

NHCE Students' Satellite Project

Preamble:

Padmashri. Prof. R.M. Vasagam, Eminent Scientist, ISRO & Former VC, Anna University and Dr.MGR University, **Dr.W.Amarnath**, Inventor & Mentor for Innovations, **Dr. K. Ramachandra**, Former Director, GTRE, DRDO & Director, NDRF, **Dr.K.Venkatesh**, COO, Drone Aerospace, **07.03.2016** **Dr.M.R.Pranesh**, Former Registrar & Professor (Ocean Technology), IIT-Madras, **Dr.S.Ravichandran**, VC, St. Peters University & CEO & Chief Scientist, KP Technologies P Ltd, **Dr.C.J.Jagadeesha**, Scientist, ISRO have addressed/ interacted with the interested Faculty Members/Students during 2016 Jan-March 3 months and National Design and Research Forum (NDRF) have **Signed MoU with NHCE** (Reported as on **07.04.2016**)

Interaction with **Dr.Mannan Bakhavathsalu**, Formerly with Philips Innovation Campus for IPR and **Dr.Saurabh Kawatra**, New Delhi for filling Patents at USA, Russia, India & Myanmar.

Preliminary Sensitization Programme:

Dr. C.J. Jagadesha, Scientist from **ISRO-Remote Sensing, Geo Informatics** has delivered an Invited Talk at MCA Dept on 07.04.2016 for the benefits of Project Team members and Faculty members. Project ideas have been evolved in the areas of Geo fencing, Image Processing using Satellite Images (Hyper Spectral Image Processing), Moving target Identification and Remote Sensing etc.

Preparatory Works: Identification of Resource Persons/Mentors is on. Scheduled a personal meeting with **Dr. Myilsamy Annadurai**, Director, ISRO Satellite Centre (ISAC) on 10 & 11 April 2016. The following Eminent Scientists have been visited NHCE during 2016-17 and have provided us input on "NHCE Students' Satellite Programme" in such a way to shape our own programme:

- **Padmashri. Prof. R.M.Vasagam**, Former Project Director, "APPLE" India's First Geo-stationary Communication Satellite, Former VC, Anna University and Dr.MGR University
- **Padmashri. & Padmabhishan. Dr. B. N. Suresh**, Former Director, Vikram Sarabhai Space Centre, (VSSC), Former Director, Indian Institute of Space Science and Technology and Vikram Sarabhai Distinguished Professor, ISRO HQ.
- **Padmashri. Dr. Mylswamy Annadurai**, Director, ISRO Satellite Centre (ISAC)
- **Padmashri. Dr. Dataguru**, Former Professor & HoD, Aerospace Department, Indian Institute of Science, Bangalore

9-16 July 2017: Indo-Russian Technovation Delegation to Moscow, Russia. Visit to Peoples Friendship University Student Satellite Centre: Ground Control Station at Moscow on 16 July 2017.

20 September 2017: Visit of NHCE Team to ISRO Satellite Centre:



NHCE Team Meeting with Director, ISRO Satellite Centre (ISAC), **Padmashri Awardee, Dr. M. Annadurai** on 20 September 2017. Two hours of Interaction with Director and Students' Satellite Program Nodal officer **Mr.S.A.Kannan** has sharpened our focus on opportunities in Satellite Imagery and Data Analytics. It is a real icebreaker in our own NHCE Students' Satellite Program. Students and faculty members from ECE, ME, CSE, ISE, EEE & MCA have been participated in the interaction at ISAC.

07 November 2017

Initiated the Formation of “**Society for Student Satellite Programmes**” and actively involved in the deliberations during the Steering Committee Meeting held at Indian Technology Congress Association, Bangalore.

19-22 December 2017, Indian Engineering Congress held at Hotel Le Royal Meridian, Chennai

First draft Memorandum of Association of “**Society for Student Satellite Programmes**” prepared by **Dr. K. Gopalakrishnan**, Dean (R&D), NHCE as Special Officer and Secretary general of the proposed “**Society for Student Satellite Programmes**” has been reviewed by experts from consortium of professional bodies. Dr. Marlene Kanga, President, world Federation of Engineering Organisations (WFEO) from Australia has graced the occasion.

04 February 2018: Meeting with Our Chairman

Our Chairman has suggested Dean (R&D) to meet Mr. G.N.V. Prasad, ISAC, Bangalore (He was out of station for 2 weeks) and explore the possibilities of NHCE Students’ Satellite Project with his help.

20 February 2018, Meeting with Mr. M. S. Jayachandran, Scientist/Engineer-G, Group Director - DTG Group SIS / IISU, Associate Programme Director-PSG-SI-GP, DPD,RS-3/3A and 3S/ 3SA, Vikram Sarabhai Space Centre (VSSC), Thiruvananthapuram, Kerala

Dr. K. Gopalakrishnan, Dean (R&D), NHCE had a meeting with **Mr. M.S. Jayachandran**, who has made significant contribution during “**Mangalyan**” Mission and also recipient of **Prime Minister's Award** from **Dr.Manmohansingh**, and also honoured during Aerospace Convention of Institution of Engineers (India) at Chennai 2017.

12 March 2018: Meeting with Minister of Higher Education, Research and Innovation, Government of France Ms. Frederique Vidal at NHCE, Bangalore

She has expressed her support to Indo-French Collaborative Students’ Satellite Programmes. Also she has suggested to **Mr. Mathieu J Weiss**, Managing Director, for a meeting at Liaison Office India, Centre National d'Etudes Spatiales (CNES), Consulate General of France, Bangalore to do the needful.

15 March 2018: Meeting with Our Chairman

Review meeting of the progress of various activities to realise the dream of “NHCE Students’ Satellite” at the earliest by Principal and Deans along with Chairman has been done.

16 March 2018: Efforts are being made by Dean (R&D) to get an early appointment of **Mr. Mathieu J Weiss**, Managing Director, for a meeting at Liaison Office India, Centre National d'Etudes Spatiales (CNES), Consulate General of France, Bangalore.

22 March 2018: **Dr. K. Gopalakrishnan**, Dean (R&D), NHCE had a Meeting with Director, ISRO Satellite Centre (ISAC), *Padmashri Awardee*, Dr. M. Annadurai at ISAC, Bangalore and briefed about the Indo-French Collaborative Satellite Programme as promised by **Minister of Higher Education, Research and Innovation, Government of France Ms. Frederique Vidal**.

03 April 2018

Exploring the Possibilities of Indo-French Collaboration for NHCE Students’ Satellite

Meeting held on 03 April 2018 at 11.00 hrs at Liaison Office India, Centre National d'Etudes Spatiales (CNES), Consulate General of France, 21, Palace Road, Vasanth Nagar, Bangalore-560 052 with **Mr. Mathieu J Weiss**, Managing Director, Liaison Office India, CNES (Centre National d'Etudes Spatiales), Embassy of France in India

Decisions:

- a) It is decided that **Mr. Mathieu J Weiss** will interact with French Universities/Institutions via the Science and Technology Department of the Embassy of France in India and identify the opportunities at ongoing space programmes to collaborate with them by NHCE, if it is interesting to both the institutions. Also he will explore the possibilities of internships for interested students of NHCE at Institutions having ongoing space programmes/student satellite projects.

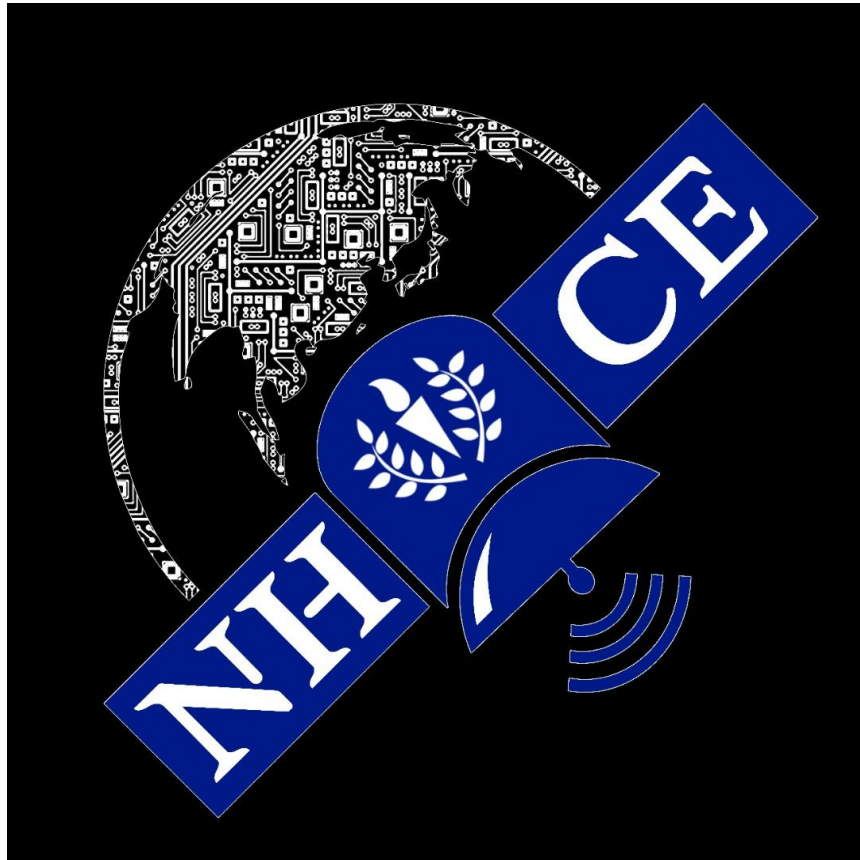
- b) It is decided to have brainstorming sessions regularly with experts (both from India and France based on their availability) at NHCE to evolve sensible and novel mission objectives along with suitable payloads for “Indo-French Students’ Satellite Project”. It is also proposed to have 3-4 years of timeline with successive set of engineering students who can be added progressively.
- c) It is suggested to sign MoU between CNES (Centre National d’Etudes Spatiales) and NHCE, to formalize the Indo-French Students’ Satellite Programme with the support of CNES (Centre National d’Etudes Spatiales) and then approach Indian Space Research Organisation (ISRO) to get slot for launching the Student satellite as per the availability earliest opportunity (PSLV/GSLV).
- d) It is decided to meet after 4 weeks to review the progress in terms of identification of novel mission objectives for Indo-French Students’ Satellite Projects.

17 April 2018: Identification of suitable (innovative) Payload for our Student Satellite Project

Efforts are being made for the Identification of suitable (innovative) Payload of our proposed Student Satellite Project by involving interested students of NHCE. It is decided during the R&D Coordinators’ Meeting held on 17.04.2018 at NHCE to conduct college wide competition among the students to evolve suitable innovative payload for our space mission. Indian Technology Congress Association has agreed to sponsor the competition.

25 April 2018: Efforts are being made for the detailed research review of 270+ Students Satellites launched so far by various Universities/Institutions across the globe. In India, so far Nine Students Satellites has been launched with the help of ISRO. The time frame for the research review to be done by our students and faculty members has been fixed as 60 days (2 Months).







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COLLEGE OF ENGINEERING
Autonomous College Permanently Affiliated to VITU Approved by AICTE & UGC
Accredited by NAAC with 'A' Grade, Accredited by NBA



Indian
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NHCE STUDENTS' SATELLITE INNOVATIVE PAYLOAD COMPETITION

Win Up To ₹ 1 Lakh Cash Award
Top 10 Best Ideas will be Honoured!
Which will make you a Proud Member of
Students' Satellite Program of NHCE!



bit.ly/nhcesat

REGISTER!!!
Last date for Submissions:
30 MARCH 2019



Contact:
Rohit Mulay +91 8951102065
Denzel George +91 9482019653
Nikhil Riyaz +91 9741896297

Proposed Plan of Activities

Activities	Process Owners	Time Line	Supporting Agencies
<i>Competition Among Students to Identify Innovative Mission Objective and Novel Payload</i>	Mr. Rohit Mulay, 6 CSE Mr. Nikhil Riyaz, 6 ECE Mr. Denzel Abraham George	30 June 2018	Indian Technology Congress Association (ITCA)
<i>Review of Students' Satellite Launched So far Globally</i>	Students' Competition Mr. Rohit Mulay, 6 CSE Mr. Nikhil Riyaz, 6 ECE Mr. Denzel Abraham George	15 July 2018	ITCA Publication Society for Students Satellite Programme (S3P)
<i>Formation Students' Team/Work Groups</i>	Dr. K. Gopalakrishnan/ R&D Coordinators at Dept.	20 July 2018	Experts from ISRO & S3P/ITCA
Signing MoU with CNES (Centre National d'Etudes Spatiales, France)	Dr. K. Gopalakrishnan	15 July 2018	CNES, France
Signing MoU/Consent from ISRO	Dr. K. Gopalakrishnan	30 July 2018	ISRO, Bangalore
First Review of Mission Objectives & Payloads	Dr. K. Gopalakrishnan/ R&D Coordinators at Dept.	20 August 2018	Experts from ISRO
Interaction with Experts from ISISpace, Netherlands	Dr. K. Gopalakrishnan	15 Sept. 2018	ITCA/Israel

NHCE Students' Satellite Program

Ever dreamt of sending things of yours up into space? Here's your chance to do so!

Suggest an **Innovative Payload** for the **NHCE Students' Satellite Competition!**

Unleash your **“Creative”** potential and suggest a **“Novel Mission Objective”**.

“Payload” is the item carried by the satellite. Pitch in ideas that are **“Practical”** yet **“Innovative”**, **“Simple”** yet **“Valuable”**. The item to be sent in the satellite should be practical enough to build and should provide useful **“Data”** from the outer space for **“Adding Value to Earth”**.

Put your tech mind forward and tell us all about your Innovative Payload Ideas that can be sent out of the Earth's atmosphere.

Become a proud member of **“Students' Satellite Program of NHCE!”**

Avail the Opportunities for **“Global Training!”**

WIN UP TO Rs. 1 LAKH CASH AWARD!

TOP 10 BEST IDEAS WILL BE HONOURED!

Last date for Submissions: 30th March 2019

For queries and more details contact:

Rohit Mulay: +91 8951102065

Denzel George: +91 9482019653

Nikhil Riyaz: +91 9741896297

To REGISTER fill the below form bit.ly/nhcesat

Major Components of Satellite Programmes

Space: Antenna systems, Attitude Control Systems, Communication Systems, Command Data Handling Systems, CubeSat Structures, Solar Panels,

Launch: CubeSat Deployers,

Ground: Ground Stations, Ground Support Equipment, Generic Engineering Model.

- a) Size & Objectives : CubeSat and Nanosat/Picosat Missions
- b) CubeSat Platforms
- c) Payload Development and Integration
- d) Launch Services
- e) Ground Stations
- f) Commissioning and Operations Support

CubeSat and Nanosat/Picosat Missions: Mission Design and Flight Hardware

Turn-key CubeSat and nanosat/picosat missions are possible with the help of **Innovative Solutions in Space (ISISpace), Netherlands**. ISISpace was founded on January 6th, 2006 as a spin-off from the Delfi-C3 nanosatellite project from Delft University of Technology in the Netherlands. ISISpace engineers were responsible for the integration of 101 CubeSats onto the PSLV launch vehicle of ISRO, a true world record. Among these 101 satellites, there are 3 satellites where ISISpace played a major role in the design, development and implementation of the spacecraft. They are able to deliver small satellites ready for launch in 6 to 18 months. They also have ample experience with working with a broad range of standardized CubeSat and nanosat parts from various vendors and if needed, customized solutions will be implemented. Customers for satellite missions include government agencies, research institutes, universities and commercial companies. Our CubeSat and nanosat solutions have been used for a wide variety of missions, from training the next generation of students, to testing out new technologies in space, from atmospheric and climate research to ocean traffic monitoring.

Israeli high-school students launch nano-satellite into space

‘This is Israeli pride for the future generation, and an opportunity to increase public awareness about space.’

By [Viva Sarah Press](#) APRIL 23, 2017, 8:00 AM



Duchifat-2 nano-satellite, built by Israeli teenagers. Photo by Roei Greenberg

A nano-satellite built by Israeli high school students was launched to the International Space Station on April 18. Named for Israel’s national bird, the Duchifat-2 (in English, Hoopoe-2) nano-satellite was one of 28 student-built nano-satellites sent into space, to be released from the space station in about six weeks’ time..... Israel has built itself an impressive reputation as a developer of the latest satellite technologies. The country holds prominence in the field of nano-satellites and micro-satellites.

According to the **Israel Space Agency (ISA)**, the country’s engineers and scientists are considered world leaders in “miniaturizing the technology and developing small, light satellites with high resolution, remote sensing and communication capabilities” as well as specializing in “the development of technologies for miniature satellites and methods for launching them.”.....

The **Herzliya Science Center** is now working on an even more ambitious national project that will include the planning, programming, construction and launch of **70 CubeSats by 70 High Schools in Israel, to celebrate the 70th birthday of Israel in 2018!**

CubeSat Platforms

For customers interested in developing and integrating the payload themselves, ISIS can provide partially assembled satellites. Such a platform generally consists of a main avionics stack (**on-board computer**, power system and **communication systems**), an attitude control system, **solar panels** and a **main structure**.

Choosing an ISISpace CubeSat Platform is, therefore, a great intermediate between a complete turn-key mission and buying separate components. Customers can indeed benefit from the expertise of ISIS as a satellite designer, and flight-proven architectures, while remaining in charge of the payload integration, mission software development, and system-level testing.

Major Efforts @ NHCE: Proposed Plan for Action:

- a) Selection of Payload (Novelty)
- b) Payload Design and Development

- c) Payload Integration
- d) Mission Software Development (Programming)
- e) System-Level Testing

Major Components of Satellite Project and Agencies to be Identified for the following:

- Payload development
- Built-to-print of flight hardware
- Environmental test services
 - Vibration testing
 - Mechanical shock testing
 - Mass properties measurements
 - Thermal vacuum testing
 - Thermal cycling
 - EMC testing
- Technical consulting on Small Space Missions

STANDARDIZED TRAINING OPTIONS

- Space Systems Engineering Training
- CubeSat Mission Design and Development
- Spacecraft Operations
- Dedicated Training Hardware Solutions

HUMAN CAPITAL DEVELOPMENT

- Tailored programmes based on your needs
- Coaching and support to customer teams
- Support in establishing local labs and facilities
- Options for on-the-job training at ISIS

TRAINING AND HUMAN CAPITAL DEVELOPMENT

ISISpace recognizes the need for training and knowledge transfer for its customers to maintain or further develop their position in the space domain. NHCE can explore the possibilities of collaboration with ISISpace, Netherlands.

APPLICATIONS:

Working on training next generation scientists & engineers, performing small scale science missions or planning a novel application using a globe-spanning constellation etc

1. **Earth Sciences:** *Nanosatellites for better understanding of our own planet*
2. **Ship Tracking Services:** *Near real time vessel tracking using satellite-AIS*
3. **Aircraft Tracking:** *Keeping track of aircraft on a global scale using ADS-B*
4. **Space Research:** *Small scale astronomy and exploration missions*
5. **Climate Monitoring:** *Network of satellites to monitor climate change*
6. **Earth Observation:** *Provide real-time imaging capability with satellite swarms*
7. **Agriculture Monitoring:** *Improve crop production using remote sensing data*
8. **Microgravity Research:** *Use the space environment to gain new insights*
9. **Pipeline Monitoring:** *Monitor critical infrastructure using satellites*
10. **Signal Intelligence:** *Use small satellites to ensure the security of our nation*
11. **Education and Training:** *Train the next generation scientists & engineers*
12. **Telecommunications:** *Provide global connectivity using small satellites*
13. **Technology Validation:** *Test your latest technologies onboard a small satellite*

VISIT TO ISRAEL

Dr. K. Gopalakrishnan, Dean (R&D), NHCE has visited The Herzliya Science Center, Israel during 3-7 June 2018 as part of Indo-Israel Delegation with the Support of Indian Technology Congress Association (ITCA)

ISRAEL 70

A program to develop and launch into space! 70 satellites by 70 high-schools! Celebrating 70 years of ISRAEL's Independence!

Interaction with "Israel 70" (70 Students Satellites Launch Programme Team) headed by **Dr.Meir Ariel**, Director, The Herzliya Science Centre and **Brig. Gen. (Res.) Abraham (Avi) Bachar**, Founder & CEO IsraTeam 98 LTD, The Israeli Homeland Security Team, Professional Crisis Management, Israel.

Program "Israel 70" will be the most advanced space project combining science and education, having a tremendous impact on the Israeli education system, academia and industry and contribute to the scientific and technological prestige of the State of Israel with support of Israel Space Agency and Ministry of Science, Technology and Space, Government of Israel. "Israel 70" is a program for developing, building, and launching into space 70 satellites, celebrating 70 years Israel's Independence. The satellites will be built by 70 high schools and by seven Israeli universities.

The satellites will form a formation flight that will cover the face of the planet and will be able to stay and function in space for several years. The formation of satellites will be capable of uploading algorithms from the ground and will serve as a platform for scientific experiments and the development and testing of future technologies. The satellites will be controlled and commanded by ground control stations to be set up in schools and universities throughout Israel, but in addition also "talk" to each other and act as a single intelligent and complex being that continues to learn and develop after launch.

The budget of the entire program is estimated at **\$25 million (Rs.170 Crores)** and includes four main components: satellite hardware, ground equipment, launch and manpower (expert scientists and engineers). Budget is based on the assumption of a 36-month long program and does not include the cost of employing teachers, lecturers or local teaching staff in schools and universities. The core team is open for Indian involvement and expressed their interest to collaborate with us. Indian Technology Congress Association (ITCA) as a consortium will facilitate interactions with NHCE, Bangalore and The Herzliya Science Centre, Israel.



Dr. K. Gopalakrishnan, Dean (R&D), NHCE with Mock-up of Nano Satellite built by School Students. Right Side Photo: Indian Delegation with Dr.Meir Ariel, Director, The Herzliya Science Centre and Brig. Gen. (Res.) Abraham (Avi) Bachar, Founder & CEO IsraTeam 98 Ltd along with Students of Satellite Team who built Nano Satellite.

Supporting Agencies:

1. Indian Space research Organization , ISRO
2. Israel Space Agency and Israel Aerospace Industry
3. French National Space Research Center, CNES
4. NASA - National Aeronautics and Space Administration (*Israel will help*)
5. European Space Agency, ESA (*Israel will help*)

6. German Space Agency, DLR (*Israel will help*)
7. Italian Space Agency, ASI (*Approaching through Known Sources/ISISpace*)
8. Canadian Space Agency, CSA (*Approaching through Known Sources/ISISpace*)
9. Japan Aerospace Research Agency, JAXA (*Approaching through Known Sources/ISISpace*)
10. Mexican Space Agency, AEM (*Approaching through Known Sources/ISISpace*)
11. United Nations Space Office – UNOOSA (*Israel will help*)
12. Innovative Solutions in Space (ISISpace), Netherlands

Funding Agencies:**Banking/Non Banking Institutions from Israel and/or Self Supporting by Host Institutions**

Note: In case of funding @2-3% Annual Interest for 5-10 year period, concerned borrower institutions will provide collaterals as per norms of funder(s)/funding agencies.

Major Components	Approx Budget in Rs.	Remarks
a) CubeSat and Nanosat/Picosat Missions: <i>Antenna Systems, Attitude Control Systems, Communication Systems, Command Data Handling Systems, CubeSat Structures, Solar Panels</i>	70-100 Lacs	2-3 Year Duration to Launch
b) CubeSat Platforms		
c) Payload Development and Integration		
d) Training and Mentoring Sessions	25-50 Lacs	
e) Internships and Exchange Programmes		
f) Launch Services	15-25 Lacs	
g) Ground Stations	50-75 Lacs	
h) Commissioning and Operations Support	15-25 Lacs	
i) Publications/Promotions and Participation in Events/Conferences	5-10 Lacs	
j) Travel and Secretarial Assistance and Coordination/Project Monitoring	15-25 Lacs	
k) Contingency @ 10-15% as per Project Cost	5-20 Lacs	

Average Project Cost per Satellite: Rs. 2 Cr to 3.5 Cr

Self-generating Funding Model for NHCE Student Satellite Programme (Duration: 3-4 Years): Model 1

- All the interested students of the proposed NHCE Satellite Programme are required to enroll for the programme. They need to undergo a rigorous training programme with fundamentals of Aerospace technologies under the guidance of Space Programme Experts. Equivalent of 12 Credits (100-150 hrs of Lecture/Practical/Seminar/On-line Learning/ Industrial Visits/Webinar/MOOCs/ Self-Study etc) in 2 Years (4 Semesters)
- **Proposed Fees:** @ Rs.1,500/- per Credit; For 12 Credits: **Rs.18,000/- Payable in 4 Installments**
 Onetime Registration Charges: Rs. 2,500/- **Total Cost Per Student: Rs.20,500/-**
Maximum Number of Students to be Involved: 500 (From 4 years of BE/9-12 Stds from School)

Work Group	Major Team/Core Activities
<i>Antenna Systems</i>	<i>Selection of Payload (Novelty)</i>
<i>Attitude Control Systems</i>	
<i>Communication Systems</i>	
<i>Command Data Handling Systems</i>	
<i>CubeSat Structures</i>	
<i>Solar Panels</i>	
<i>CubeSat Platforms</i>	<i>Payload Design and Development</i>
<i>Payload Identification/Development</i>	
<i>System Integration</i>	<i>Payload Integration</i>
<i>Software Programming</i>	<i>Mission Software Development (Programming)</i>
<i>Launch Service</i>	<i>Launch Logistics</i>
<i>Ground Control Station</i>	<i>GCS</i>
<i>Commissioning and Operations Support</i>	<i>Observation</i>
<i>Review of Literature/Case Studies</i>	<i>Documentation</i>
<i>Testing and Analysis/ Failure Analysis</i>	<i>System-Level Testing</i>

NHCE Student Satellite Project

To
The Chairman,
NHCE

19 July 2018

Through: The Principal, NHCE

Sub: NHCE Student Satellite Project-Request for Approval-Suggested Alternatives to Proceed-Reg.

Satellite Category/Details/ Project Duration/ Supporting Organisations/ Proposed Budget	Specimen Image/Remarks
<p>ThumbSat (FemtoSat): Size: 48 mm × 48 mm × 32 mm (1.9 in × 1.9 in × 1.3 in) Mass: Approximately 25 grams + 15 grams Endurance: 2-4 Weeks (<i>Proportionate to Cost</i>) Transported to space as a secondary payload Pay Load: 48x48x25mm Science Experiments in Space GCS: 200+ Centres will provide Links/Feed Shaun Whitehead and Scoutek Ltd (UK) www.thumbosat.com (Mexico) Budget: Rs.15-25 Lacs (Including Launch) Duration: 12-15 Months</p>	  
<p>CubeSat (NanoSat): Size: 100 mm × 100 mm × 100 mm Mass: Approximately 1 kg (1000 gms) Pay Load: 100 mm × 100 mm × 50 mm Deployed by sharing the satellite Dispenser Endurance: 4-6 Weeks (<i>Proportionate to Cost</i>) Innovative Solutions In Space (ISIS) Delft, Netherlands GCS: Outsourced/Optional to Build: Rs.50 Lacs http://www.cubesat.org/ https://www.isispace.nl/satellite-solutions/ Budget: Rs.35-50 Lacs (Satellite) Launch Cost: Education-Free/Rs.20-30 Lacs Duration: 24-30 Months</p>	 
<p>NanoSat: Size: 330 mm × 330 mm × 370 mm Mass: Satellite: 10 kg Pay Load: 5 kg; 240 mm x 240 mm x 15 mm Endurance: 8-10 Weeks (<i>Proportionate to Cost</i>) Deployed by sharing the satellite Dispenser Data Patterns, Chennai/Bangalore (Ex ISRO Team) https://www.datapatternsindia.com/ GCS: Outsourced/Build: Rs.50-75 Lacs Budget: Rs.125-150 Lacs (Satellite) Launch Cost: Education-Free/Rs.40-50 Lacs Duration: 24-36 Months</p>	

Classification/Category of Satellites

- a) Minisatellite (100–500 kg)
- b) Microsatellite (10–100 kg)
- c) Nanosatellites (1 -10 kg)
- d) Picosatellites (100 gm-1 kg)
- e) Femtosatellites (10-100 gm)

Category	Hardware (HW)	Ground Control Station		Launch	Contingency Man Power 20%	Total
		Lab Equipment	Ground Station			
CubeSat	61	10	44	75	60	250-300 (2.5-3 Cr)
NanoSat	187	51	44	170	76	460-500 (4.6-5 Cr)



Report on Activities of UNISEC India

(For the Period: September-October 2018)

Preamble:

Dr.K.Gopalakrishnan, Dean (R&D), New Horizon College of Engineering, Bangalore and Secretary General, Indian Technology Congress has initiated the establishment of UNISEC India Chapter. During the preparation (August 2018) for the 1st International Seminar on Students' Satellites to be held along with 6th Indian Technology Congress at NIMHANS Convention Centre at Bangalore on 5-6 September 2018, **Ms. Rei Kawashima**, Secretary General, UNISEC Global, Japan has been in touch with the Organizing Committee and introduced the Single Point of Contact for India (SPOC), **Dr. G. P. Ganapathy** who have initiated the process of establishment of **UNISEC India Chapter**.

Major Events:

- a) UNISEC Global has actively participated in the 1st International Seminar on Students' Satellites as one of the Invited Agency, represented by SPOC, **Dr. G. P. Ganapathy** during the **Inaugural Session** and highlighted the various activities of UNISEC Global and other Satellites Projects supported by UNISEC.
- b) **Ms. Rei Kawashima** has sent her recorded Video Presentation which has been screened during the event. The active support and services of UNISEC has been recognized during the event and logo of UNISEC has been displayed in all print materials and event display backdrops etc.
- c) UNISEC has supported the publication of "**Compendium of Students, Satellites**" which has been published by Indian Technology Congress Association (ITCA) in association with World Federation of Engineering Organisations (WFEO) and BRICS Federation of Engineering Organisations (BRICS FEO). The Compendium has been released by **Honorable Chief Minister of Karnataka State, India, Mr. H. D. Kumaraswamy** during the Inaugural Session of 6th Indian Technology Congress held on 5 September 2018 at Bangalore, India.
- d) **Competition for Designing Innovative Payload for Students' Satellites** has been announced.
- e) During the two days of Seminar the initiative for establishing "**UNISEC India Chapter**" has been completed with the support of the President, ITCA, **Dr. L. V. Muralikrishna Reddy** and he has provided necessary support to house the Secretariat at his office.
- f) **UNISEC India Chapter** has been formally established on **18th October 2018** and communicated by **Ms. Rei Kawashima**, Secretary General, UNISEC Global, Japan.
- g) The following Local Chapters/Institutional Chapters have been Established:
 1. *New Horizon College of Engineering, Visvesvaraya Technical University, Bangalore, Karnataka*
 2. *Bangalore University, Bangalore, Karnataka*
 3. *REVA University, Bangalore, Karnataka*
 4. *VIT University, Vellore, Tamil Nadu*
 5. *SRM University, Chennai, Tamil Nadu*
 6. *Dr.MGR University, Chennai, Tamil Nadu*
 7. *Saveetha Engineering College, Saveetha University, Chennai, Tamil Nadu*
 8. *Karpagam University, Coimbatore, Tamil Nadu*
 9. *Kalasalingam University, Krishnankoil, Tamil Nadu*

10. Thiagarajar College of Engineering, Madurai, Anna University, Tamil Nadu
11. S. V. National Institute of Technology, Surat, Gujarat
12. SRKR Engineering College, Bhimavaram, JN Technical University, Kakinada, Andhra Pradesh
13. Andhra University, Visakhapatnam, Andhra Pradesh
14. Indian Institute of Technology-Kanpur, Uttar Pradesh

(The Core Committee is in the process of evolving suitable federal arrangements considering the largest number of Universities/Engineering Educational Institutions (EElIs) in India. According to the HRD Ministry, India has 6,214 engineering and technology institutions which are enrolling 2.9 million students. Around 1.5 million engineers are being graduated every year in India from 900 Degree Awarding Universities/Institutions)

h) **UNISEC India** has been actively involved in the process of Organizing **2nd International Programme on Students' Satellite: Mission 2022** (Link to <http://itca.org.in/satellite>). Universities/Institutions associated with UNISEC India has been given priority in participation during the event.

i) **Major Initiatives of UNISEC India: Nano Satellite for Class Room Teaching at University/EElIs**

Design and Development of 1U & 2U Functional Engineering Model (Timeline: 9-12 Months)
Design and Development of "Single Card Satellite-Bus (SiCS-B)": 10 cm x10 cm (Timeline: 18 Months)

j) **Contact**

UNISEC India (Key Executives/Core Team)

Mentor: Padmashri Prof. R. M. Vasagam (Vasagam@gmail.com)

President: Dr. L. M. Muralikrishna Reddy (malingireddy@yahoo.com)

Secretary General: Dr. K. Gopalakrishnan (profgoki@yahoo.com)

SPOC: Dr. G. P. Ganapathy (seismogans@yahoo.com)

Students Representative: Mr. Nikhil Riyaz (nikhilryz@gmail.com)

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Contact Info

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L to R: Dr.K.Gopalakrishnan (Secretary General, UNISEC India), Padmashri Prof.R.M.Vasagam (Mentor, UNISEC India), Dr.W.P.Krishna (Founder Member, UNISEC India), Hon'ble CM of Karnataka, Mr.H.D.Kumaraswamy, Dr.L.V.Muralikrishna Reddy (Founder President, UNISEC India), Dr.Sanjay Sanchetti (Founder Member, UNISEC India) and Mr. P.K.Thiagarajan.





Dr. G.P. Ganapathy, (SPOC, UNISEC Global and Founder Member, UNISEC India)



Video Presentation of Ms. Rei Kawashima, (Secretary General, UNISEC Global)







1st International Seminar on Students' Satellites (For More Information and Photo Gallery, Visit to <https://drive.google.com/drive/folders/1PISISWwoPEhXjLxLUikPGtdU7B3oBDMR>)

INAUGURAL SESSION OF 1st International Seminar on Students' Satellites <i>during</i> 6th Indian Technology Congress 2018 <i>Technology First: Make India Innovate, Excel Globally and Prosper</i>	
Wednesday, 05 September 2018	14:00 – 15:30 Hrs
Inauguration and address by Chief Guest Dr B N Suresh <i>Padma Bhushan Awardee</i> Chancellor, Indian Institute of Space Science and Technology (Deemed University) Former Director, Vikram Sarabhai Space Centre(VSSC) Vikram Sarabhai Distinguished Professor, ISRO	
Keynote Address by	
Student Participation in Space Exploration Shri M S Jayachandran Scientist/Engineer-G, Group Director -DTG Group SIS / IISU Associate Programme Director, VSSC, ISRO	
University Space Engineering Consortium (UNISEC) - Global Activities and Students Satellite Projects Dr G P Ganapathy Professor & Director, Vellore Institute of Technology (Deemed University) University Space Engineering Consortium (UNISEC)- Single Point of Contact for India	
Prof B Dattaguru <i>Padma Shri Awardee</i> Former Chairman, Department of Aerospace Engineering, Indian Institute of Science Presided the Inaugural Session	

Wednesday, 05 September 2018		16:00 – 17:30 Hrs
Chair	Dr K R Venugopal Vice Chancellor, Bangalore University	
Speaker	Theme	
Dr Shaun Whitehead (VIDEO) Creationeering/Scoutek Ltd, UK	ThumbSat - the Tiny Satellite that will unlock space for Everyone (<i>VIDEO Presentation</i>)	
Shri Sudip Kar Co-Founder, D'Vine Research Labs	Quest of 'Space' Based Solutions	
Er. Bharatha Raja , Senior Engineer-Satellite Systems, Datta Patterns (I) P Ltd	Small Students Satellites: Role of Industries	
Dr Sharan Asundi (VIDEO) Assistant Professor, Department of Aerospace Science Engineering at Tuskegee University and Visiting Researcher at NASA Goddard Space Flight Center, USA	Pico/Nano/Micro-Satellite (PNMSat) Program: An Effort to Establish Space Systems Engineering Research and Education Paradigm for Aspiring Engineers (<i>VIDEO Presentation</i>)	
Ms Rei Kawashima (VIDEO) Secretary General, UNISEC Global (University Space Engineering Consortiums), Japan	UNISEC-Indo-Japan Possible Collaborative Initiatives and Prospects for Small Satellites (<i>VIDEO Presentation</i>)	

Thursday, 06 September 2018	09:30 to 11:00 Hrs
Chair and Address	
Dr Y S Rajan <i>Padma Shri Awardee</i> Honorary Distinguished Professor, Indian Space Research Organization	
Speaker	
Dr Mylswamy Annadurai <i>Padma Shri Awardee</i> Former Director, ISRO Satellite Centre Former Project Director, <i>Chandrayan</i> (Moon Mission) and Former Programme Director, <i>Mangalyan</i> (Mars Orbiter Mission)-MOM	
Dr Meir Ariel Director The Herzliya Science Centre, ISRAEL	
Shri Arun Venkatesan Managing Director VSTP Ltd/Sapienza Space Systems and Space Surveillance Laboratory, Italy	
Way-Forward and Concluding Session	
Thursday, 06 September 2018	11:30 to 13:00 Hrs
HALL B NIMHANS Convention Centre, Bengaluru	
Dr G P Ganapathy Professor & Director, Vellore Institute of Technology (Deemed University) University Space Engineering Consortium (UNISEC)- Single Point of Contact for India	
Dr J Ramkumar Professor, IIT Kanpur	
Dr Wooday P Krishna National President, Indian Institution of Production Engineers	
Dr Meir Ariel Director, The Herzliya Science Centre, Director, The Centre for NanoSatellites, Tel Aviv University, Israel	
Dr Enti Ranga Reddy Legend Technologies, Bangalore	
Shri Sudip Kar Co-Founder, D'Vine Research Labs, Bangalore	
Dr V Dillibabu Scientist, Gas Turbine Research Establishment, DRDO and Founder, Engineers Without Borders-Bangalore	
Dr K Gopalakrishnan Convener, Students Satellite Programme, ITCA, Chairman, R&D, IEI & Dean (R&D), New Horizon College of Engineering	



Proposal to Host 7th UNISEC Global Meeting at Bangalore, India

Preamble:

UNISEC-India in association with member academic Institutions and Universities wish to host 7th UNISEC Global Meeting in befitting manner at Bangalore, India during November 2019!

Where: At Bangalore (Bengaluru), INDIA (*ISRO's Head Quarters is located in Bangalore*)

India is the fourth country to demonstrate the flight testing of Scramjet Engine after the United States, Russia and European Space Agency. India becomes first Asian nation to reach Mars orbit, joins elite global space club, when its indigenously made unmanned spacecraft entered the orbit of Mars on Wednesday (September 24, 2014)— and the first nation in the world to successfully reach Mars on its first attempt. But India's mission cost a fraction of NASA's \$670 million Maven, which entered Mars orbit Sunday. The Curiosity Rover, which touched down on Mars in 2012, cost nearly \$2 billion. By comparison, India's \$72 million Mars orbiter is the cheapest interplanetary mission ever. (Ref: https://www.washingtonpost.com/world/india-is-the-first-asian-nation-to-touch-mars-orbit-joins-elite-global-space-club/2014/09/23/b6bc6992-a432-4f1e-87ad-5d6fc4da3460_story.html?utm_term=.f07476531adb)

India has made rapid strides in its space program in the last few years. The Indian space program under the Department of Space aims to promote the development and application of space science and technology for the socio-economic benefit of the country. The Indian Space Research Organisation (ISRO), which functions under Department of Space, has propelled the country into an elite club of nations with major advancements in space technology.

India sends 104 Satellites into Space: India scripted a new chapter in the history of space domain on 15 February 2017 with the successful launch of a record number of 104 satellites by ISRO's Polar Satellite Launch Vehicle - PSLV-C37 in a single mission. The primary satellite carried were the Cartosat-2 series satellite along with two Indian nanosatellites. Out of these 101 co-passenger satellites carried were international customer satellites from USA (96), Netherlands (1), Switzerland (1), Israel (1), Kazakhstan (1) and UAE (1). **Communication Satellites:** "South Asia Satellite" - A gift from India to the South Asian countries, was successfully launched and dedicated to neighbouring countries by Honourable Prime Minister of India. "South Asia Satellite" was successfully launched by GSLV-F09 on May 05, 2017. **GSLV-MkIII**, in its first developmental flight, successfully launched GSAT-19, India's high throughput communication satellite on June 05, 2017. GSAT-17 communication satellite was launched on June 29, 2017 from Kourou using procured launch services from Arianespace. It carried C-band and Ext C-band payloads, payloads for mobile communication, search and rescue payload and Data Relay Transponder payload for providing continuity of services and in-orbit back up. **NavIC:** The Indian Regional Navigation Satellite System (IRNSS) with an operational name of NavIC ("sailor" or "navigator" which also stands for Navigation with Indian Constellation) an autonomous regional Satellite Navigation System set up by India to provide accurate real-time positioning and timing services over India and the region extending to 1,500 kilometres (930 mi) around India.

Read more at: <https://www.oneindia.com/feature/4-years-of-modi-govt-isro-propels-india-into-elite-club-of-nations-2708913.html>

Proposed Venue 1:

The Leela Palace, Bengaluru

https://www.theleela.com/en_us/hotels-in-bengaluru/the-leela-palace-hotel-bengaluru/

Nearest Airport: 39 kms / 50-60 minutes

Alternative Venue 2:

Shangri-La Hotel, Bengaluru

<http://www.shangri-la.com/bengaluru/shangrila/>

Nearest Airport: 32 kms / 40-50 minutes

Bengaluru is well connected to major cities in India and abroad.

Airport Connections:

Kempegowda International Airport (KIA) is the country's third busiest airport and features award-winning facilities. Guests can choose to have a hotel limousine pick-up or private-hire taxi service to reach The Leela Palace/Shangri-La Hotel, Bengaluru.

How:

We can able to get the Support of Indian Space Research Organisation (ISRO), Department of Space, Government of India and Department of Science and Technology, Government of Karnataka for the successful conduct of the event. Apart from this, Israel Space Agency, Roscosmos of Russia, European Space Agency, CNES, France can also be approached for invited Speakers and other fraternal support for the event. Naturally, we can expect the support of Japanese Space Agency through the networks of UNISEC-Japan.

The proposed budget: Approximately 30,000 USD - 50,000 USD (*can be mobilised through the delegate fees, monetary sponsorship from stake holders, exhibitors, etc with the help of Global Head Quarters: UNISEC Japan*)

When:

Proposed Dates: 18-20 November 2019 (*Average Temperature: High/Low: 27° /17°*) Clear Sky
(*We are open for any other dates, if suggested by Organising Committee, UNISEC Japan*)

Who:

Proposed Organising Committee will have Eminent Space Scientists from Various National Space Agencies across the world in general and ISRO in particular, including the Chairman, ISRO, **Dr. K. Sivan**. Representatives and invited Delegates from India's largest Higher Education System which has 900+ Universities and 6,214 engineering and technology institutions which are enrolling 2.9 million students (*Around 1.5 million engineers are being graduated every year in India*).

Representatives from the following Centres/Organisations can be invited to the event:

ISRO Centres

1. Vikram Sarabhai Space Centre (VSSC)
2. Liquid Propulsion Systems Centre (LPSC)
3. Satish Dhawan Space Centre (SDSC) SHAR
4. U R Rao Satellite Centre (URSC)
5. ISRO Propulsion Complex (IPRC)
6. Space Applications Centre (SAC)
7. National Remote Sensing Centre (NRSC)
8. ISRO Telemetry, Tracking and Command Network (ISTRAC)
9. ISRO Inertial Systems Unit (IISU)
10. Laboratory for Electro-Optics Systems (LEOS)

11. Development and Educational Communication Unit (DECU)
12. Indian Institute of Remote Sensing (IIRS)
13. Master Control Facility (MCF)
14. Department of Space and ISRO HQ
15. Antrix Corporation Limited

Autonomous Bodies

1. Physical Research Laboratory (PRL)
2. North Eastern-Space Applications Centre (NE-SAC)
3. Semi-Conductor Laboratory (SCL)
4. Indian Institute of Space Science and Technology (IIST)
5. National Atmospheric Research Laboratory (NARL)

What:

On the eve of 7th Global Meeting of UNISEC, we can do impressive road shows and spread the initiatives of UNISEC across the Universities in India and establish local chapters and also organise various events including competitions such as “Mission Idea Contest; Deorbit Device Competition; Debris Mitigation Competition; CanSat Leadership Training Program and Nano-Satellite Symposium” etc at periodical intervals across India. On the day of Inauguration of 7th UNISEC Global Meeting, we can have “Plenary Session” to highlight the objectives and initiatives of UNISEC among the large numbers of “Delegates” (Approximately 500-600) drawn from UNISEC India Chapters.

However, the regular Agenda of UNISEC Global meeting will be followed by the plenary session in separate tracks as per the guidelines of UNISEC Japan. Visits to various ISRO Centres and Facilities can be organised for participants (*subject to the prior approvals of Government of India*).

Why:

India's knowledge capital Bengaluru (Bangalore) has been named among the top 10 global innovation hubs in the world. According to a report titled "The changing landscape of disruptive technologies", released by global advisory firm KPMG, Bengaluru shares the eighth position with Israel's Tel Aviv. The Chinese city of Shanghai is placed at the top, followed by Tokyo, London, New York, Beijing, Singapore and Seoul.

The tech focus in the IT capital of the country has propelled India to the third slot when it comes to disruptive technology breakthroughs that will have a global impact.

In 2016, approximately 950 multinational corporations (MNCs) were in India and collectively set up 1,200 R&D hubs, according to consulting firm Zinnov's annual report on global in-house centres (GICs). Read more at: <https://www.deccanherald.com/content/667781/bengaluru-only-indian-city-top.html>

The Economy of Bangalore is an important part of the economy of India as a whole and contributes over 87% to the Economy of the State of Karnataka, accounting for 98% of the Software Exports of the State.

Diversity of Talent

Bangalore has traditionally housed several international technology firms, earlier ones being Texas Instruments, India. Bangalore houses a number of reputed engineering colleges producing high quality computer scientists, the Indian Institute of Management, Bangalore (IIMB), a top management Institute in India, the Indian Statistical Institute (ISI), the Indian Institute of Science (IISc), the Indian Institute of Astrophysics, the National Law School (NLSIU), The Indian Institute of

Theoretical Sciences, National Institute of Fashion Technology (NIFT) and hence produces the most diverse young talent in one city, incomparable to any other city in the world.

The Silicon Valley of India

Earliest start-ups that flourished in the city in the 90s are multi-billion dollar market capitalized companies on global stock exchanges like Infosys, Wipro Technologies, Mindtree being popular ones and smaller ones include Tejas Networks and so on. After two decades of domination by IT Services and regional offices of global technology companies, top talent began building new age firms between 2000-present. Flipkart, having originated in Bangalore, acquired several other e-commerce companies originated in Bangalore like Myntra and was itself eventually acquired by Walmart in 2018 for close to \$20 Billion. Several other unicorns have their origins in Bangalore like Swiggy, Ola Cabs, InMobi, Quickr etc. The remaining Indian unicorns have strong teams situated in Bangalore. Top venture capital funds have setup their India offices in the city to find opportunities to invest in start-ups.

Aerospace: India's largest indigenous OEM, Hindustan Aeronautics Limited (HAL) had its headquarters in India. Several smaller tier 1 and tier 2 suppliers had their base in the city to serve the OEM need. The National Aerospace Laboratories (NAL) is also headquartered in Bangalore and is dedicated to the development of civil aviation technologies. Bangalore also housed now defunct full service airline brand Kingfisher Airlines, which acquired another airline startup, Air Deccan, a budget airline.

Space: The Indian Space Research Organization (ISRO), one of the top national space agencies in the world is headquartered in the city. ISRO is recognized world over for its indigenous capabilities in launching low cost satellites using its own launch vehicles, the PSLV and the GSLVs. ISRO has a record of deploying 104 satellites in orbits successfully in a single launch, which is a world record. [4] ISRO has also launched a Mars mission, Mars Orbital Mission, which was the lowest cost inter-planetary orbital mission. Startups have made attempts to launch lunar rovers and are analyzing satellite images to uses in agriculture and climate.

*Hence, we wish to host the 7th UNISEC Global Meeting at Bangalore (Bengaluru), INDIA during 2019!
And we will do the needful for making it a memorable event for every participant!*

We as a host organization agree to take care of issuing an official invitation letter to get a visa to the necessary participants.

With Regards,

Signed/-

Dr. K. GOPALAKRISHNAN

Secretary General, UNISEC India

Date: 07 December 2018



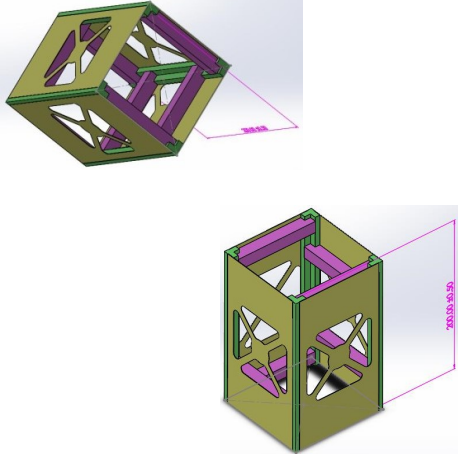
Monitoring the Progress of NHCE Students Satellite Program Vs Plan of Activities

Monitoring the Progress of NHCE Students Satellite Program Vs Plan of Activities

Activities	Process Owners	Time Line	Supporting Agencies	Action Taken	Outcome/Remarks
Competition Among Students to Identify Innovative Mission Objective and Novel Payload	Mr. Rohit Mulay, 6 CSE Mr. Nikhil Riyaz, 6 ECE Mr. Denzel Abraham George	30 June 2018	Indian Technology Congress Association (ITCA)	Last Date was Extended to Involve More Number of Students to get Better Innovative Ideas!	Yet to get innovative Payload ideas from Students. Revised Dead Line: 30 March 2018
Review of Students' Satellite Launched So far Globally	Students' Competition Mr. Rohit Mulay, 6 CSE Mr. Nikhil Riyaz, 6 ECE Mr. Denzel Abraham George	15 July 2018	ITCA Publication & 75 Students' Satellite Consortium. Part of 1 st International Seminar on Students' Satellites	Extensive and Intensive Review of nearly 2500 Students' Satellites have been done meticulously by our team for the Publication Compendium of Students' Satellites. 150+ Students/Faculty have been participated 2days Seminar on Students Satellites!	Published Compendium of Students' Satellites with ITCA and WFEO. Released by CM of Karnataka during 5.9.2018 during 6 th ITC at NIMHANS, Convention Centre, B'lore. Edited by Dean (R&D), Dr.K.Gopalakrishnan. 150+ Students/Faculty have interacted with Global Experts/Scientists of Space Industry!
Formation Students' Team/Work Groups	Dr. K. Gopalakrishnan/ R&D Coordinators at Dept.	20 July 2018	Experts from ISRO & S3P/ITCA	Involving ECE, CSE, ME in the front and others in next level. Ongoing.	Basic configuration (1U) has been chosen for Satellite Engineering Model. In Progress.
Signing MoU with CNES (Centre National d'Etudes Spatiales, France	Dr. K. Gopalakrishnan	15 July 2018	CNES, France	Meeting held on 03 April 2018 at 11.00 hrs at Consulate General of France, B'lore with Mr. Mathieu J Weiss, MD, CNES, France.	Minutes of Meeting sent to them. Mr. Mathieu is too busy. Even invited to International Seminar on Students' Satellites. He could not attend. Pursuing.
Signing MoU/Consent from ISRO	Dr. K. Gopalakrishnan	30 July 2018	ISRO, Bangalore	Current Policy of ISRO, No More Free Launch for EEIs/Students' Satellites!	Initiated and Joined 75 Students' satellite Mission 2022! With Global Participation!
First Review of Mission Objectives & Payloads	Dr. K. Gopalakrishnan/ R&D Coordinators at Dept.	20 August 2018	Experts from ISRO	Networked with Eminent ISRO Scientists and Israel Scientists	Dr. K. Gopalakrishnan, Dean (R&D), NHCE has visited The Herzliya Science Center, Israel during 3-7 June 2018 as part of Indo-Israel Delegation with the Support of ITCA. ISIS has supplied systems to Israel Students' Satellites.
Interaction with Experts from ISISpace, Netherlands and Other Global Best Practices/Organisations/Countries	Dr. K. Gopalakrishnan	15 Sept. 2018	ITCA/Israel Established active working relationships with Israel.	ITCA has coordinated 2 nd Visit to Israel during 10-16 November 2018 to explore the funding opportunities at Israel for EEIs.	
ThumbSat, UNISEC, ISIS, Open Cosmos, MSMES/D'Vine Research Labs, CANEUS and UN-COPUOS	Dr. K. Gopalakrishnan	15 Oct. 2018	ITCA/ISRO/Planet Aerospace/UN/WFEO	WFEO has supported the Publication of Compendium. Networked with UNISEC Global (Japan). Interacted with them and made them to present their keynote during 1 st International seminar on Students Satellites at ITC. Nikhil of NHCE was elected as Student representative of India to UNISEC India.	Established University Space Engineering Consortium (UNISEC) India and became the Secretary General and Point of Contact for the Global Activities. http://www.unisec-global.org/pointofcontact.html . Brought D'Vine Research Labs (DRS) to NHCE as Start-up. Three of our Students Attending 6 th Global Meet of UNISEC and presenting at International Space University, France.



Monitoring the Progress of NHCE Students Satellite Program Vs Plan of Activities

Activities	Process Owners	Time Line	Supporting Agencies	Action Taken	Outcome/Remarks
2 nd Review of Mission Objectives & Payloads	Dr. K. Gopalakrishnan	15 Nov 2018	Experts from ISRO/ITCA/Israel	ITCA has coordinated 2 nd Visit to Israel during 10-16 November 2018 to explore the funding opportunities at Israel for EEIs.	Decided to source from Heritage suppliers to increase the chances of success in a mission also to meet the objectives along with better orbit life.
Establishment of University Space Engineering Consortium (UNISEC) India. Having Regular Interaction with HQ at Japan, Ms. Rei Kawashima, Secretary General, UNISEC Global	Dr. K. Gopalakrishnan	15 Nov 2018	ITCA/ Experts from ISRO	Established UNISEC India Chapter with the Support of ITCA. Dr. GK became the Secretary General of it. Our Student Nikhil Riyaz is Students' Representative for India!	UNISEC India will be our window to easily network and share the Global Experiences of space industry/Institutions including Japan. UNISEC Bangalore Chapter also has been formed at NHCE. Our Student Denzel is Students' Representative for Bangalore!
6 th UNISEC Global Meeting at International Space University (ISU), Strasbourg, France	Dr. K. Gopalakrishnan/ Nikhil/Denzel/Bhavana	21 Nov 2018	ITCA/UNISEC India/75 Students' Satellites Consortium	3 of our Students Nikhil, Denzel & Bhavana have been Represented UNISEC India during 19-21 Nov 2018 at ISU, Strasbourg, France	Nikhil has presented the UNISEC India Activity Report on behalf of DR.GK, Secretary General, UNISEC India. Bhavana has presented Post Group Discussion Summary.
Networking and Creating Conducive Eco System for our Satellite Programme	Dr. K. Gopalakrishnan R&D Coordinators at Dept.	30 Nov 2018	ISRO/ITCA/Israel/Planet Aerospace	Organised 2 nd International Seminar on Students' Satellites: Mission 2022 during 28-29 Nov 2018	Our Satellite Team had very good interaction with Experts and networked with experts.
NHCE Satellite: Designing of Engineering Model of Satellite Bus as Class Room Satellite. Making of First Prototype	Dr. K. Gopalakrishnan using NHCE Student Team/MSMEs	30 Dec 2018	ITCA/D'vine Research Labs	Budget sent for Approval of Chairman through Principal on 02 Nov 2018. a) Satellite Bus Type : 2U (Fully anodized flight grade) b) Payload type: Humidity, Temperature Sensor, UV which can be received remotely c) On Board CPU: Atmega or MCP d) Communication Module: 2.4GHz Radio unit e) Electrical Power Module: 12V, 1 A on board bus	



Monitoring the Progress of NHCE Students Satellite Program Vs Plan of Activities

University Space Engineering Consortium (UNISEC) Japan-7 th Proposal to Host UNISEC 7 th Global Meeting at Bangalore	Dr. K. Gopalakrishnan, Secretary General, UNISEC India/ Dr. LV Muralikrishna Reddy, President, UNISEC India	10 Dec 2018 November- December 2019	UNISEC India ITCA TIMSAT, Israel 75 Students' Satellites Consortium Open Cosmos, UK UNISEC Japan	<i>Draft Proposal is Under Preparation to be sent to Ms. Rei Kawashima, Secretary General, UNISEC Japan Approximate Budget will be Rs.50+ Lakhs. Majority of the Expenses will be managed through Sponsors! Predominantly from UNISEC Japan!</i>	<i>Work In Progress</i>
Design and Development of On Board Computer (OBC) for Small Satellites using COTS and Raspberry Pi	Dr. K. Gopalakrishnan	30 January 2019	ITCA Ms. Pramitha	<i>Identifying Potential/Interested students for Next Year for R&D and Hackathon for involving in Programming for NHCE Satellites</i>	<i>Immediately after the Semester End Exams in January 2019</i>
Functional Engineering Model of NHCE 2U Satellite will be Tested with Balloon Launches with help of Team from Indian Institute of Astrophysics (IIA), Bangalore and D'Vine Research Lab	Dr. K. Gopalakrishnan	28 February 2019	ITCA Ms. Pramitha Mr.Sudip, D'Vine Research Lab	<i>Team from Indian Institute of Astrophysics (IIA), Bangalore and D'Vine Research Lab. Launch will be done with Govt Permission to 30-32 Km Height from the Ground and with GPS Tracking.</i>	<i>Immediately after the Semester End Exams after discussing with Team at IIA and their Launch Schedules! Telemetry and On Board Computer (OBC) and other subsystems can be tested in real life environment at 30 Km vertical distance from the ground!</i>
Design and Development of Ground Control Station at NHCE	Dr. K. Gopalakrishnan	30 March 2019	ITCA Ms. Pramitha Mr. Sudip, D'Vine Research Lab	<i>Identified the Resource Person from AMSAT India, Mr. B. A. Subramani, Director, Educational relations and Secretary & Station Director, Upagrah Amateur Radio Club-VU2URC, ISRO Satellite Centre, Bangalore</i>	<i>HAM Radio Club need to be Started immediately at NHCE. Immediately after the Semester End Exams after discussing with Interested Students, Mr. Subramani will be invited to Address the students and inaugurate the Club soon.</i>

REPORT

SECOND INTERNATIONAL
PROGRAMME ON

Students' Satellite Mission 2022

28-29 November, 2018
Bengaluru, India



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





< Shivakumar
 Shri Awardee
 an - Karnataka Science and
 Technology 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



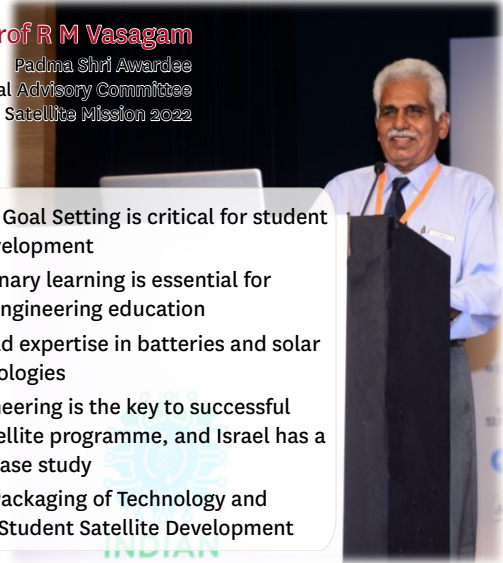
Dr Meir Ariel
 Director General
 The Herzliya Science Center and
 Director, Nano Satellite Center
 University of Tel Aviv, ISRAEL

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



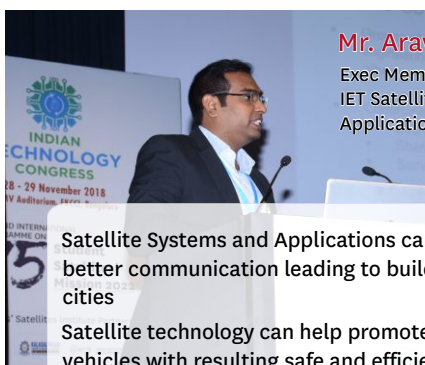
Mr C D Shridhara
Director
Ananth Technologies

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



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**



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



UK Space Cluster

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
ENTM 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

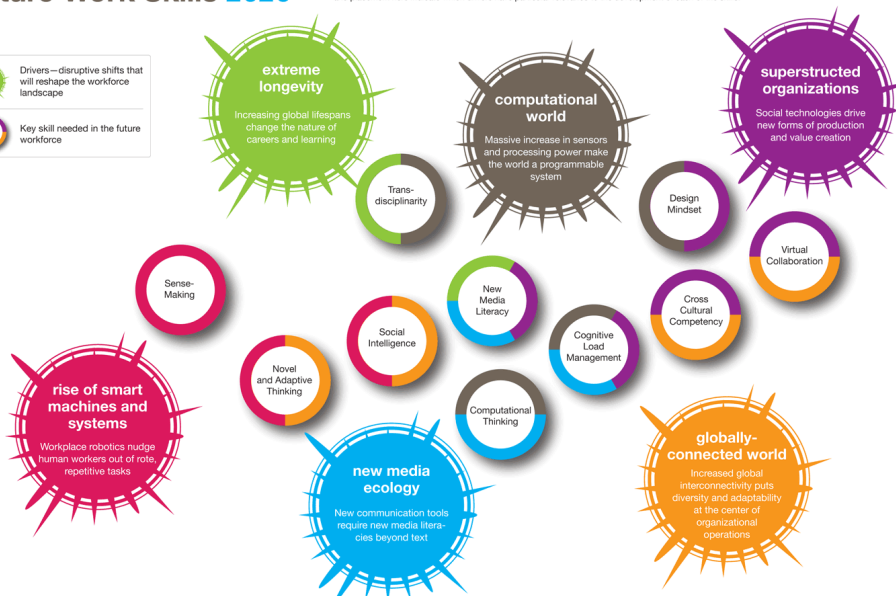
Future Work Skills 2020 - Addressed through Student Satellite Mission

Future Work Skills 2020

While all six drivers are important in shaping the landscape in which each skill emerges, the color-coding and placement here indicate which drivers have particular relevance to the development of each of the skills.

KEY

- Drivers—disruptive shifts that will reshape the workforce landscape
- Key skill needed in the future workforce



Key Competencies

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

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



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
Czechoslovakia

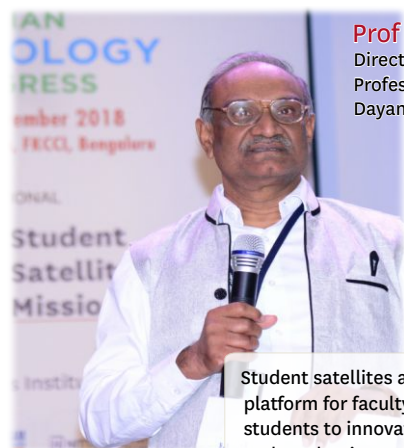
AI-Deep Learning-Data Science Applications for Satellites Projects

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

CAD/CAM 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

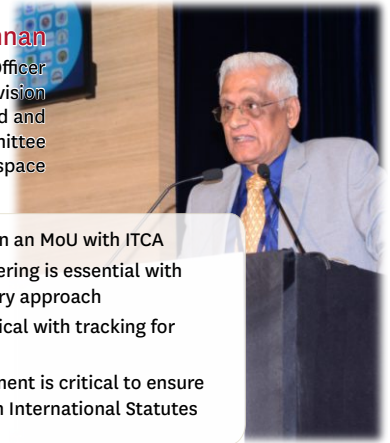
Compliance with Space Debris Mitigation Guidelines

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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