Kammavari Sangham (R) - 1952
K.S.Group of Institutions
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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Report on ITC – 2019

OBJECTIVES

- Democratization of space
- To leverage the end to end life cycle expertise.
- To enhance student skills, employability, entrepreneurship mindset.
- To facilitate achieving the institution’s goal of having its satellite in space.
- To fulfill national security needs.
- To stimulate multi-disciplinary capabilities in tomorrow's workforce.
- To collaborate with the academia and to maximize these technological advantages by sharing the human and technical resources from academia along with latest technologies and tools.

75 Student Satellites' Mission 2022

ITCA has initiated the ambitious **"75 Student Satellites' Mission 2022"** in collaboration with National and International tech-space organizations. The mission comprises a consortium of Institutions who would be developing and launching their own student-built satellites by 2022. ITCA is glad to share that currently 32 institutions are part of this consortium and their teams would be progressing to 'deep-dive' technology-capability-business potential assessments with ITCA's mentors and domain experts.

The development of the frame work covers launch low-earth orbit (LEO) - potentially for monitoring, assessments and transmissions with the provision for establishment of small satellite low ranges, applications for specific sector with safety and security. **Engineer Your Satellite (EYS)** programme is a real-time work-based application programme designed and managed by the ITCA Secretariat in partnership with Universities/ Colleges and Knowledge Based Industry in the space-sector, with the mission to enhance skilled academic education to prepare universities/ colleges for ground reality with effective introduction to their future professions in the space sector.

The objective of this Mission is to make "75 Brilliant Institutions" a respectable place for advancement in Satellite Space of the world. One of the main objectives is to attract future scientists and engineers to the Space Sector by transforming knowledge, know-how and standards in all field of space technology.

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. 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.

Students of participating institutions would come from different disciplines and get to build nano satellites weighing between 3 and 12 kg. They may demonstrate a novel concept, science experiment, or technology in orbit.

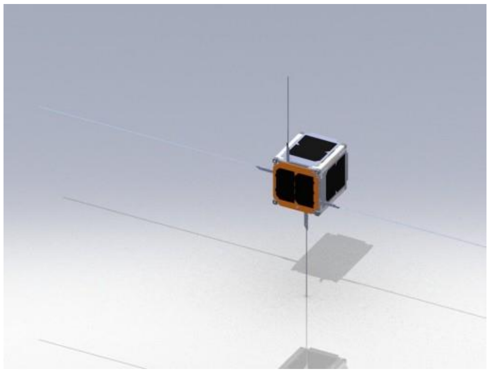
Student Satellites offers the unique advantage of shorter development lifecycles, manageable set of requirements resulting in scaled-down complexity, shorter mission life and an acceptable risk of the mission for the Institutions.

Technical Sessions

- Inaugural Programme.
- Plenary session - Human digitalization: Future intelligence.
- Inaugural and plenary session: International seminar on 75 students' satellites mission 2022.
- Technologies and development models for accelerated student satellite mission.
- UNISEC India sponsored session: Developing your small satellite project mission.
- Business plan and opportunities for Indo-Israel SpaceTech investments initiative.
- Concluding session-New space sustainability: Small satellites for software defined industry performance.
- Valedictory session.

Duchifat-1

Duchifat-1 – a 1U CubeSat – is an experimental and educational spacecraft developed at Herzliya Science Centre, Israel. The main objective of the mission is the transmission of real-time data from the satellite to ground stations using the amateur radio frequencies. The satellite will link to a number of LEO satellites and ground stations using the Automatic Position Reporting System (APRS) protocol. This will allow remote access for worldwide position/status reporting using simple mobile radios with omni-directional antennas. Real time position reporting is accomplished using GPS data. Duchifat-1 will be capable of transmitting a variety of data including short text messages and telemetry data acting as a digipeater. The APRS protocol is useful for SAR (Search and Rescue) and CAP (Civil Air Patrol) missions.



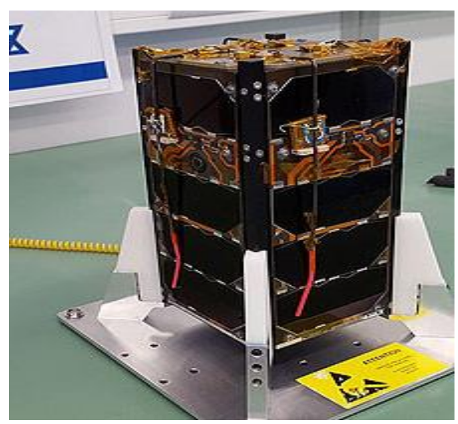
Hoopoe (Duchifat 2, QB50 IL01)

Hoopoe is an Israeli 2U-CubeSat constructed by the Space Laboratory of the Herzliya Science Center as part of the QB50 mission.The purpose of this CubeSat includes upper atmosphere science, radio communication experiments, technology demonstrator, education, training and outreach.

As a payload for QB50, the satellite carries a multineedle Langmuir probe (mNLP) sampling the electron density of the space around it, Thermistors and a Magnetometer.

The satellite was launched with the bulk of the QB50 constellation to the ISS in 2017, from where the satellite was deployed on 18 May 2017.

Duchifat 3



The Israeli student satellite Duchifat-3 is an experimental and educational spacecraft developed and built by students of secondary schools at the Space Laboratory of the Herzliya Science Centre (HSC). It is built to the 3U CubeSat standard.

Duchifat-3 has three missions which will operate in parallel: high-school students educational satellite on-board camera for earth imaging amateur radio transponder and APRS digipeater

A launch has not yet defined but is expected to be into a 500-600 km sun-synchroneous orbit in late 2018.

TAU (spacecraft)

Stellar parallax is the basis for the parsec, which is the distance from the Sun to an astronomical object that has a parallax angle of one arcsecond. (1 AU and 1 pc are not to scale, 1 pc = ~206265 AU) What TAU would do is use its distance from the Earth to make the parallax measurement, so rather than just 1 AU as with an Earth-based annual parallax it would be hundreds of AU. This would increase the distance measurement horizon from about 500 light years for the Hipparcos satellite to 250 000 light years.

TAU (Thousand Astronomical Units) was a proposed unmanned space probe that would go to a distance of one thousand astronomical units (1000 AU) from the Earth and Sun by NASA/JPL in 1987 using tested technology. One scientific purpose would be to measure the distance to other stars via stellar parallax. Studies continued into 1990, working with a launch in the 2005–2010 timeframe.

It was a proposed nuclear electric rocket spacecraft that used a 1 MW fission reactor and an ion drive (with a burn time of about 10 years) to reach a distance of 1000 AU in 50 years.The primary goal of the mission was to improve parallax measurements of the distances to stars inside and outside the Milky Way, with secondary goals being the study of the heliopause, measurements of conditions in the interstellar medium, and (via communications with Earth) tests of general relativity.

Space law

Space law is the body of law governing space-related activities, encompassing both international and domestic agreements, rules, and principles.Parameters of space law include space exploration, liability for damage, weapons use, rescue efforts, environmental preservation, information sharing, new technologies, and ethics.Other fields of law, such as administrative law, intellectual property law, arms control law, insurance law, environmental law, criminal law, and commercial law, are also integrated within space law.

The origins of space law date back to 1919, with international law recognizing each country's sovereignty over the airspace directly above their territory, later reinforced at the Chicago Convention in 1944. The onset of domestic space programs during the Cold War propelled the official creation of international space policy (i.e. the International Geophysical Year) initiated by the International Council of Scientific Unions. The Soviet Union's 1957 launch of the world's first artificial satellite, Sputnik 1, directly spurred the United States Congress to pass the Space Act, thus creating the National Aeronautics and Space Administration (NASA).Because space exploration required crossing transnational boundaries, it was during this era where space law became a field independent from traditional aerospace law.

National law

Space law also encompasses national laws, and many countries have passed national space legislation in recent years. The Outer Space Treaty gives responsibility for regulating space activities, including both government and private sector, to the individual countries where the activity is taking place. If a national of, or an organization incorporated in one country launches a spacecraft in a different country, interpretations differ as to whether the home country or the launching country has jurisdiction.

The Outer Space Treaty also incorporates the UN Charter by reference, and requires parties to ensure that activities are conducted in accordance with other forms of international law such as customary international law (the custom and practice of states).The advent of commercial activities like space mining, space tourism, private exploration, and the development of many commercial spaceports, is leading many countries[which?] to consider how to regulate private space activities.[33] The challenge is to regulate these activities in a manner that does not hinder or preclude investment, while still ensuring that commercial activities comply with international law. The developing nations are concerned that the spacefaring nations will monopolize space resources.

Launch vehicle

A launch vehicle or carrier rocket is a rocket propelled vehicle used to carry a payload from Earth's surface to space, usually to Earth orbit or beyond. A launch system includes the launch vehicle, launch pad, vehicle assembly and fuelling systems, range safety, and other related infrastructure.[1][not verified in body]

Orbital launch vehicles can be grouped based on many different factors, most notably payload mass, although price points are a major concern for some users. Most launch vehicles have been developed by or for national space programs, with considerable national prestige attached to spaceflight accomplishments. Payloads include crewed spacecraft, satellites, robotic spacecraft, scientific probes, landers, rovers, and many more. Orbital spaceflight is difficult and expensive, with progress limited by the underlying technology as much as human and societal factors.

Speaker's Thoughts:

1.Dr.Y.S.Rajan
Padma Shri Awardee
Former Chairman,NIT Manipur
Former Vice Chancellor,Punjab Technical University

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.

2.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, Israeli partnership: Envisioned for Reliable and Space proven HW Comprehensive, curated training programme to help build competencies in Space & Satellite Technologies.

3.Prof.M.Krishnaswamy
Project Director-NIUSAT
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. 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.

4.Prof. R.M.Vasagam
Padma Shri Awardee
Chairma,National Advisory Committee
Students Satellites 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. Integrated Packaging of Technology and Funding for Student Satellite Development.

5.Mr.R.K.Rajangam
President
Planet Aerospace
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.

6.Mr.Aravind Kilaru
Executive Member
IET Satellite Systems and 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.

7.Prof.B.Dattaguru
Padma Shri Awardee
Department 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.

8.Dr.K.Gopalakrishnan
Secretary General
Indian Technology Congress Association,
Students Satellite Mission 2022

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. 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.

9.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.

10.Prof.Kumar Abhijeet
Assistant Professor
National Law of Indian 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.

OUTCOMES

- Rise of smart machine and systems.
- Provide a unique opportunity to develop innovative public-private partnerships to enhance education at all levels.
- Learned best practices and hands-on experience on critical technologies associated with student satellite development missions.
- Enhanced the faculty & the student competencies.
- Develop competencies to conceive, design, develop and operate envisioned satellite development programs.

-Parth P Shah

5th sem B, CSE

KS Institute of Technology.