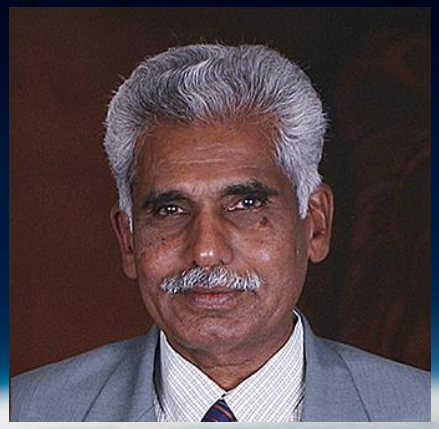
75 Students' Satellites Mission: 2022
UNISEC -India

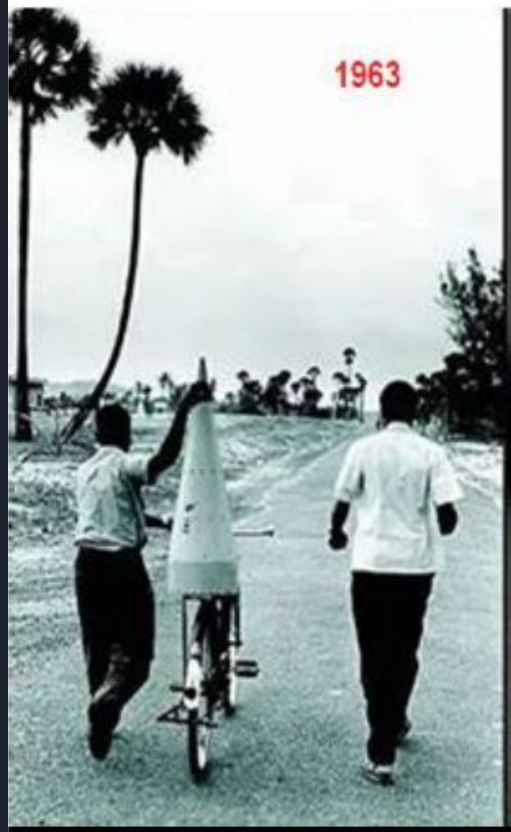


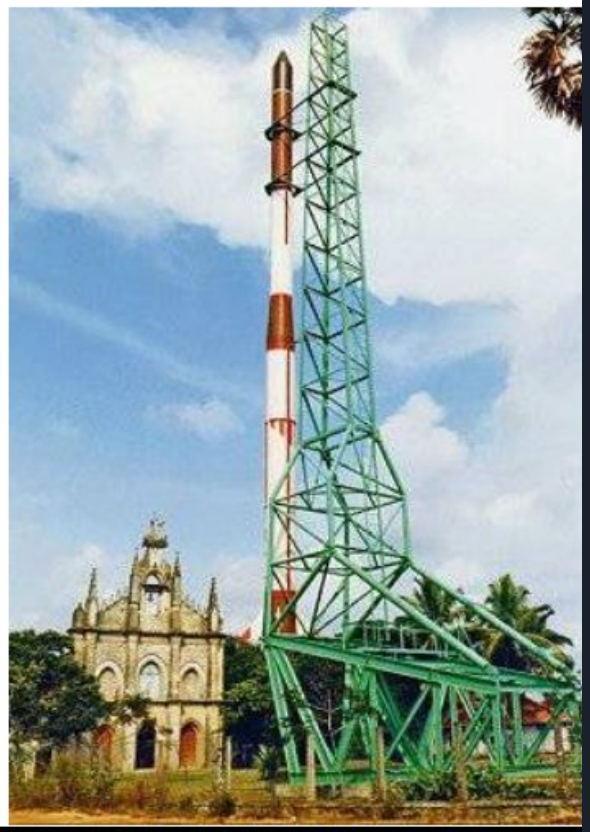
Padma Shri Prof. R.M. VASAGAM

Chancellor, Dr. MGR & KARPAGAM University
Vice President, Indian Technology Congress Association
Former Director, APPLE Project, ISRO
Former VC, Anna University
Former CHAIRMAN ASDB / IEI

21 May 2022

40 Years of APPLE: Interactions held on 19 June 2021 with Padma Shri Prof. R.M. Vasagam and APPLE Team!





EARLY DAYS OF ISRO: ROCKET WAS BROUGHT ON BICYCLE AND A SATELLITE ON BULLOCK CART

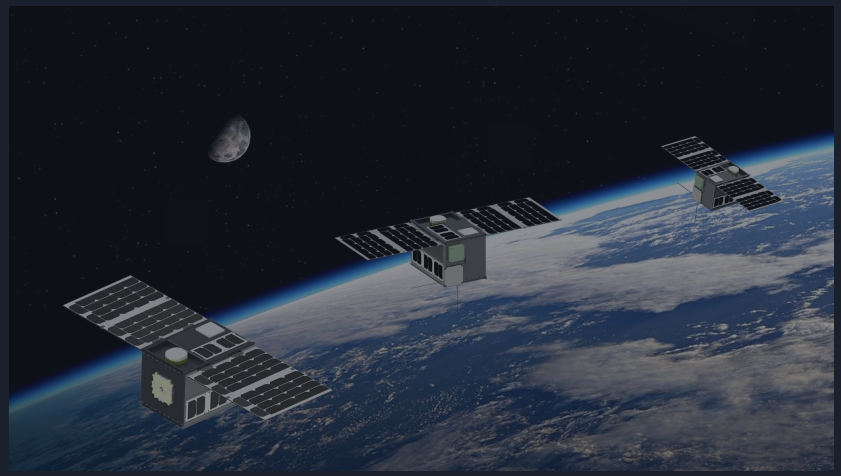
From St Mary Magdalene's Church-Fishing Hamlet to Red Planet

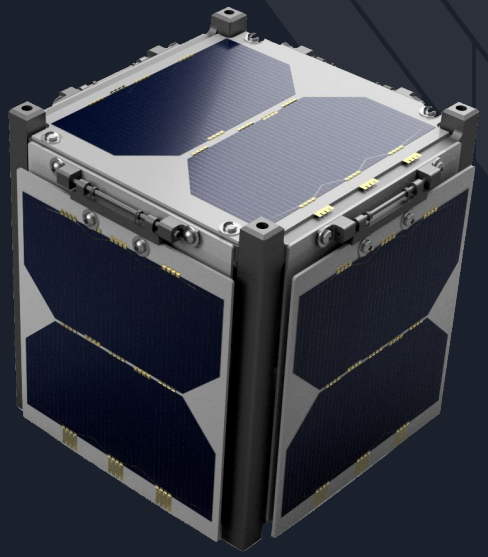
21 November 1963: India's 1st Rocket, Transported on a Bicycle, Launched from a Church!
In 1980s for Antenna-Range Test, APPLE Satellite was brought in Wooden Bullock Cart to protect its highly magnetic sensitive instruments, so no Iron structure or metal vehicle could carry it. APPLE Satellite was tested for electro-magnetic cleanliness on a makeshift test facility using a bullock cart.

Ariane personnel in front of APPLE satellite (with Square Solar Panels)
-Courtesy: Ariane Space

Small satellites era has come to forefront

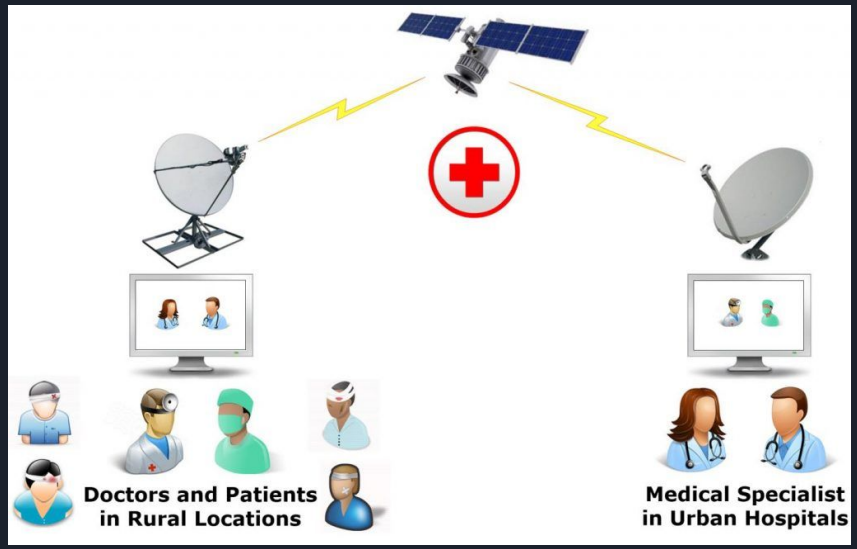
- Cubesats have matured with increasing capabilities
- Missions for science,technology and intersatellite links demonstrated
- One U to12 U missions have been successfully flown.
- Democratising space technology has been accomplished.
- Globally more than 3000 small satellites have been built and launched by student teams





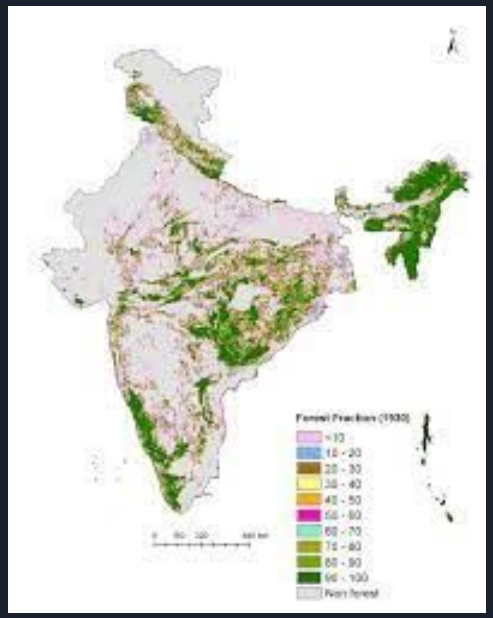
Civilian needs

- Civilian early warning systems
- Disaster relief operations support
- Healthcare and epidemiology support



Civilian needs

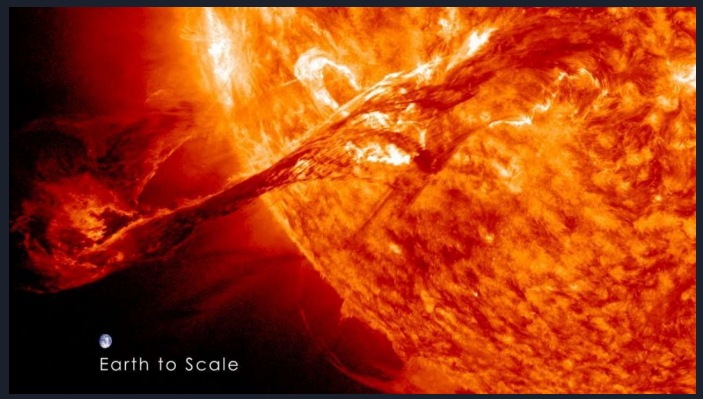
- Communication outages due to solar storm prediction and mitigation
- Storms and cyclones tracking with increasing frequencies



India Vegetation Index:
Courtesy: National Remote Sensing Centre

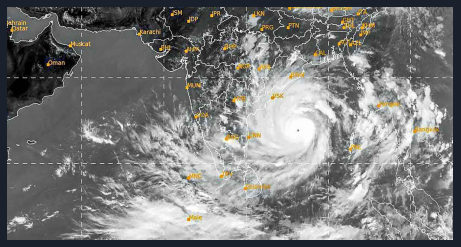
Cyclone: Amphan

Australia: Forest fires



Solar Storms

INSAT - Orissa Cyclone- Role of Space Systems in Disaster Warnings and Mitigation



- The "Super-cyclone" that hit the Orissa coast on Saturday, October 29, 1999 was tracked by the India Meteorological Department (IMD) through INSAT-1D Very High Resolution Radiometer (VHRR) imagery and INSAT-2E Charged Coupled Device (CCD) Cameras continuously every half an hour from October 26, 1999. Periodic warnings were issued to the Civil Administration (Collectors) of the areas that were likely to be affected by the cyclone through the INSAT Cyclone Warning Dissemination System (CWDS) receivers. 34 such CWDS receivers are deployed in the Orissa state. 28 were working when the cyclone warnings were issued. These warnings were available to the civil administrators till the cyclone hit the coast. These CWDS receivers operate through S-band transponders of INSAT-2B satellite and are capable of being selectively addressed.

- Normally, these receivers are kept with the Civil Administration (in Collector's' office) in the Districts that are prone to cyclones. Cyclone warnings through the CWDS receivers consist of a siren which can be heard by the District Collector/BDO/Tahsildar/State Functionary. This siren is followed by a verbal message in the State language of the district. These sirens and warning signals are not intended to be heard directly by the common man. The Civil Administration is expected to act on these hourly warnings for initiating necessary machinery for disaster mitigation. It may be noted that 250 such receivers have been deployed along the East and West Coast of India in 9 States.

- Within two days after the cyclone hit the Orissa coast, three INSAT portable mobile telephony terminals were handed over to the Civil Administration in Bhubaneswar for relief work. These terminals work with the INSAT-2C Mobile Satellite Service (MSS) transponders. Within 3 to 4 days, five Very Small Aperture Terminals (VSATs) were airlifted from Delhi and a network of five VSATs was established. HCL Comnet and Essel Shyam supplied the VSATs. At present, VSATs are located at Krishi Bhavan, New Delhi; Secretariat, Bhubaneswar-1; Secretariat, Bhubaneswar-2; District HQ Collector Offices in Jagatsinghpur and Kendrapada; and in Paradeep, Erassama and Balikuda. It helped in establishing contact between the Relief Commissioner at Delhi and the Orissa Secretariat via VSAT network, operating through the INSAT-2C Extended C band transponders. This network of VSATs has now been extended to 13 places.

Read at your own pace post presentation

Civilian needs

- Forest fires monitoring
- Rescue and relief operations in inaccessible area

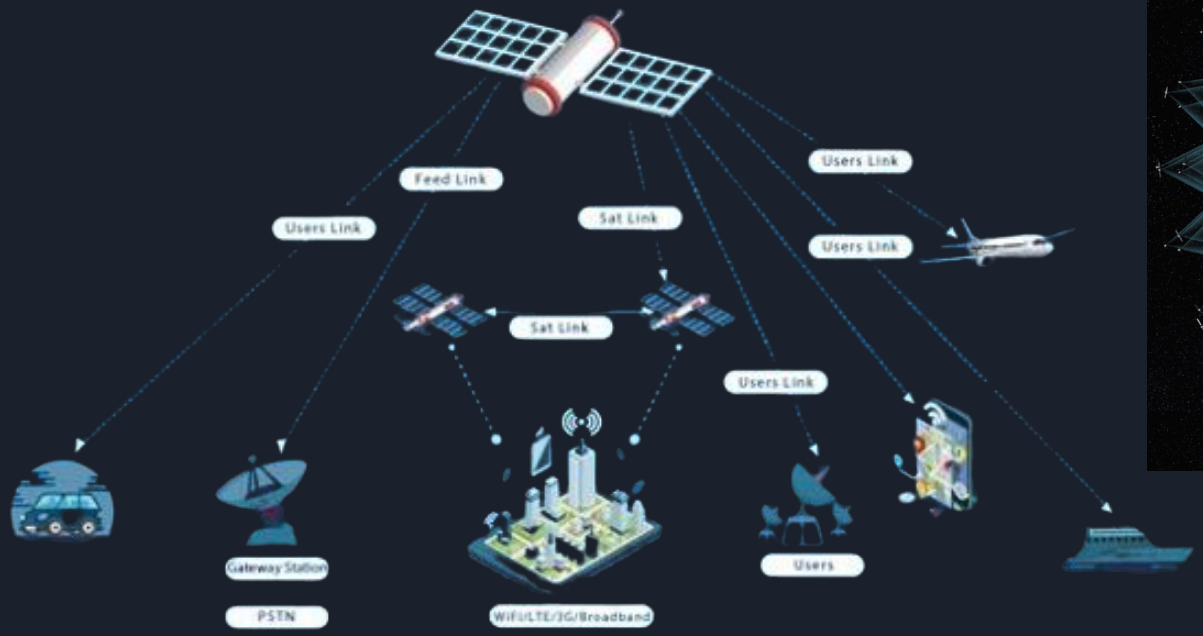
Uttarakhand:
Forest fires 2021

Indian Air Force/Navy:
Search and Rescue
Chennai floods

UNISEC INDIA
University Space Engineering Consortium

IoT Applications

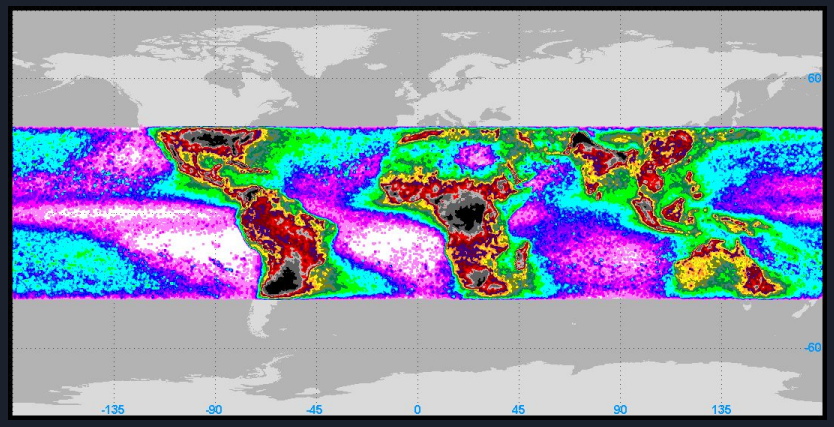
- A network of ground based distributed sensors sending data to cloud with global access
- satellite constellations providing near real-time access to data
- archived data to enable trend analysis



Courtesy: ESA

IoT Applications

- lightning data on global scale
- sea erosion mapping
- Tsunami warning
- earthquake monitoring with radon gas precursor events



Lightning Data *Courtesy: NASA*

NOAA Deployed Tsunami warning Buoys. *Courtesy: NOAA*

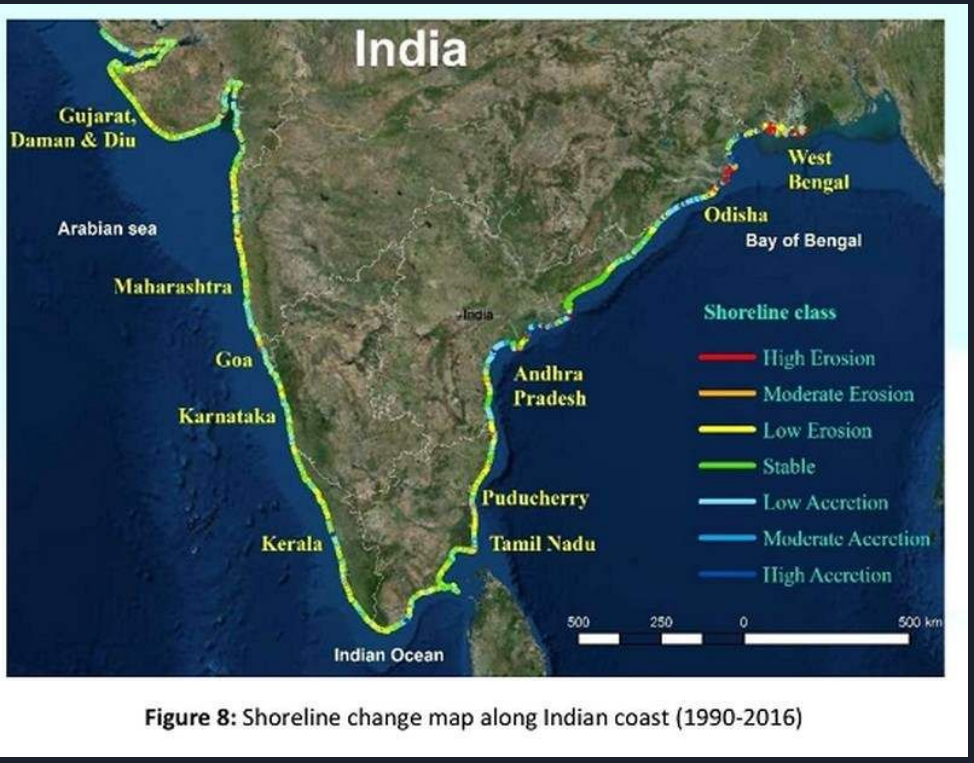


Figure 8: Shoreline change map along Indian coast (1990-2016)

7% Erosion in the last decade!

Case for a civilian early warning system

- The past chairman of ISRO, Prof. Satish Dhawan advocated the need for one

Satish Dhawan – The Father of Experimental Fluid Dynamics

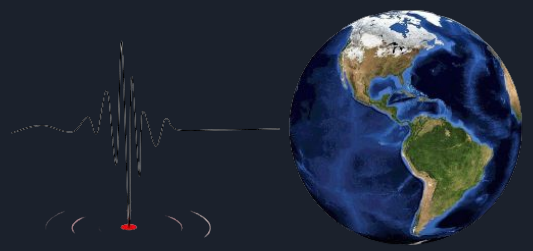
India Establishes Caltech Aerospace Fellowship

The Indian Department of Space / Indian Space Research Organisation (ISRO) has established a fellowship at the California Institute of Technology (Caltech) in the name of Satish Dhawan (1920–2002), a Caltech alumnus (Eng '49, PhD '51) and a pioneer of India's space program.

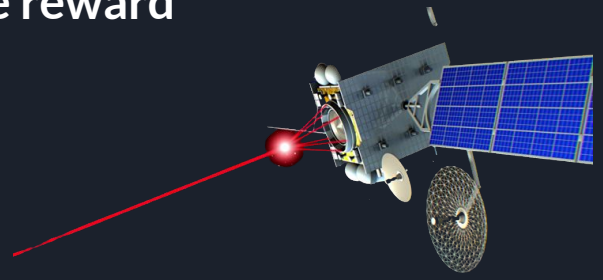
"If you do not have a mission, no problem will occur, but if you do have a mission or task definitely problems of varying magnitudes will crop up. But problems should not become the master of the individuals, individuals should become the master of the problem, defeat it and succeed."

Case for a civilian early warning system

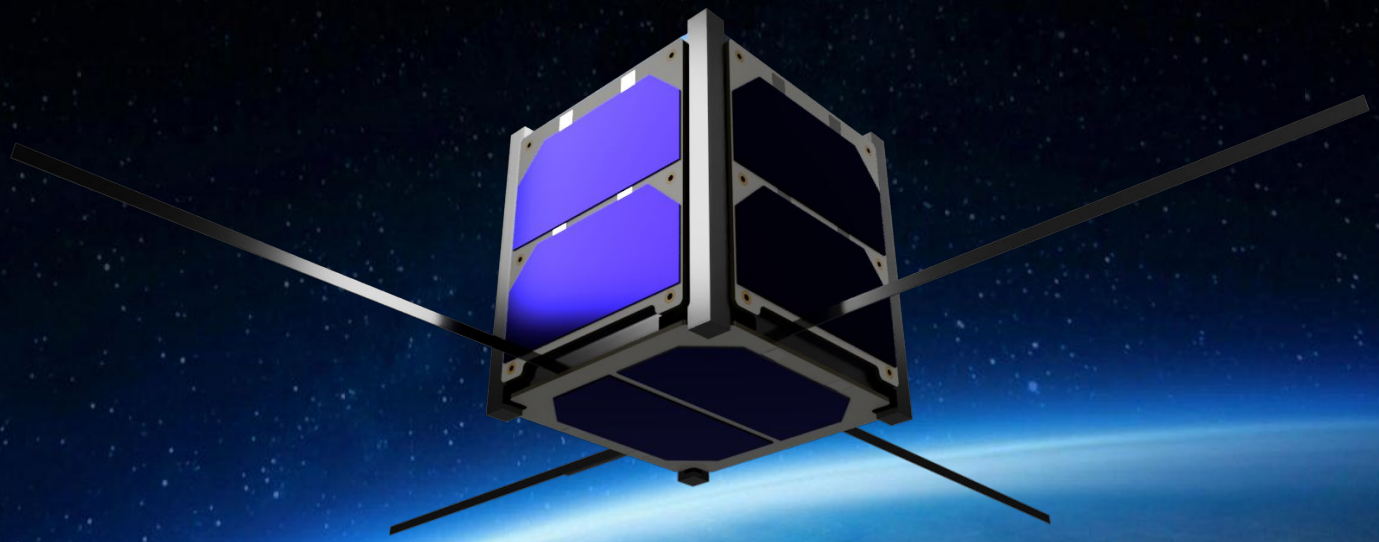
- It is analogous to military early warning systems
- Today technology can make it a reality
- UNISEC, ITCA-TSC and Serbian efforts can make it happen.
- such a system will help UN and national agencies in times of calamities
- saving of life and property on a global scale will be the reward



Airborne AWACS



Military Satellite implementing Laser Communications



Conclusion

The 75 students' Satellites mission: 2022 is one such mission

Let it succeed !

Thank you