

# Satellite Projects by **Antarikchya** **Pratisthan Nepal** [Space Foundation Nepal]



**ANTARIKCHYA**

अन्तरिक्ष प्रतिष्ठान नेपाल



Eliza Sapkota  
Satellite Research Fellow  
Antarikchya Pratisthan Nepal

# Antarikhya Pratisthan Nepal [APN]



**“Vision 2050: a vision to launch  
Nepal’s First Astronaut in Space  
by 2050”**



**“Train space engineers and R&D in  
space technology in Nepal”**

# Next Generation Space Tech Engagement Program



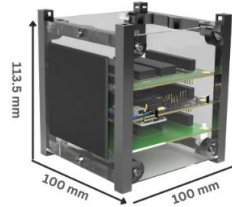
NepaliSat-1 BIRDS-3

Grade 3-7



PaperSat Art  
Program

Grade 6-10



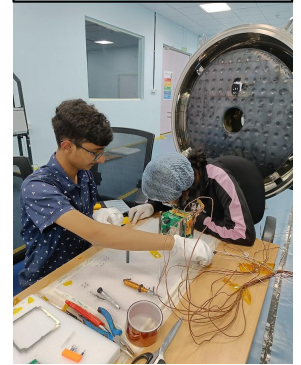
ECube

Grade 7-12



SastoCube  
Satellite  
Program

Grade 11-12



1st High School  
CubeSat



# Science, Technology, Innovation and Capacity-Building in Nepal through PHI

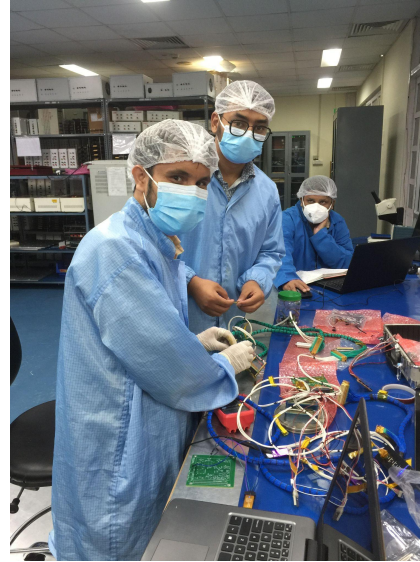
“Train and develop space engineers and in house space facilities in Nepal”



Ground Station Operation at NAST



Antenna Lab Development at Khwopa Eng. College



Satellite Research Fellow at Satellite Testing Lab at India



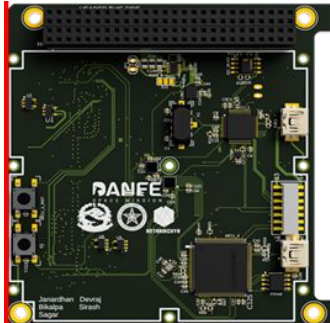
GS antenna maintenance at NAST



# Antarikchya Pratisthan Nepal

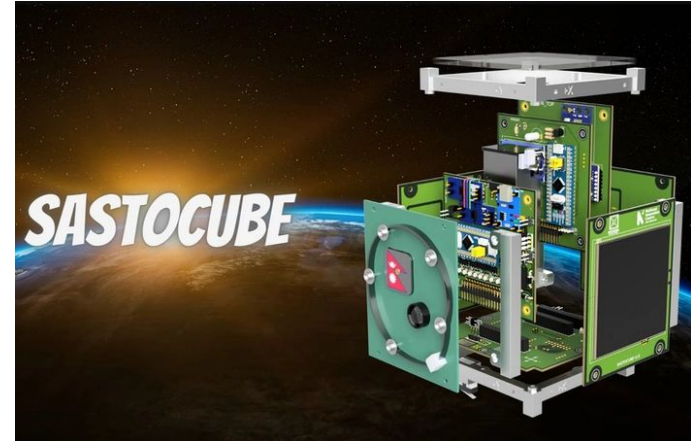
## Space Projects

- Danfe
- Munal
- Danfe-II [PHI-1]



## Education Programs

- PaperSat
- E-Cube
- SastoCube



# MUNAL

High School Satellite Consortium



-





# Project MUNAL

## Objectives:

- In house design, build, test and launch of Nepal's first High School CubeSat
- To demonstrate novel SPDM based COM/OBC designed in-house
- To give continuity and improvement to two Missions of NepaliSat-1: Store & Forward (S&F) and Imaging Mission

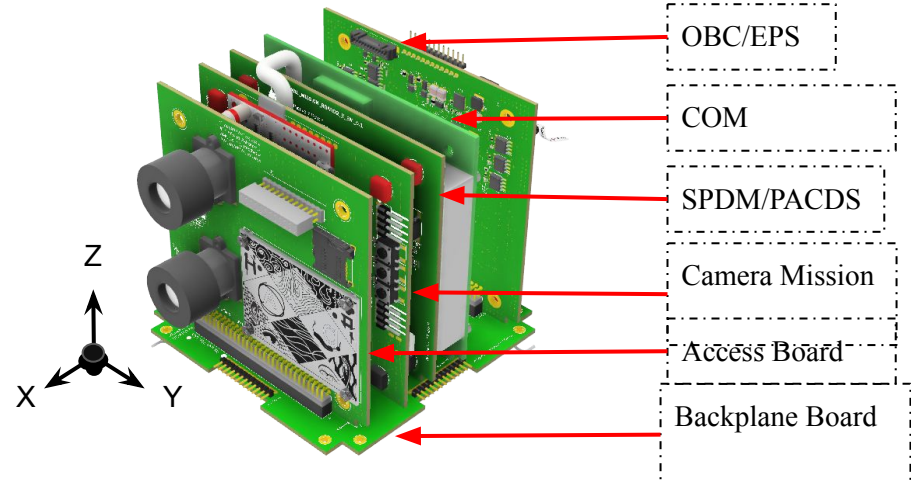
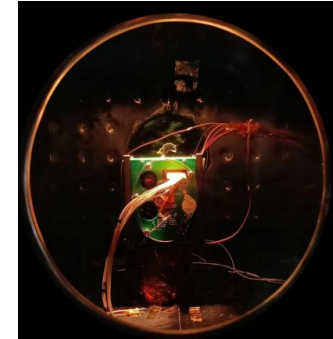
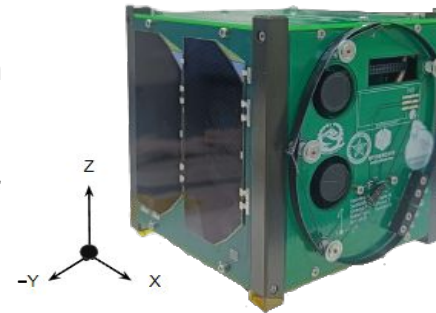
Specifications	
Dimension	1U (100X100X113.5) mm
Weight	1.051 kg
Harness	Backplane Board
Missions	Camera, PACDS, SPDM, Art mission

OBC : On-Board Computer

EPS : Electrical Power Supply

SPDM : Satellite System on Chip Payload Demonstration Mission

PACDS : Passive Attitude Control and Determination System



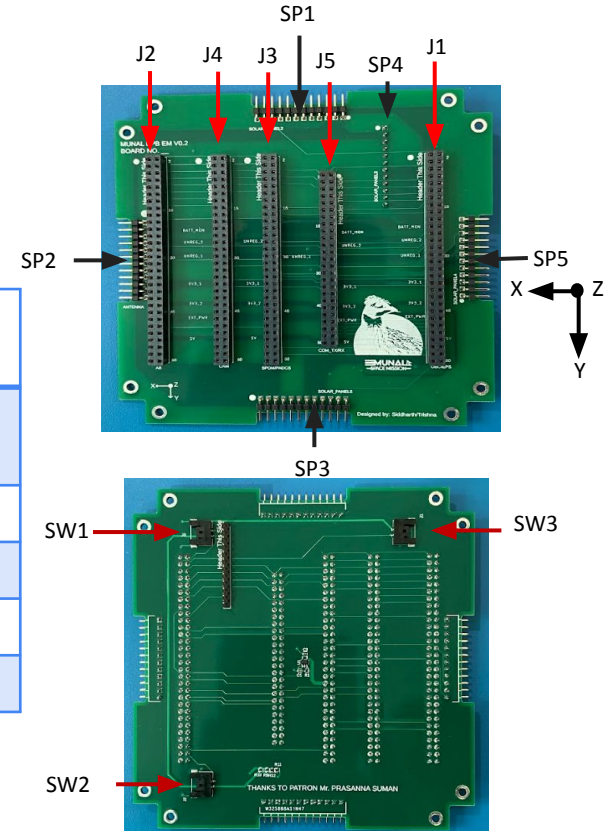
# BPB: Backplane Board

- 60 pin connectors are used for all the mission boards and EPS/OBC.
- 50 pin connector for COM board (Reference: Addnics COM board ICD)



Boards placement on BPB

Connector Name	No. of Pins	Description
J1-J4	60	OBC/EPS, AB, SPDM/PACDS, CAM
J5	50	COM Board
SP1-SP4	12	Solar Panels
SP5	12	Antenna Panel
SW1-SW3	2	Deployment switch





# CAM: Camera Mission

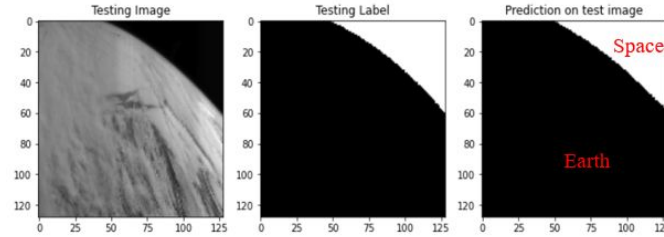
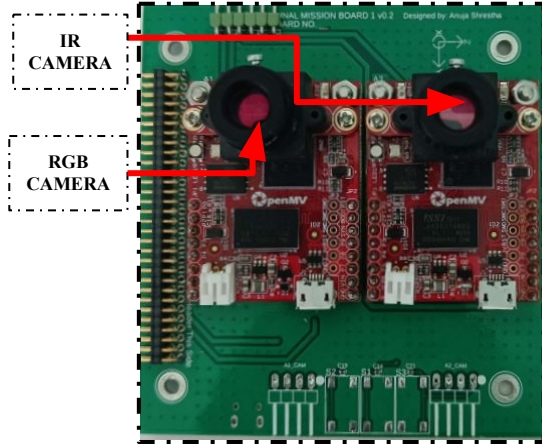
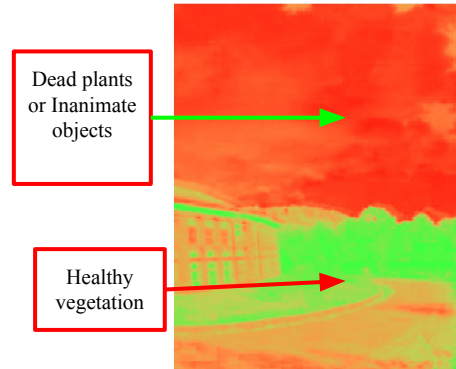


Image Classification

Image Segmentation

Feature	Specification
Cameras	OpenMV H7 Plus (RGB & NIR)
Ground Swath	168*95 km (550km orbit)
Ground Sampling Distance	131m
Resolution	1280x720



RGB Image

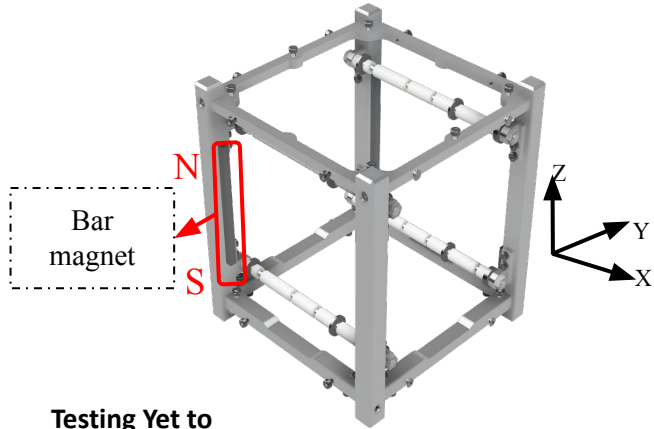


IR-Image

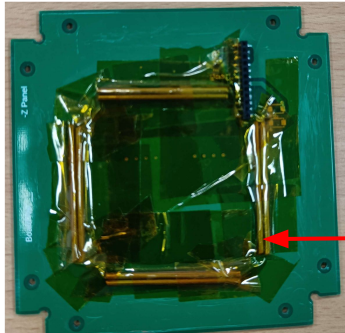




# PACDS: Passive Attitude Control and Determination



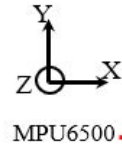
Testing Yet to be done



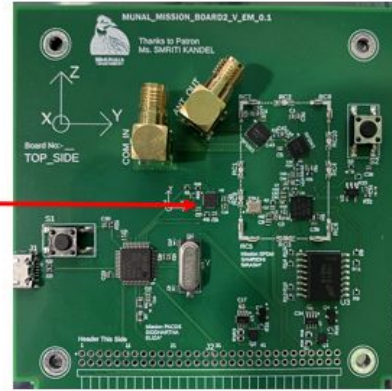
Hysteresis Rod (on Bottom Solar Panel on Bottom Surface)

\*Reference: BIRDS-5 ADCS Design

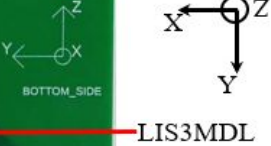
BIRDS Open-Source



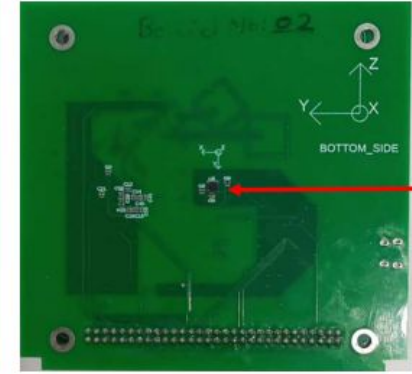
MPU6500



Top



LIS3MDL

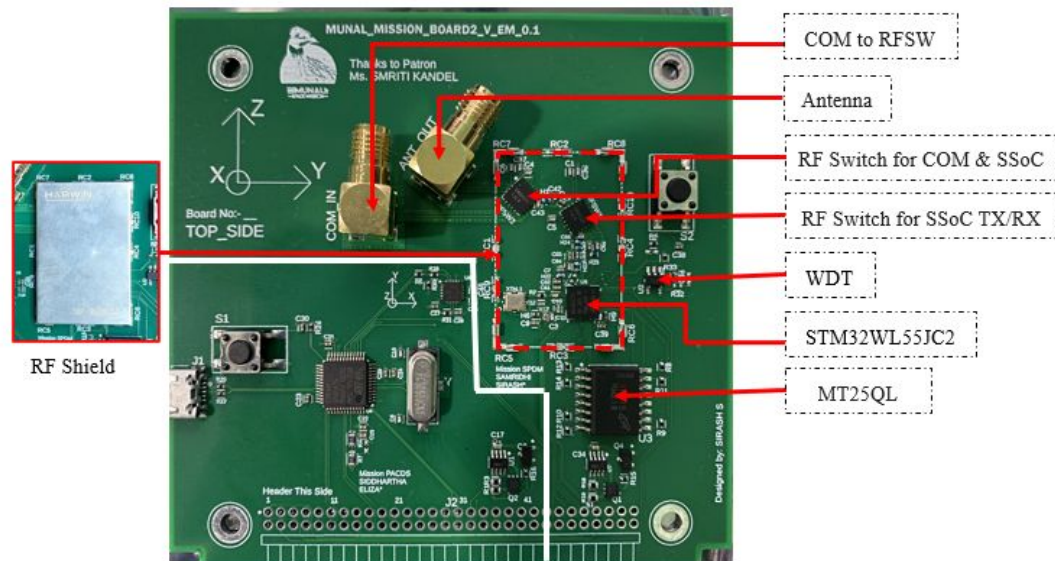


Bottom

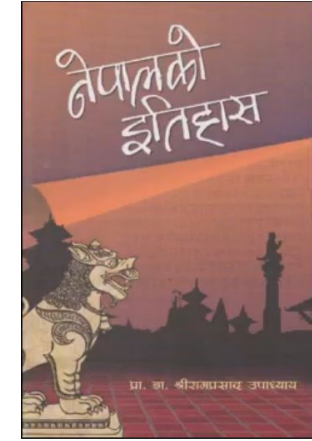
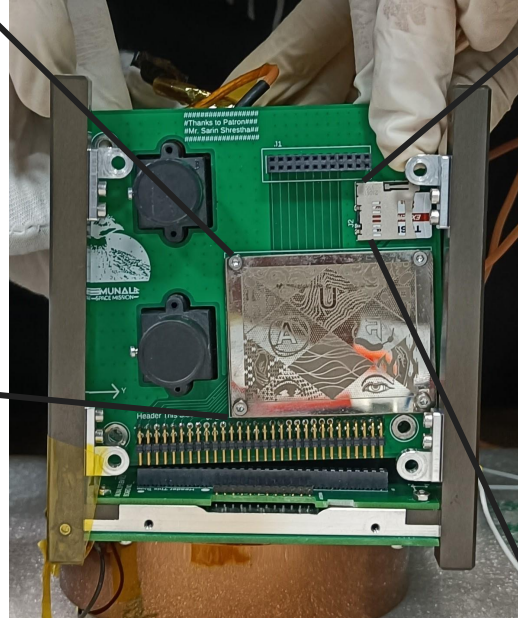
Bar Magnet	4*4 <sup>11</sup> (each rail)	AlNiCo 5
Hysteresis Rod	8	HyMu80

# SPDM: Satellite System-on-Chip Payload Demo

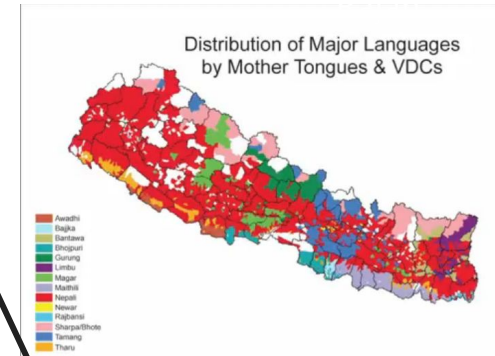
- Demonstrate the use of integrated Communication(COM) and On-Board Computer(OBC) subsystem based on novel SSoC for future cubesat missions using LoRa(Long Range) Modulation.
- ARM based Dual Core Processor with Radio
- +22 dBm Transmitting power
- -148 dBm Receiving sensitivity



# Art and Culture Mission



धन २	व्यय १२	
सहज ३	तनु १	आय ११
सुख ४	१० कर्म	
सुत ५	७ जाया	९ धर्म
रिपु ६	रन्ध्र ८	







# Danfe Space Mission

Multi Payload CubeSat Platform (MPCP)



สถาบันเทคโนโลยีอวกาศนานาชาติเพื่อการพัฒนาเศรษฐกิจ (สทอศ.)

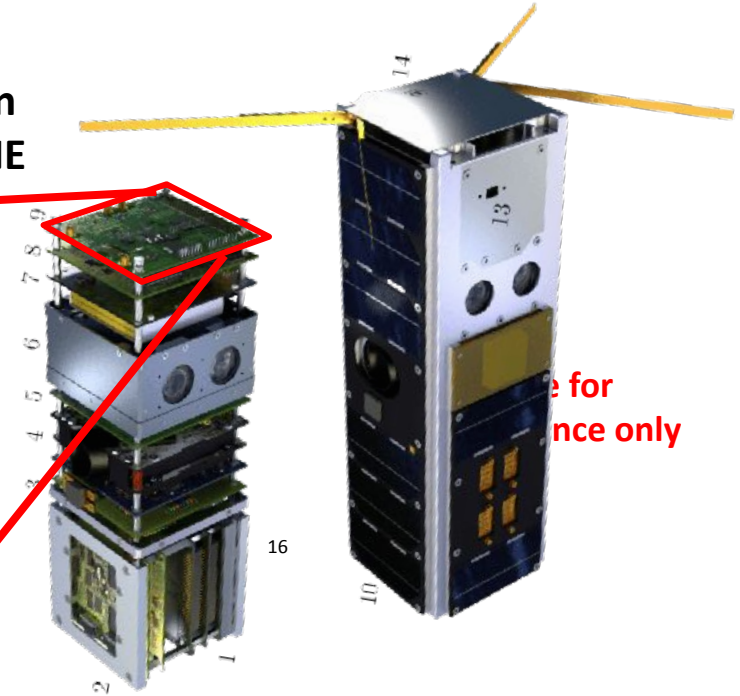
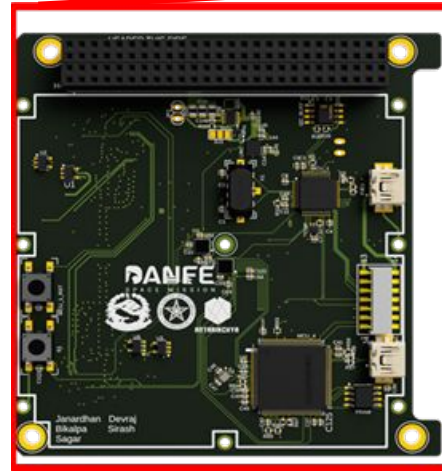


# Overview

- ❑ MCPC 3U Satellite for Mission Demonstration
- ❑ PX4 Demonstration Mission
- ❑ Satellite System-on-Chip Demonstration Mission
- ❑ Also Ground Sensor Terminal Design for KITSUNE



*Pictured: GST installed in Melamchi River originates from the Jugal Himal at an elevation of about 5,875 m*

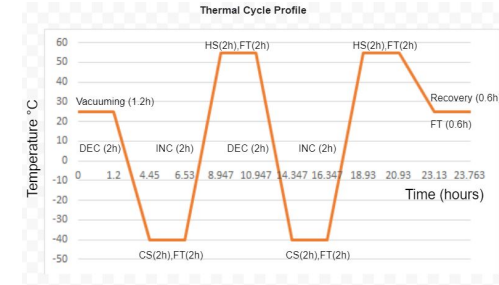
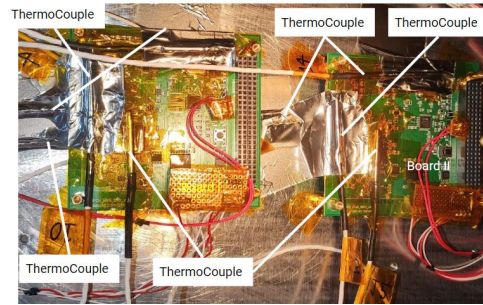
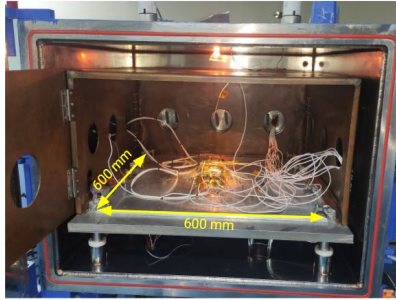


for  
nce only

Source: Aalto-1, multi-payload CubeSat: Design, integration and launch



# Space Qualification Test



Thermal Vacuum Test at Centum Electronics, Bangalore, India



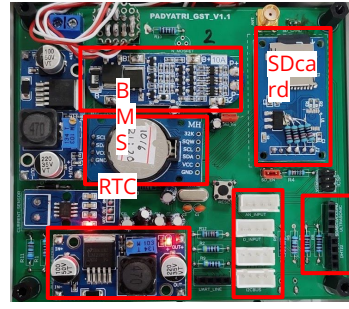
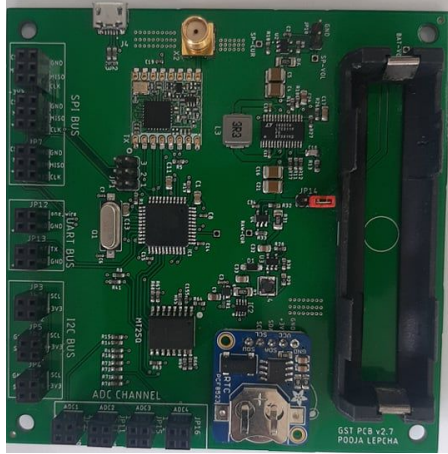
Thermal Vacuum Test at Centum Electronics, Bangalore, India



Electromagnetic Compatibility Test at Khwopa Engineering College, Bhaktapur, Nepal



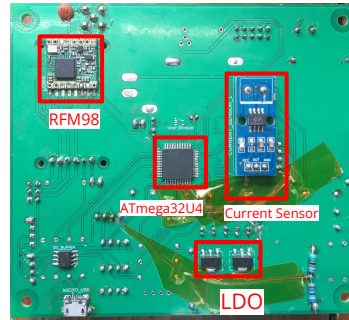
# GST Design and Uplink Test



*Pictured: GST PCB top side*



*Pictured: GST battery pack*



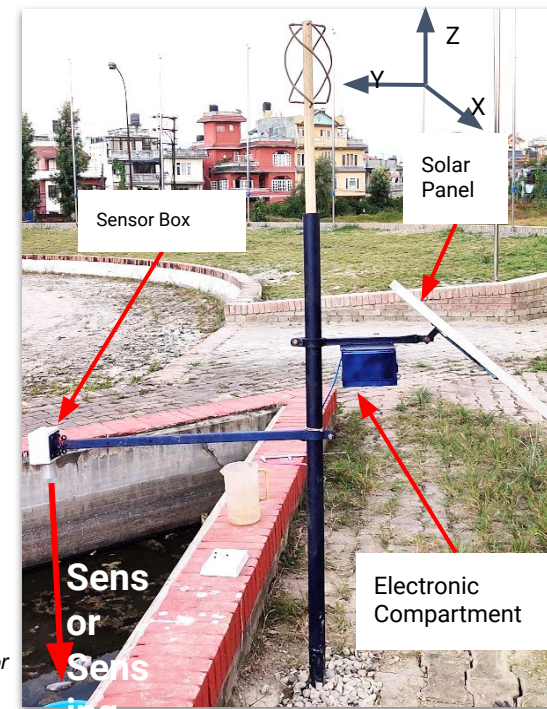
*Pictured: GST PCB bottom side*



*Pictured: Temperature humidity sensor and ultrasonic sensor*



**GST from Kyutech**



**Long Duration test of GST installed at NAST**

**In house Design of GST for Flood Early warning System**

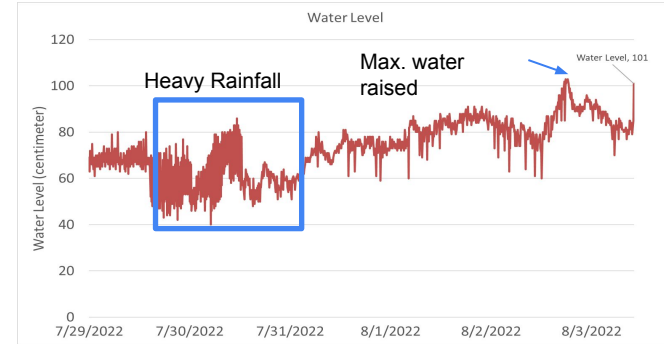




# KITSUNE GST Installation for Flood Warning in Melamchi Municipality [Rural area]



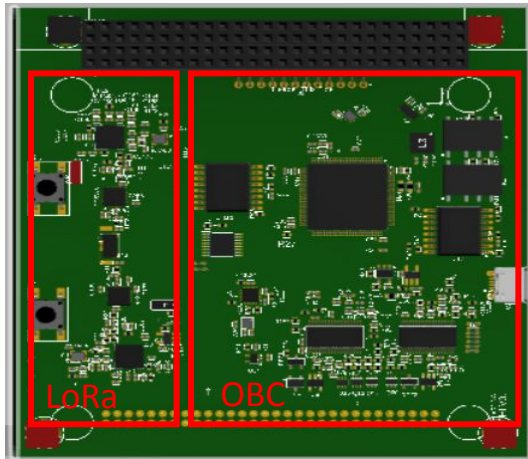
GST Melamchi River Data





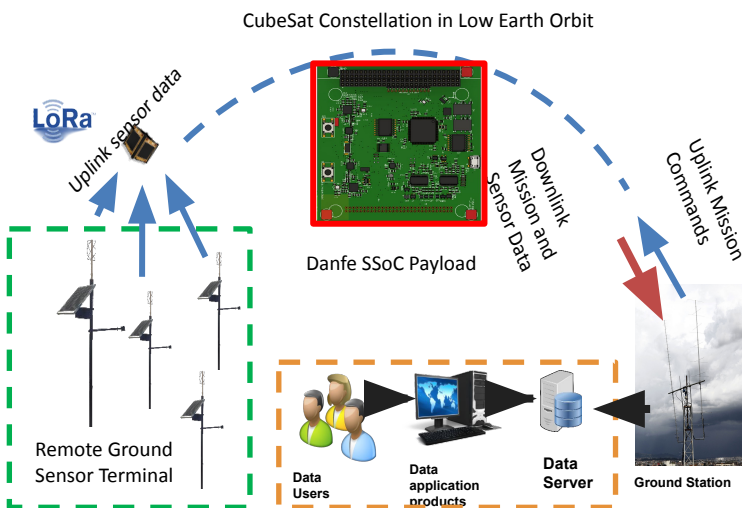
# Danfe-2

- UNOOSA's Access to Space for all: Payload Hosting Initiative project.
- MBRSC'S 12U satellite: (PHISat)
- Munal's OBC/EPS and Danfe Space Mission in a single board. (Modular Design)
- Integrated OBC, EPS and Communication system (Bus system in a single board)
- PDR completed on May 9



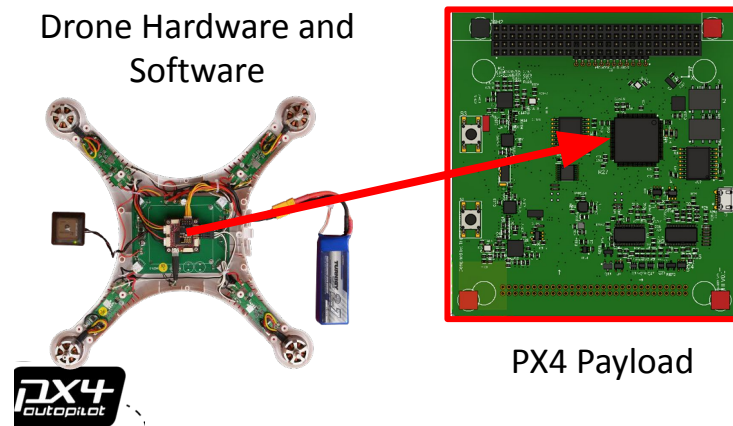
# PHI-I APN LoRa Payload [Danfe-2]

- Nepal's Payload hosted by 12U MBRSC Satellite PHISat



- ☐ Satellite System-on-Chip Demonstration Mission

## Drone Hardware and Software



PX4 Payload

## ☐ PX4 Demonstration Mission



“Design a payload for CubeSat which contributes in next-generation capacity building for in-house satellite development in Nepal”

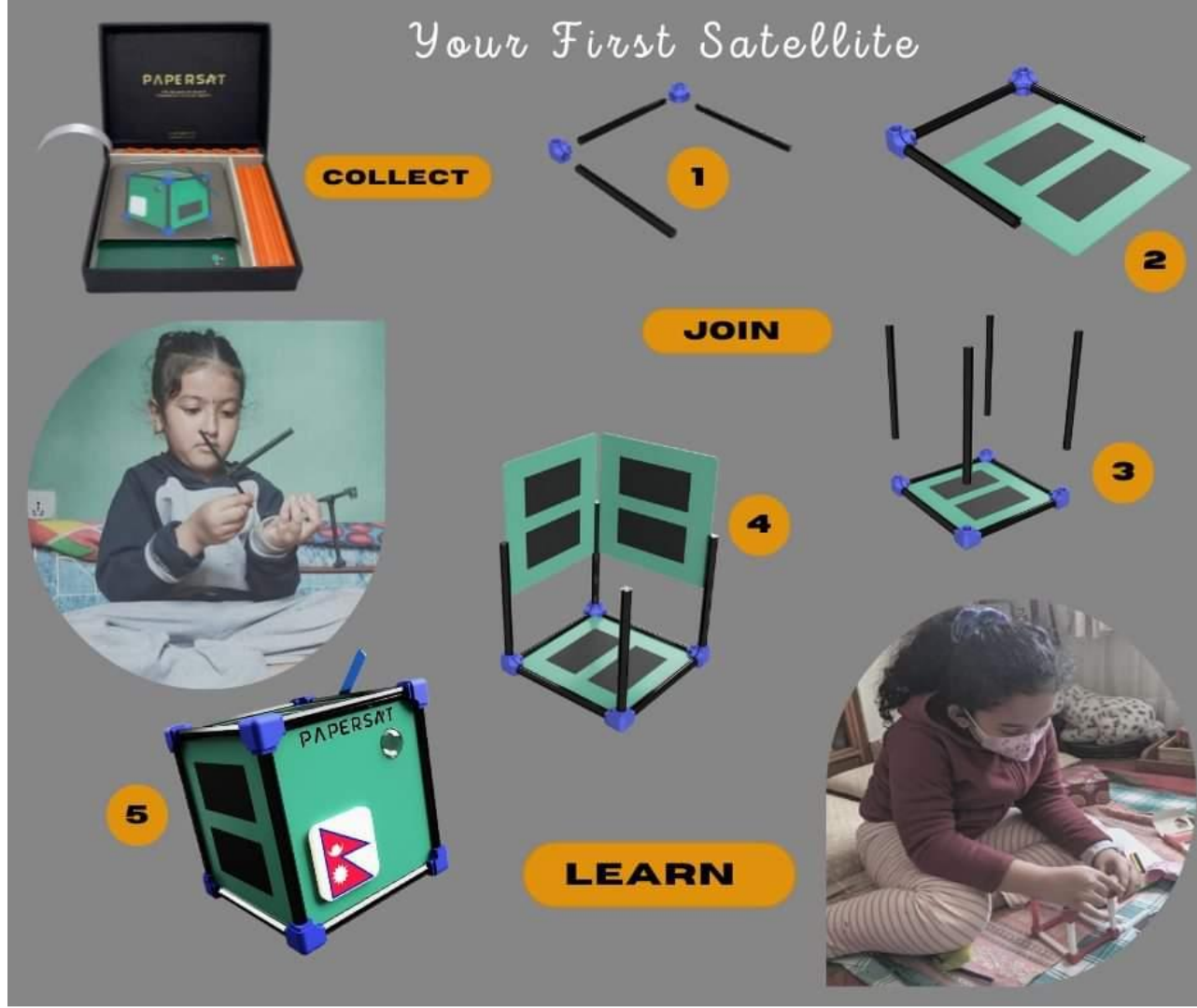
# Antarikchya Educational Programs



TINKER  
LAB



# PaperSat



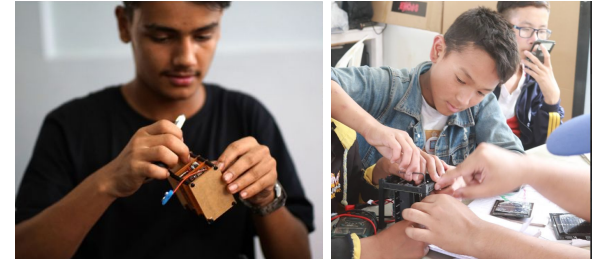
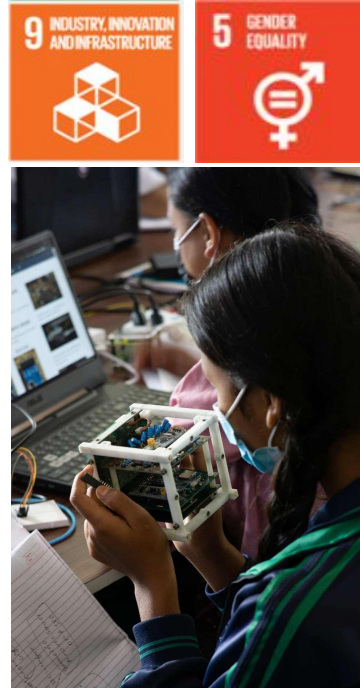
# Satellite Bootcamp



PaperSat Space Art Comp



Localized CanSat Training  
(UNISEC Derived Concept)

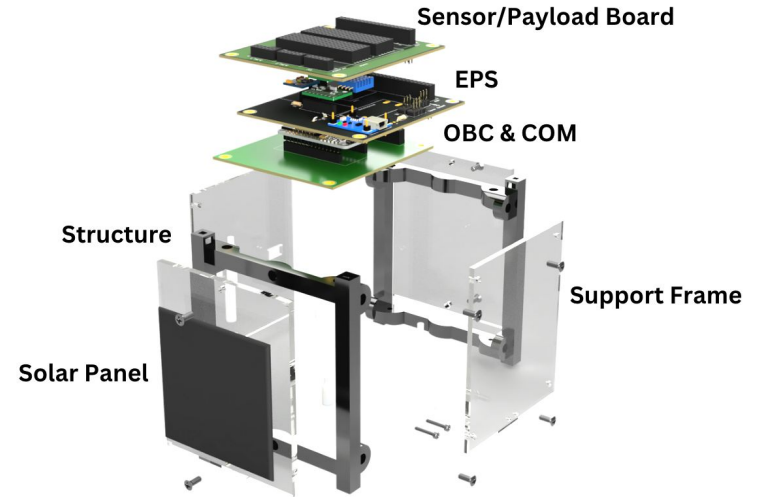
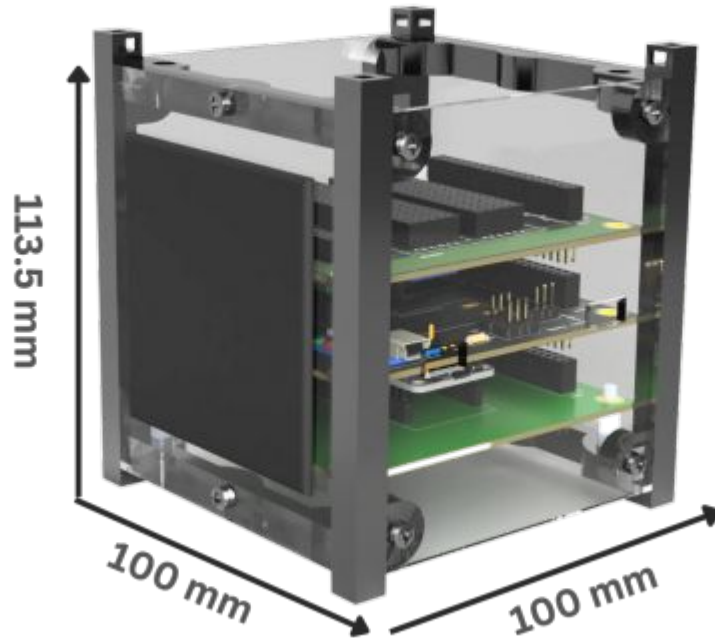


CanSat training provided at Budhanilkantha  
School



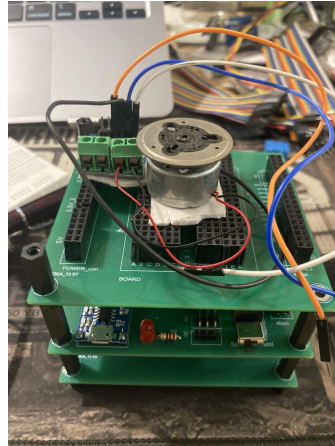
# E-Cube

Educational Kit to educate young students about Satellite Systems





# Educational Training Program



**E-Cube An Educational Satellite**



# E-Cube



## SATELLITE BOOTCAMP (TRAINING)\*\*



Satellite technology has revolutionized the way we live, work, and communicate. From weather forecasting to navigation, from communication to disaster management, satellites have become an indispensable part of our daily lives. However, despite their ubiquitous presence, the technology behind these satellites remains a mystery to most people. To address this knowledge gap and inspire the next generation of innovators, we propose the Satellite BootCamp, a comprehensive hands-on training program that provides participants with a thorough understanding of small satellite design and system engineering. Through intensive practical lessons, participants will learn the skills and knowledge necessary to design, develop, and test their own functional small satellites.



**CLASS 8 AND ABOVE**  
**10 TRAINEES**  
**6 Days**  
**ONE-TO-ONE SATELLITE KIT**

## IMPACT

**“ I HAD TAKEN TRAININGS FROM OTHER ORGANIZATIONS BUT NOTHING CAME CLOSE TO ANTARIKCHYA'S PROGRAMS WHICH USES SPACE TECHNOLOGY AS A TOOL TO TEACH CIRCUITRY, ELECTRONICS, PROGRAMMING AND DESIGN IN A MORE HANDS-ON METHOD. VERY UNIQUE.”**

**NABIN KANDEL**  
 SATELLITE BOOTCAMP BATCH I

BRIHASPATI '17



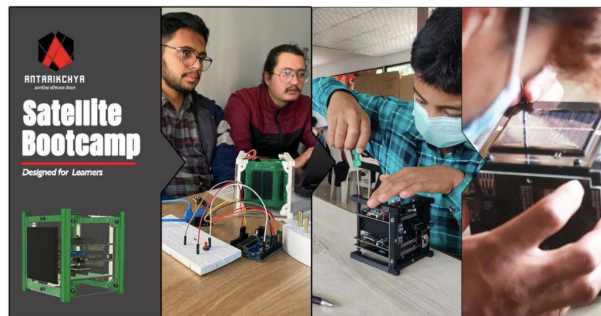
50+ SCHOOLS



700+ STUDENTS



>33% WOMEN



## 1. Design Process

**CAD**  
 CAD (Computer-Aided Design) is the use of computer-based software to aid in design processes. CAD software is frequently used by different types of engineers and designers. CAD software can be used to create two-dimensional (2-D) drawings or three-dimensional (3-D) models which makes the user easier to visualize digitally.

## PCB

Printed circuit board (PCB) design brings your electronic circuits to life or in its physical form. PCB design software makes it easier to define stable electrical connectivity between the components placed on manufactured board.

## 2. Manufacturing

### 3D Printing

3D printing or additive manufacturing is a process in which the originally generated CAD model is constructed into a three-dimensional object layer-by-layer. 3D printing can be done in a variety of processes in which material is deposited, joined or solidified under computer control, with material being added together to get the desired 3-D output.

### Soldering

Soldering is a process in which two or more metals are joined by melting and putting a filler metal into the joint, the filler metal having a lower melting point than the adjoining metal. Unlike welding, soldering does not involve melting the work pieces.

### PCB Manufacturing

PCB manufacturing is the process or procedure that transforms a circuit board design into a physical structure based upon the specifications provided in the design package. This physical manifestation is achieved through the following actions or techniques: Imaging desired layout on copper clad laminates

## 3. Building a Satellite

### Introduction to satellite

The satellite that we are building is CubeSats. They are also of different types, among them we are building 1U. CubeSats 1U is a 10x10x10 cm cube of space from which CubeSats derive their name and can have 1.33 kg of weight for every 1U in their structure.

### Assembling a Satellite

We use off-shelf components and systems to make a satellite. A particular design process is followed starting from basic integration to complete satellite integration. And as a result you will make complete 1U satellite.

### Programming a Satellite

Programming is one of the key factor to run and operate satellite, here you will program each sensor (Payload) in the satellite and at the end you will create a program to acquire a data from satellite to ground station.

## 4. Satellite Mission

### Satellite Mission Discussion

Satellite missions are inspired by different climates i.e. Global warming, GLOF, Climate Change, etc. we will discuss on what a Satellite mission should be to observe such climates and find the satellite's purpose.

### Satellite Mission Implementation

From different mission ideas previously brainstormed, here we decide one of the mission ideas as our main mission. Following the step, previously decided mission idea will then be implemented into the satellite. Implementation phase can be considered as the most intriguing phase as one can implement their formerly learnt skills like CAD modelling, PCB design, Soldering, 3D printing. This will result in satellite payload with properly implemented mission on it.

### Mission Presentation

We will have presentation and discussion on what has been obtained, executed and implemented till now. As well as the expertise review of the work and suggestion to make the satellite design process successful and a properly functioning satellite as a result.

www.antarikchya.org

## CANSAT BOOTCAMP (TRAINING)\*\*



A CanSat Bootcamp is a hands-on educational program that offers students the opportunity to design, build, and launch their own miniature satellite, known as an Idolsat. The program typically includes classroom instruction in the technical requirements of building a functioning CanSat, as well as hands-on work in designing and building the device. Students will learn about the key components of a CanSat, including sensors, communication systems, and data processing capabilities, and will gain valuable skills in electronics, programming, and engineering. CanSat Bootcamp is an exciting and educational experience that promotes skills development, teamwork, and creativity, and inspires students to pursue careers in STEM fields, including space-related disciplines.



**CLASS 7 AND ABOVE**  
**20 TRAINEES**  
**4 Days**  
**ONE-TO-ONE SATELLITE KIT**

**ANTARIKCHYA IS TRAINING NEXT GENERATION SPACE LEADERS**



MELANCHI '22