BIRDS-4S (Maya-5 & Maya-6): The Filipino J-Cube Experience

48th UNISEC Meeting - Introduction to J-Cube
September 21, 2024
STAMINA4Space-STeP UP (Batch 2 Scholars)

PRESENTATION OUTLINE

01 What is the BIRDS-4S Project?

02 Satellite Overview

03 Satellite Missions & Subsystems Overview

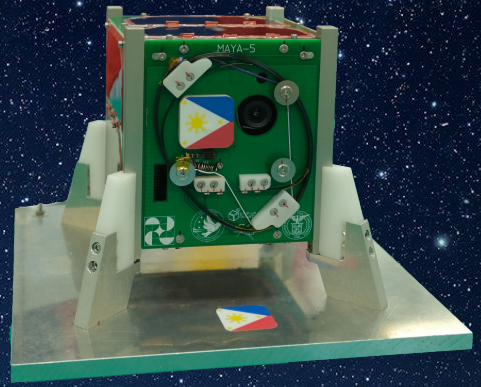
04 Project Activities and Timeline

05 Project Conclusion

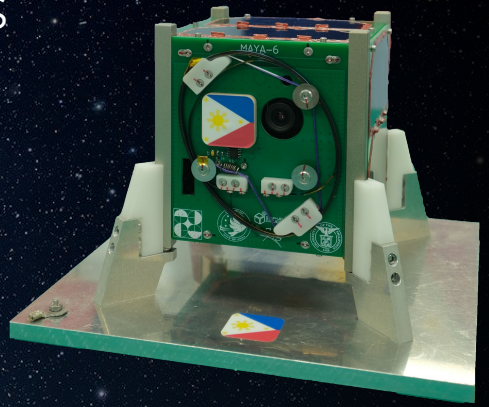
HERITAGE

Maya-2 (BIRDS-4)

BIRDS-4S



Maya-5



Maya-6

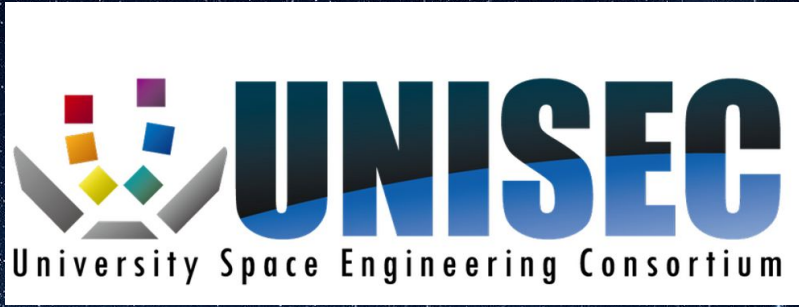
The BIRDS-4S is a project of the **Department of Science & Technology - STAMINA4Space** (Philippines' space initiative project, and predecessor of the Philippine Space Agency)

Its local university partner is the
University of the Philippines - Diliman

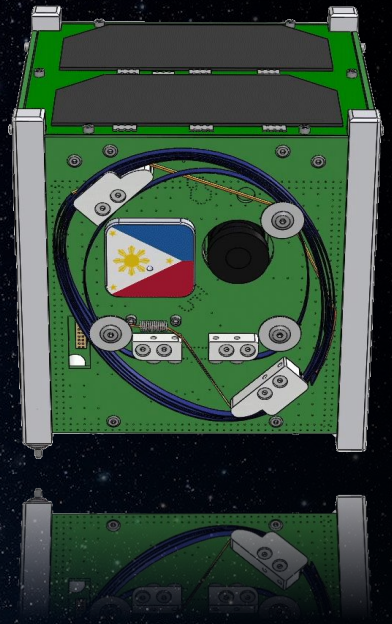
Its partner university in Japan is the
Kyushu Institute of Technology

Kyutech
Kyushu Institute of Technology

The University partnership as well as the deployment of the satellite via the KIBO module within the ISS was made possible by the **University Space Engineering Consortium (UNISEC)** and **Japan Aerospace Exploration Agency (JAXA)**



To **continue Philippines' satellite development** while transitioning to **locally fabricated satellites** by designing, building, testing, launching and operating satellites that will serve as the heritage for future CubeSat missions



MEMBERS

ALVAREZ, Anna Ruth

- Communications Subsystem
- Assistant Project Manager

CHUA, Angela “AC”

- Camera Mission (CAM)
- Image Classification (ICU)
- ADCS Mission
- Missions Lead

COLAMAR, Ronald

- EPS Subsystem
- TMCR Mission
- Backplane Board (BPB)
- AIT Lead

MACARAEG, Khazmir “Val”

- Hentenna Mission
- Antenna Subsystem
- Frequency Coordination
- Comm. Subsystem Lead

DOLORIEL, Chandler “Timm”

- On-Board Computer (OBC)
- Image Classification (ICU)

TAGABI, Gio Asher

- Experimental OBC (OBC-EX)
- ADCS Mission

CO, Joseph “JJ”

- Store and Forward Mission
- APRS-DP Mission
- Ground Station
- Project Manager

REMOCALDO, Genesis “Jimbo”

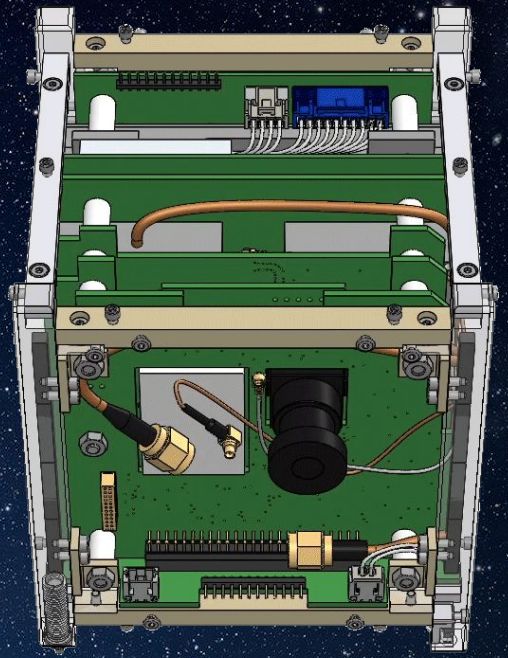
- Structure Subsystem
- Antenna Deployment

SATELLITE OVERVIEW

	Maya-5 & Maya-6
Class	CubeSat (Nanosatellite)
Mass	Approx. 1kg
Dimensions	10cm x 10cm x 10cm (Stowed State)
Orbit	Low Earth
Launch Date	June 2023
Deployment from ISS	July 2023
Mission Duration	Approx. 1 year (Deorbited)

	Maya-5 & Maya-6
Subsystems	- On-Board Computer (OBC) - Electrical Power System (EPS) - Communications Subsystem (COM) - Antenna and Antenna Deployment - Structure - Backplane Board - Ground System
Missions	- Camera Mission (CAM) - Image Classification Unit (ICU) - Store-and-Forward (SF-WARD) - APRS-Digitpeater Mission - Hentenna Mission - Attitude Determination and Control System (ADCS) - Experimental On-Board Computer (OBC-EX) - Total Ionizing Dose Measurement of On-Board COTS and Rad-Hard Components (TMCR)

SATELLITE OVERVIEW



The satellite has a total of **6 external panels** and **7 interior boards**.

1 Antenna Panel
5 Solar Panels
2 Mission Boards
5 Subsystem Boards

SUBSYSTEMS OVERVIEW

On-Board Computer (OBC)

- “Brain” of the satellite. Manages data, executes commands, monitors the satellite.

Electrical Power System (EPS)

- Controls the power supply of the satellite.

Communications Subsystem (COM)

- Main communication between the satellite and GS. Receives command, and transmits data and CW beacon.

Antenna & Antenna Deployment

- Enable communication via VHF and UHF bands.

Structure

- Ensures CubeSat structure accommodates requirements.

Backplane Board (BPB)

- Connects subsystems and mission boards together.

Ground Station (GS)

- Communicates with the satellites by sending commands and receiving telemetry and mission data.

MISSIONS OVERVIEW

Camera Mission (CAM)

- Main “eye” of the satellite. Captures images from space.

Image Classification Unit (ICU)

- Images from CAM is processed and classified on-board by an AI model.

Store & Forward (SF-WARD)

- Collects data from sensors from remote location and forwards them to GS.

APRS-Digipeater Mission (APRS-DP)

- Automatic packet reporting system
- Satellite acts as a “signal tower” for radios.

Hentenna Mission

- Experimental mission to use 1U CubeSat frame as an antenna

ADCS

- Attitude Determination and Control System
- Use to determine the location and orientation of the satellite.
- To stabilize the satellite after deployment.

TMCR

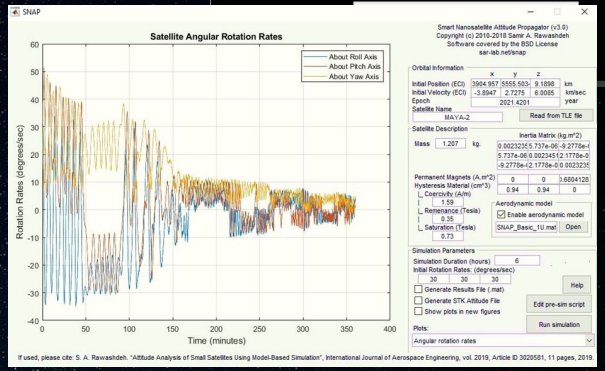
- Determine radiation endurance of COTS components by comparing the ground and on-orbit test data.

Experimental OBC (OBC-EX)

- Locally designed experimental OBC which integrates the function of OBC and ADCS

PROJECT ACTIVITIES (1/7)

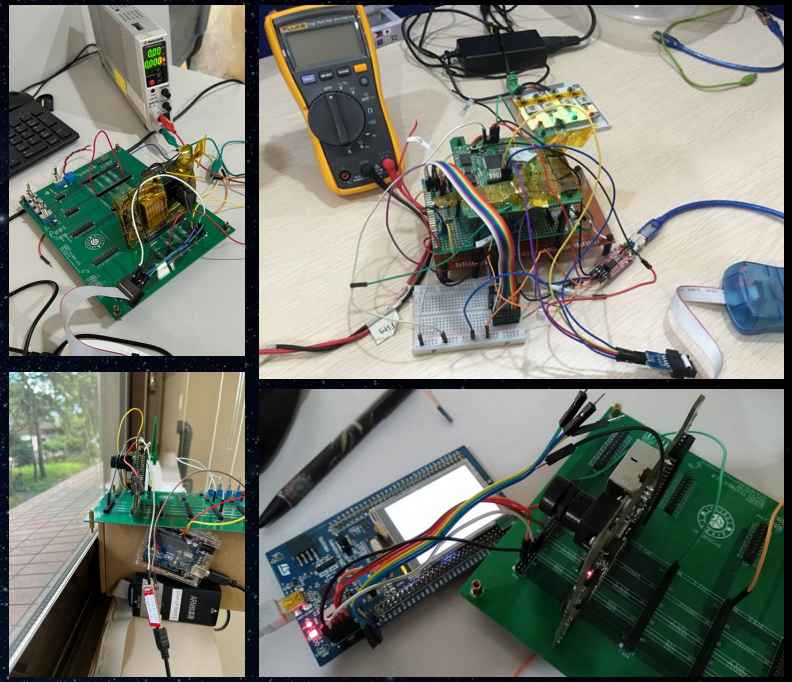
SEPT 2020 - Project Orientation and Kick-off



OCT-NOV 2020 - Individual research of satellite, coding and simulation

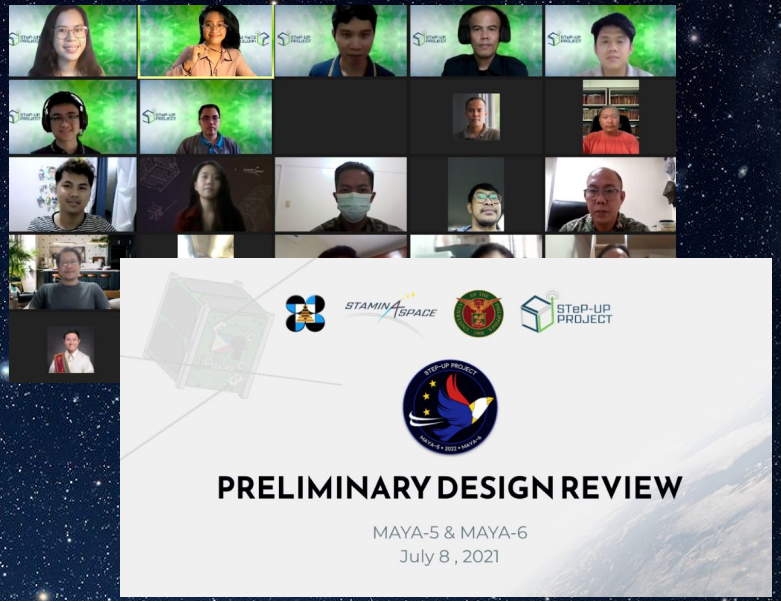
PROJECT ACTIVITIES (2/7)

NOV 2020 - Mission Design Review (MDR)



DEC 2020-JUL 2021 - Arrival of satellite parts from Japan; Engineering Model (EM) assembly and testing

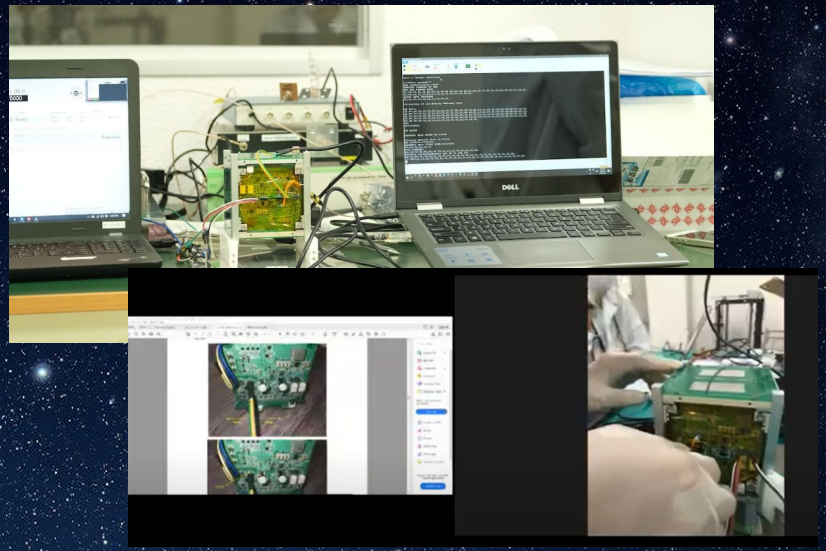
PROJECT ACTIVITIES (3/7)



JUL 2021 - Preliminary Design Review (PDR)

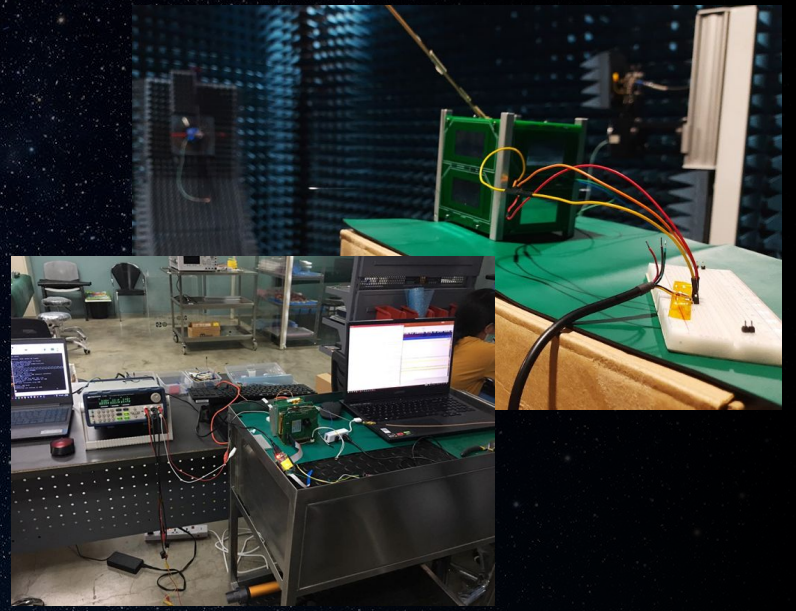
JUL-NOV 2021 - EM integration and testing

PROJECT ACTIVITIES (4/7)



DEC 2021-FEB 2022

- EM space environment testing in KyuTech (online - done by BIRDS-4 members in Japan)



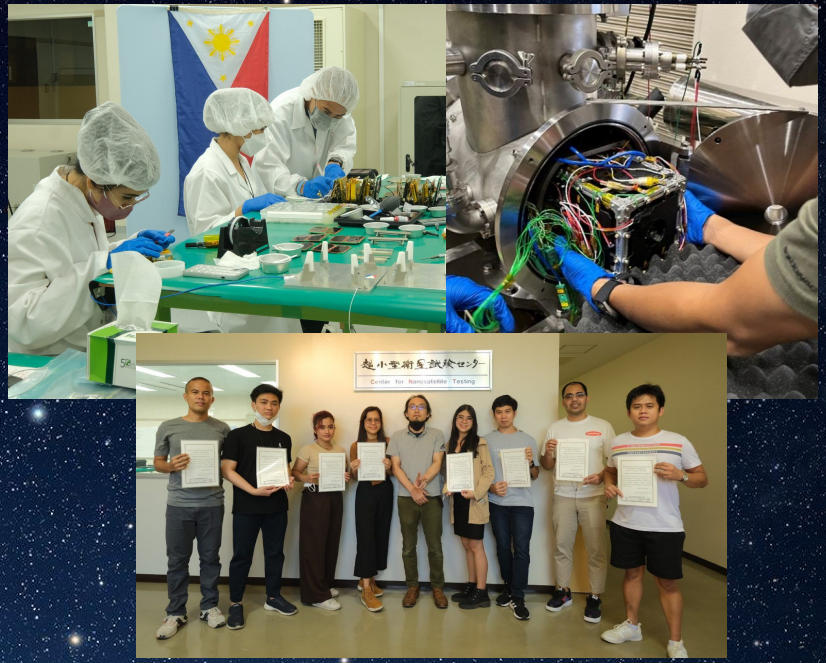
MAR-APR 2022 - Flight Model (FM) assembly and testing

PROJECT ACTIVITIES (5/7)

APR 2022 - Critical Design Review (CDR)

APR-JUL 2022 - FM integration and testing

PROJECT ACTIVITIES (6/7)



AUG-SEP 2022 - FM space environment testing in Kyushu Institute of Technology, Japan

FEB 24, 2023 - Turnover of satellites to JAXA

PROJECT ACTIVITIES (7/7)

JUN 5, 2023 - Launch to ISS via SpaceX Falcon 9

JUL 19, 2023 - Deployed from ISS via “KIBO” or Japanese Experiment Module (JEM) Small Satellite Orbital Deployer-26 (J-SSOD-26)

Being part of the BIRDS-4S project and being able to learn how to develop and test a satellite is both **honor** and a **privilege**. Thanks to DOST, UP-Diliman, KyuTech, UNISEC and JAXA for this great opportunity!

STAMIN4SPACE
Thank You!
MAYA-6
MAYA-5
University of the Philippines Diliman
Maya-6
University of the Philippines Diliman
Maya-5