter timescale using COTS components and subsystems.

ITCA's SpaceTech ecosystem provides the depth and breadth of domain experience, as well as multidisciplinary knowledge, to reliably execute challenging SmallSats programmes, including commercial satellite constellations.

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75 Students' Satellites Mission:
A Spectacular state-of-the-art Programme for
Expanding Global NewSpace and Emerging FastSpace



Powerhouse of Technological Expertise and Innovation



NewSpace and its Opportunity for Advancement

Democratization and affordable access to space are the characteristics of the NewSpace era. A few years ago, space activities were limited to the realm of national space agencies, and investments for such programmes would come largely from the governments. Today, space has become accessible to even common citizens including students and researchers in academic institutions and universities. Entrepreneurs and venture capitalists, government supported/funded organizations, and private sector users are all participating in the commercial space endeavour.

Global technological advances, including high-quality semiconductors from the extremely price-sensitive mobile phone industry, 3D printing of parts from the automotive and aerospace industry have helped grow the use of high-performance COTS components and subsystems. Access to the spare capacity of large rockets through ridesharing has helped slash launch costs, bringing the deployment of SmallSats within the purview of first-time users. Affordable-cost hardware including miniaturized optics, MEMS sensors and accelerometers, smart materials, high-efficiency batteries (Li-Ion) and solar cells (multi-junction GaAs-gallium arsenide semiconductor) have helped in establishing the standards for enhanced reliability in operations of SmallSats.

The standardization of SmallSats (CubeSats and NanoSats) has facilitated the transformation of the space industry, with missions' development costs dropping to fractions of the price of conventional satellites and with development time reduced to few months from the time the need is assessed to the time the satellite is placed in orbit. In addition, SmallSats constellations can ensure continuous renewal of the satellite system, which translates to the delivery of optimum technological services at all times.

Government's Perspective on Indian Space Programmes



"To commemorate the 75th year of its independence, India is going to launch 75 such satellites into space, which Indian students are developing in schools and colleges."

Hon'ble Prime Minister
Shri Narendra Modi @ 76th
United Nations General
Assembly in New York on
Saturday, 25 September 2021

75 Students' Satellites Mission 2022

The Government of India's aggressive policies and Hon'ble Prime Minister Shri Narendra Modi's Vision for a \$ 5 trillion economy to achieve self-sufficiency in a wide range of industries have given rise to a slew of innovative initiatives, including those in expanding the space industry. One of the government's objectives is to encourage start-ups in the space sector and academic institutions to reach their full potential facilitating India to become a space hub. ISRO's tremendous achievements in the global space arena, and the ambitious initiatives of agencies of the Department of Space-NSIL and IN-SPACe, have paved the way for the rapid deployment of SmallSats produced by the next-generation enterprises.

"On the occasion of 75 years of independence (Azadi Ka Amrit Mahotsav), India is going to launch 75 satellites into space made by Indian students in schools and colleges," Prime Minister articulated at the meeting of the world leaders at the United Nations General Assembly (UNGA) session. These positive actions have enabled Indian society to embrace the NewSpace or Space 4.0 era.

ISRO has lined up a array of complex space missions including Gaganyaan, DISHA-a twin aeronomy satellite mission, Venus CNES, TRISHNA, Chandrayaan-03, Aditya L1, XpoSat, IRNSS technology demonstration, and launch of EOS-02, EOS-4 & EOS-6 satellites. These missions will collectively give myriad opportunities for space aficionados to contribute and build the NewSpace industry for future generations.

75 Students' Satellites Mission

The aspirational and ambitious Mission 2022, which aims to launch 75 student-built satellites into orbit, has been well structured within a participatory ecosystem building on the combined domain expertise of competent and experienced Indian Space Engineers, and collaboration with leading global Spacetech organizations. Thanks to the fervent initial backing of organizations/agencies from Israel, Russia, Serbia, and Japan, the mission has expanded today, with 50+ countries contributing to build strong capabilities in academic institutions for the design and development of student-built SmallSats.

Among the many mission objectives, the greater emphasis is on academia focusing on science-based education and experience-based learning, to foster an innovation culture in the country and train the future workforce in the ever-expanding space arena and allied sectors.

The mission's purpose is to educate students on how to design, develop, manufacture, integrate, test, launch, and monitor SmallSats through hands-on learning, **besides serving in NewSpace research programmes and a workforce development initiatives.** To that end, ITCA has devised a rigorous systems engineering and project management approach to ensure the successful deployment of SmallSats by students under active expert mentoring and guidance.

The envisioned SmallSats are primarily CubeSats of 1U, 2U, 3U, and other configurations built with cutting-edge technology. Such SmallSats' performance is comparable to larger ones based on earmarked payloads and applications. Furthermore, CubeSats with these configurations would use and have access to an extensive range of widely accessible COTS components as well as a variety of launching possibilities.

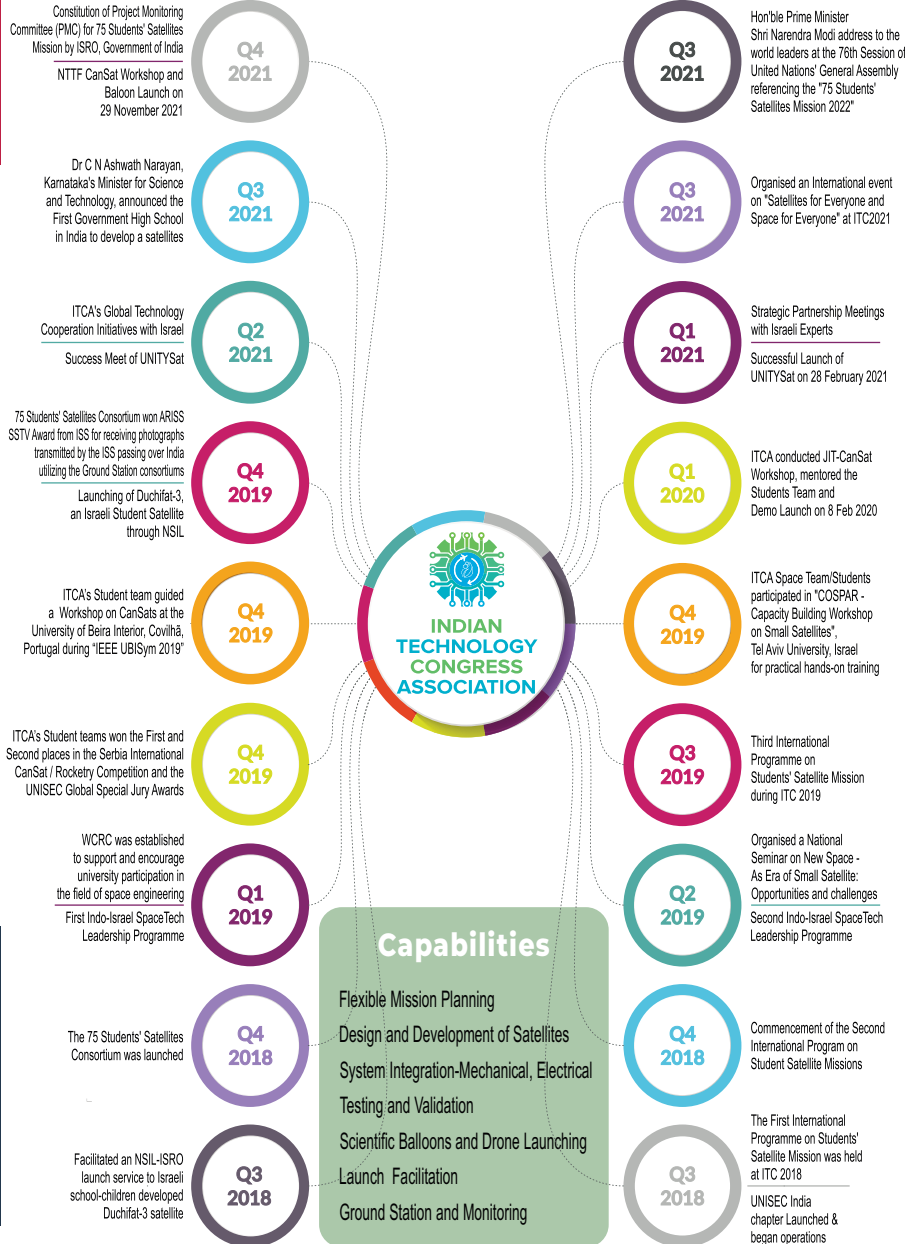
The satellites are launched into a 400-500 km LEO orbit and are monitored by ground stations explicitly designed for this purpose at the respective institutions. Typical satellite mission applications identified by ITCA include weather monitoring, earth observation, communication, and the Internet of Things (IoT), geolocation and logistics, disaster management and rescue, etc.

At the end of the successful mission, participants will be able to compile a portfolio of signature space projects that will highlight their competencies.

Illustrative Snapshot...

75 Students' Satellites Mission

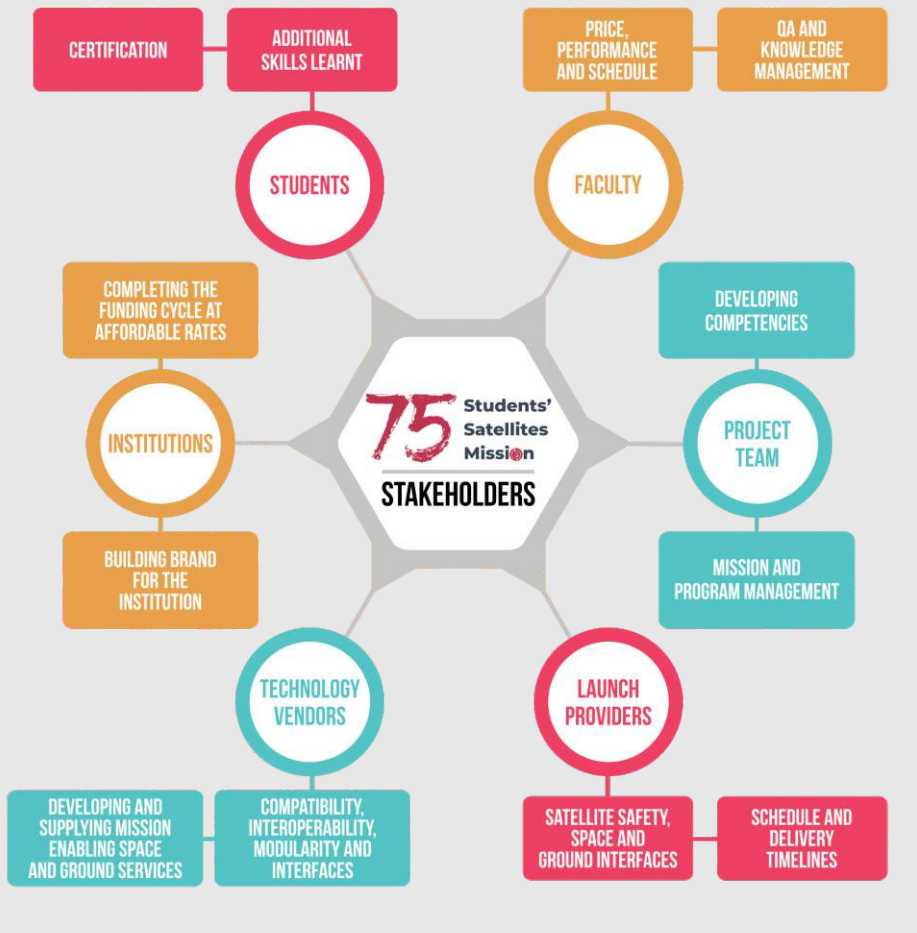
The Journey



Mission Deliverables

Benefits to Host Institution

- 1U/2U/3U Satellite: Functional Qualified for Space Launch with Qualification Test Reports
- Establishing Nano Satellite Centre and Ground Control Station (GCS) - Antennas, Receiver, Rotator @ Campus
- SatNOGS/TinyGS Ground Station Network (TinyGS community is based on LoRa Satellites only)
- ITCA Proprietary SatNav: A Mobile App for tracking of Satellite by students
- Satellite Functional Engineering Models/Qualification Models for Test/further studies as Classroom Satellite
- Integration of Satellites with Launch Vehicle-PSLV/SSLV Services at ISRO-Spaceport, Sriharikota
- Launch Qualification Tests of the Satellite: Jigs/Fixtures for CubeSats
- Safety Submission Requirements for Launch: Coordinated with ISRO-VSSC, Trivandrum
- Interface Control Document: Coordinated with ISRO-VSSC, Trivandrum
- Frequency Allocation: Orbit Spectrum Coordination & Acquisition
- Registration of Satellite with IN-SPACE
- Launch Campaign and Deployer Integration
- Participation of Institution's Satellite Team in World CanSat Rocketry Championship/Global Events/International Exposure
- Learning Resources/Training Materials (6 Months-24 Credits/Audio Visuals on Small Satellites and Space
- Training Programmes/Internships/Mentor Sessions/Publications on Space and Small Satellites/Startups



Value Addition through Mission

Today's society is far more reliant on space assets for daily necessities, resources, and economic prosperity. In the coming years, the ongoing space missions and future scientific research will be critical for gaining a deeper understanding of our planet Earth, combating climate change, and promoting global socioeconomic development. When these elements come together, the traditional space is transformed into Newspace with numerous openings and possibilities, demanding new resources and a large, trained workforce.

With its unrivalled entrepreneurial focus and favourable private investments, the current dominant space economy provides brisk prospects and future opportunities for students and professionals excited by these pursuits.

Aside from a plethora of employment opportunities in the burgeoning space sector, the multidisciplinary learning framework, transnational technology culture, and entrepreneurial spirit are significant spin-offs/outcomes. In addition, the universities and institutions will spawn start-ups through collaborative incubation with the involvement of industry and R&D institutes.

Engineer Your Satellite Capacity Building Training Programmes

Engineer Your Satellite (EYS) is a series of comprehensive training suites developed by ITCA to boost capacity and broaden the learning canvas of participating students. International specialists have crafted the curriculum to provide theory, hands-on practice, and real-time exposure. Under the supervision of internationally acknowledged experts in space technologies, participating students will be exposed to the state-of-the-art concepts in small satellite development, both within the country and in global locations, during the EYS programme/s in the Institution. 6 Months structured (24 Credits) Course will benefit all Space enthusiasts/Participants.

The EYS programme aims to create groups of acclaimed student leaders in STEM disciplines with a proven track-record of demonstrable experience in multidisciplinary approach of problem solving, backed by industry-recognized systems engineering framework.



TSC Technologies Pvt Ltd is a space technologies start-up mentored and incubated by ITCA in India. It provides turnkey project support with respect to small satellites globally to meet the needs and requirements of its clients. Delivered through a single engagement, multi-source model, TSC Tech Team works closely in liaison with its clients to provide premium service that significantly reduces costs.



University Space Engineering Consortium (UNISEC)-India is the Chapter of UNISEC-Global. UNISEC-Global envisions a world where space science and technology are used by individuals and institutions in every country, rich or poor, and offers opportunities across the whole structure of society—whether academic, industrial or educational— for peaceful purposes and for the benefit of humankind.

UNISEC-Global is an international nonprofit body, consisting of local-chapters across the world. Since its establishment in November 2013 in Japan, UNISEC-Global has provided a forum every year to promote practical space development activities, mainly at university level, such as designing, developing, manufacturing, launching and operating micro/nano/pico satellites and rockets, including their payloads.



TMISAT is an Israeli New Space company founded by committed professionals and entrepreneurs interested in exploring business prospects in the space sector. TMISAT has the distinct advantage of being present in all aspects, including designing and developing SmallSats for the ITCA's ambitious 75 Students' Satellites Mission 2022.

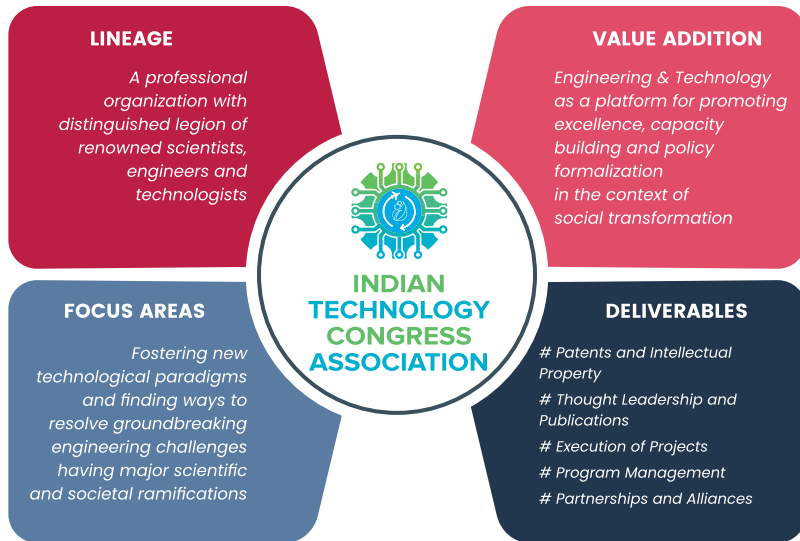


World CanSat/Rocketry Championship (WCRC) is an international competition open to elite competitors from around the world, representing their nations, as university student teams or as independent student teams.

Serbia and India agreed to launch the initiative to establish CanSat/Rocketry Championship at the Global level, so that the CanSat/Rocketry program can be raised to a higher level, involving even more students and countries. Both countries believe that this is very important globally, primarily in terms of education, and in promoting Space engineering in general. The WCRC was formulated and negotiated among the founding organizations from six nations: Serbia, India, Italy, Tunisia, Canada and Peru.

In Synergy with...





Indian Technology Congress Association, popularly called ITCA, has been at the forefront of engineering interventions and transfer of technology by showcasing contemporary solutions for social good over the last 17 years.

ITCA has attained international prominence as a unique platform fostering Industry-Academia-Research Labs-Policy Makers' collaboration with the objective of capacity-building for global technological progress. Its adherents and members from the industry, R&D Laboratories, and Academic Institutions have collaborated and 'institutionalized' their service / "giving-back" to the society.

Space technology and small satellites, precision agriculture, and Industry 4.0 are prominent recent areas of ITCA's activity. It has pioneered the transfer of advanced technologies including Sensors for Societal Applications, Tissue Engineering, and Micro Air Vehicles (MAVs). ITCA has created teams of professionals from diverse fields to progress Techno-Economic Viability (TEV) analysis for large infrastructure projects conceptualized by State Governments under Public Private Partnership (PPP) mode.

ITCA, through its one-of-a-kind initiative, is at the forefront of broadening the scope for SmallSats that are being launched into orbit at an increasing rate by universities/institutions, research groups, and start-up tech companies. Having sparked and stimulated interest in SmallSats in students of educational institutions across the country, ITCA's teams have built advanced skills and competencies in satellite technology over multiple disciplines to understand, analyze and design complex space systems. This learning, coupled with the practical knowledge and expertise of industry veterans in delivering successful projects, uniquely positions ITCA and its affiliated partners to meet the demand for developing affordable and reliable state-of-the-art commercial SmallSats as well as the ongoing Student-built Sats mission.

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Supporting Agencies/Countries

