Philippine Space Agency

November 16, 2022

PHL-50: Building the Future of University-based Microsatellites in the Philippines

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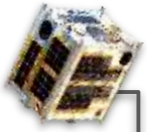
APRSAF
ASIA-PACIFIC REGIONAL SPACE AGENCY FORUM

SE4AWG
SPACE EDUCATION FOR ALL WORKING GROUP

University-based Satellites of the Philippines



Diwata-1

Diwata-2

Maya-1 (BIRDS 2)

Maya-2 (BIRDS 4)

Maya-3

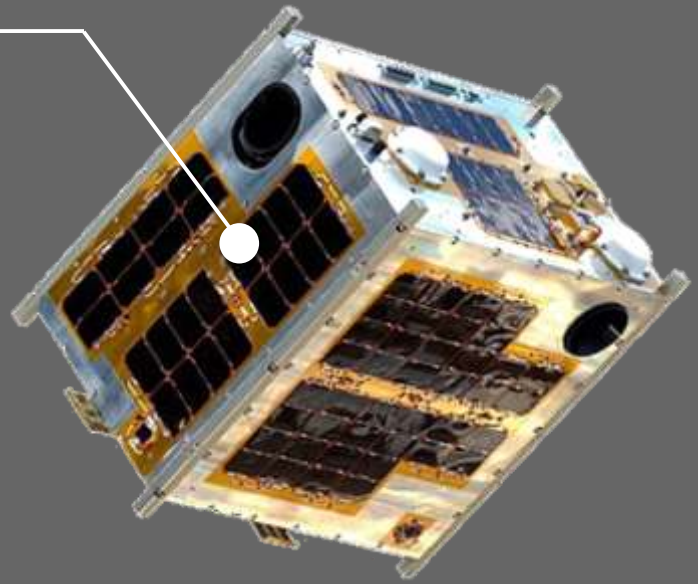
Maya-4

Maya-5

Maya-6

DIWATA-1

Class	Microsatellite (Microsat)
Mass	52.40 kg
Type	Scientific Earth Observation
Dimensions	55 cm x 35cm x 55 cm
Orbit	Low Earth
Payloads	High Precision Telescope (HPT), Spaceborne Multispectral Imager with Liquid Crystal Tunable Filter (SMI w/ LCTF), MIddle Field Camera (MFC), Wide Field Camera (WFC)
Launch	23 March 2016 via Atlas V Rocket from Kennedy Space Center (Cape Canaveral, Florida)
Release	27 April 2016 from the International Space Station (ISS)
Mission/s	Disaster Response and Management Environment and Natural Resource Assessment
Image acquisition	Disaster Response and Management Environment and Natural Resource Assessment
Status	Decommissioned (06 April 2020)

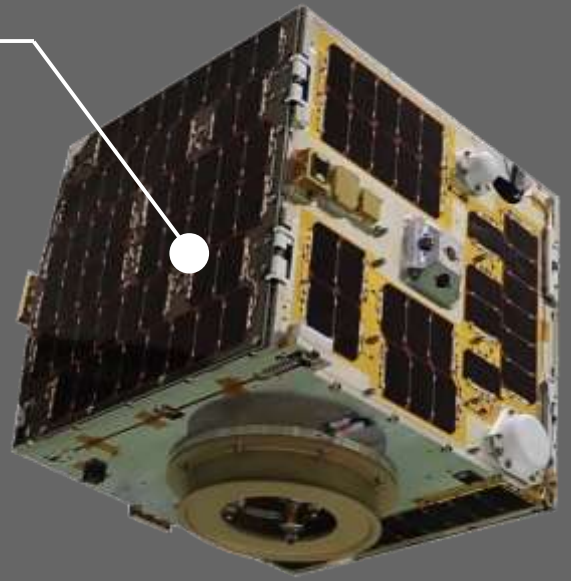


Trivia

Diwata-1 is the **first Filipino-built satellite** under the Development of Philippine Scientific Earth Observation Microsatellite (**PHL-Microsat**) Program, in partnership with Japanese Universities: **Hokkaido University** and **Tohoku University**.

DIWATA-2

Class	Microsatellite (Microsat)
Mass	57.36 kg
Type	Earth Observation
Dimensions	50 cm x 50cm x 50 cm (Stowed State)
Orbit	Low Earth, Sun Synchronous
Payloads	High Precision Telescope (HPT), Spaceborne Multispectral Imager with Liquid Crystal Tunable Filter (SMI w/ LCTF), MIddle Field Camera (MFC), Wide Field Camera (WFC), Enhanced Resolution Camera (ERC), Amateur Radio Unit (ARU), Zenith Sun Sensor Module (SAS-Z) and an Extended Attitude Control unit (ACU-Ex)
Launch	29 October 2018
Release	Direct release to space via rocket
Mission/s	Multi-spectral Earth Observation for remote sensing applications Data collection by Store-and-Forward Mechanism Provide satellite data to fisheries, agriculture and other sectors Amateur Radio Communications, APRS
Image acquisition	Approximately 80% or 245,063 sq. km of Philippine land area covered (as of June 2020)
Status	In orbit (since 29 October 2018)



STAMINA4Space

Space Technology and Applications Mastery, Innovation and Advancement

- To further development of local expertise in **Space Science and Technology Applications (SSTA)**
- To spur the development of **high-value industries in the country**
- To address our manifold needs in scientific earth observation for **disaster risk reduction and management**, **resource assessment, environmental monitoring** and other applications.

STAMINA4Space

OPTIKAL

Optical Payload Technology, In-depth Knowledge Acquisition, and Localization (OPTIKAL)

PHL-50

Building PHL-50: Localizing the Diwata-1,2 Bus System as the Country's Space Heritage 50kg Microsatellite Bus (PHL-50)

STeP-UP

Space Science and Technology Proliferation through University Partnerships (STeP-UP)

GRASPED

Ground Receiving, Archiving, Science Product Development, and Distribution (GRASPED)

ASP

Advanced Satellite Development and Know-How Transfer for the Philippines

Building PHL-50: Localizing the Diwata-1, 2 Bus System as the Country's Space Heritage 50 kg Microsatellite Bus (PHL-50)

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PHL50

*This project aims to **build on** and **sustain the gains** from Diwata-1 and Diwata-2 Microsatellites by **developing a reference bus platform** that can cater to **various satellite components** and **university-based missions**.*

Funded by Department of Science and Technology Philippine Council for Industry, Energy, and Emerging Technology Research and Development (DOST-PCIEERD)

Implemented by University of the Philippines Diliman - Electrical and Electronics Engineering Institute (UPD-EEEI)

PHL-50 OBJECTIVES

RO 1

Develop a bus platform and its key components

RO 2

Conduct extensive research on critical components

RO 3

Establish a small-satellite simulation system

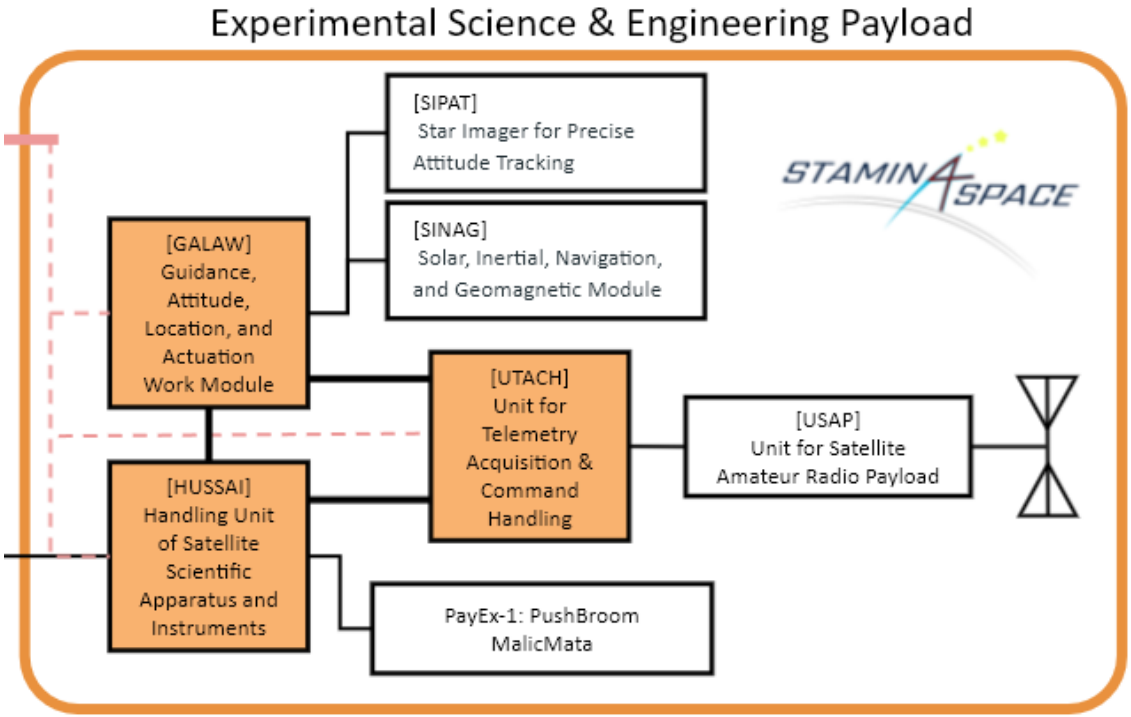
CO 1

Engage with private and public institutions

CO 2

Proliferate know-how on small satellites

RO1: Develop a bus platform and its key components



ESEP

- Integration of PHL-50 small satellite subsystems for evaluating the unit level and inter-module performance of the identified key components for localization.

- Acts as a controlled ecosystem for conducting major functionalities in a small satellite, which are:
    - Satellite command & data traffic handling
    - Mission control & data handling
    - Satellite attitude management.
    - Amateur radio communications

RO1: Develop a bus platform and its key components

Attitude Determination & Control System (ADCS) Board

FPGA Board

ON-BOARD COMPUTERS

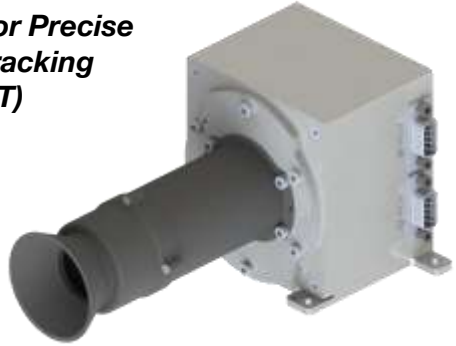
Unit for Telemetry Acquisition and Command Handling (UTACH) Board

Unit for Satellite Amateur Radio Payload (USAP) Module

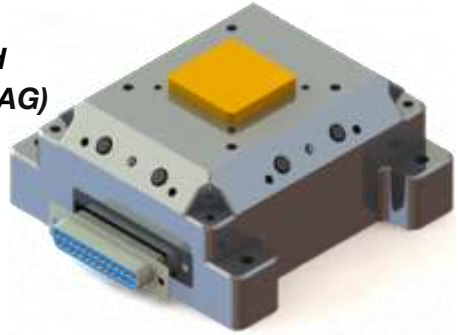
COMMUNICATIONS PAYLOAD

RO1: Develop a bus platform and its key components

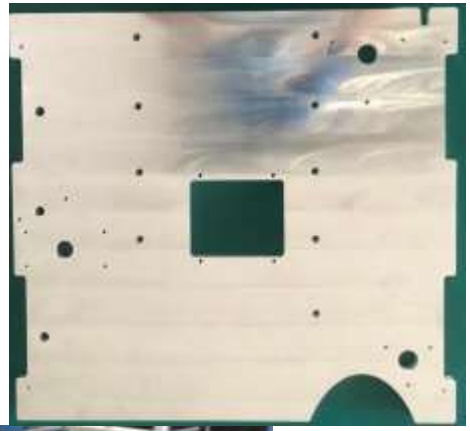
Star Imager for Precise Attitude Tracking (SIPAT)



Solar, Inertial, Navigation, And Geomagnetic (SINAG) Module



ATTITUDE DETERMINATION AND CONTROL SENSORS

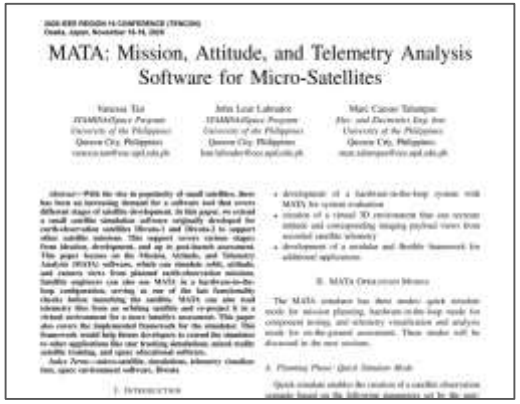


SATELLITE BUS STRUCTURE, PANELS, & MODULE ENCLOSURES

RO2: Conduct extensive research on critical components

2 *Published Papers*

5 *Conference Presentations*



MATA: Mission, Attitude, and Telemetry Analysis Software for Micro-Satellites

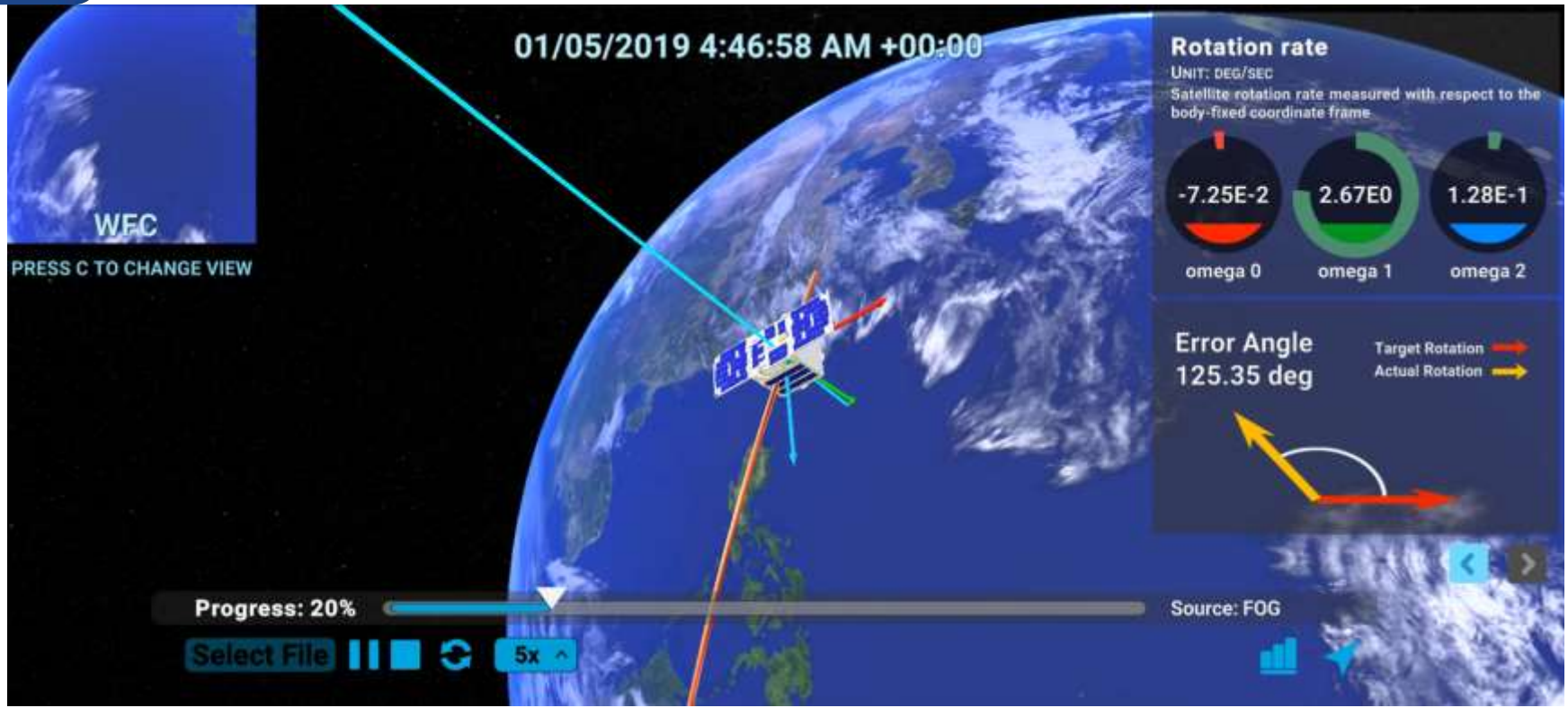
2020 IEEE Region 10 Conference (TENCON)

Optimal Philippine Small Remote Sensing Satellite Design

38th International Communications Satellite Systems Conference (ICSSC)

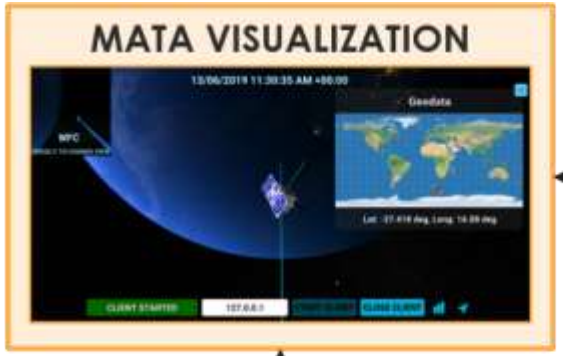
Small Satellite Conference 2020 & 2021

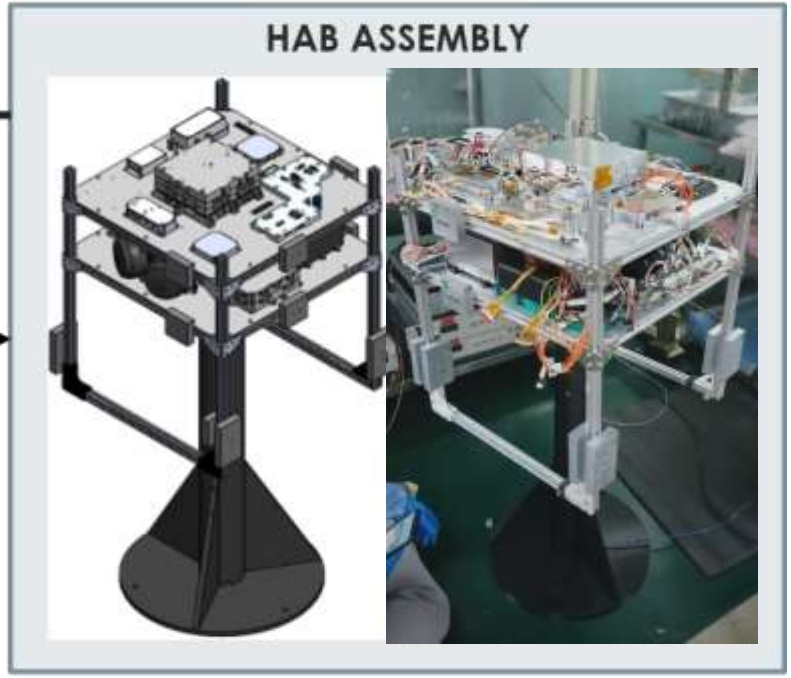
RO3: Establish a small-satellite simulation system



Mission, Attitude, and Telemetry Analysis (MATA) Software for Microsatellites

RO3: Establish a small-satellite simulation system





Hemispherical Air Bearing (HAB)

RO3: Establish a small-satellite simulation system

Motorized Gimbal System

Target Applications:

- Simulation of attitude control dependent systems
- Simulation of Reaction Wheels and any 3 DOF moving units.

Target Applications:

- Simulation of geomagnetic field that a satellite would experience in orbit
- Magnetic field of about 2G per coil pair
- Homogeneous magnetic field of at least 0.001 m^3

Helmholtz Cage

CO1: Engage with private and public institutions

PRECISION MANUFACTURING

NSB ENGINEERING
DESIGN AND FABRICATION

VJF

PRIMATEKNICA
Primateknica Corporation

PCB DESIGN, FABRICATION, AND ASSEMBLY

ARKUS
Philippines

IMES

PYTHOS
...the Filipino can!
PYTHOS TECHNOLOGY PHILIPPINES INCORPORATED

TESTING SERVICES

dti BUREAU OF PHILIPPINE STANDARDS

IMI

Continental
The Future in Motion

DEVELOPMENT OF CUSTOM FPGA IP BLOCKS

esi labs

SMARTFOX
DATA SOLUTIONS, INC.

STAMINA SPACE

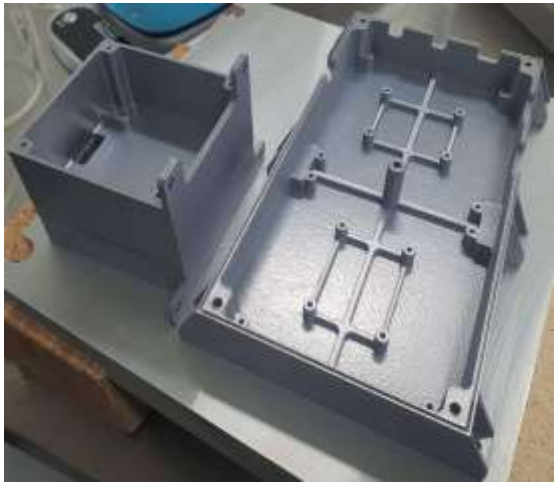
CO1: Engage with private and public institutions

Joint Research Agreement (JRA) with Department of Science and Technology - Metals Industry Research and Development Center (MIRDC)

Research on Advanced Prototyping for Product Innovation and Development using Additive Manufacturing Technologies (**RAPPID-ADMATEC**) Project

~40% lighter than Maya-1 (BIRDS 2) frame

Development of Cube Satellite Frame



(L) Star Tracker Electronic Box
(R) UTACH Enclosure

Computing Unit Enclosures

Deployable Mechanism Parts

CO2: Proliferate know-how on small satellites

Proliferation of know-how on small satellites to high school and college students

Manila Science High School

University of Sto. Tomas

Ateneo De Naga University

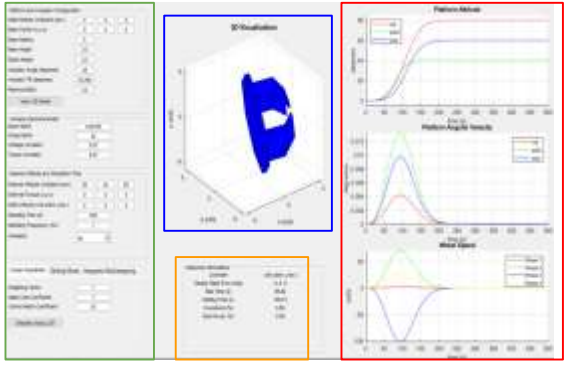
Ateneo De Naga University

CO2: Proliferate know-how on small satellites

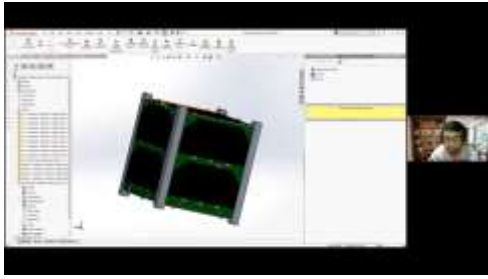
MS/MEng in Electrical Engineering - Nanosatellite Development Track Course Development and Teaching Load

Maya 3 & 4 Nanosatellite Preliminary Design Review

"Attitude Determination and Control Simulation and Visualization Tool"



Thesis Proposal and Progress Reports



Online Tutorials

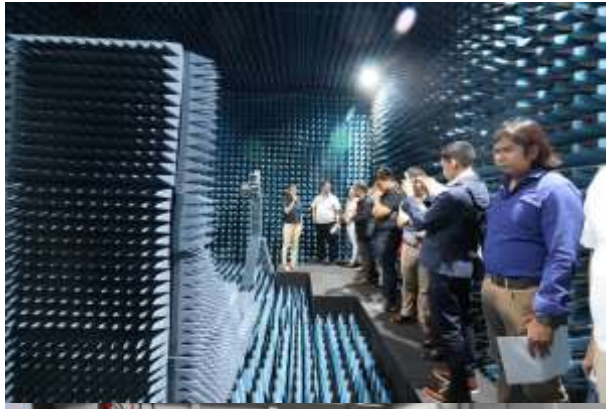
Technical Assistance to Graduate Students (STeP-UP scholars)

Undergraduate Capstone Projects

CO2: Proliferate know-how on small satellites

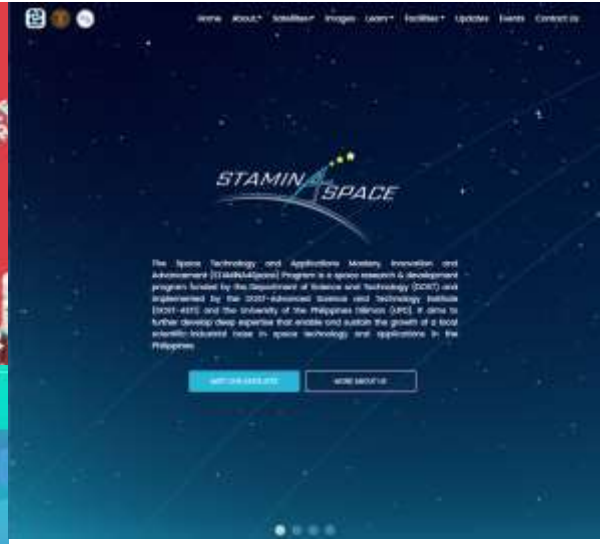
University Laboratory of Small Satellites and Space Engineering Systems (ULyS^{3}ES)

Facility Tours



Full Anechoic Chamber

CO2: Proliferate know-how on small satellites

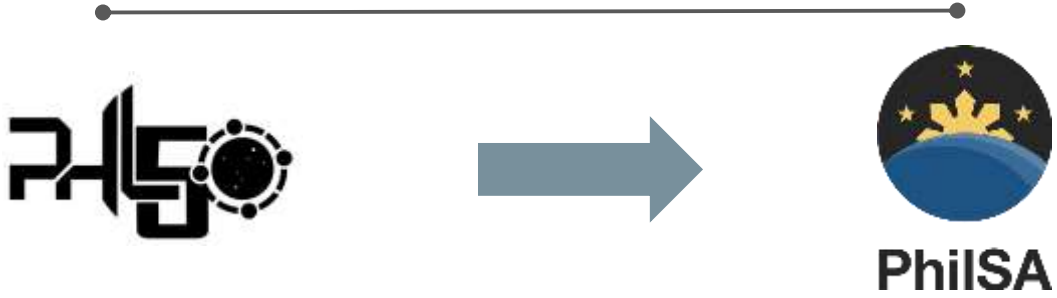


Speaking Engagements

Online Reach
27,824 total followers

CONCLUSION

- **The PHL-50 Project** ended last March 31, 2022
- To seamlessly continue what it started, the **Philippine Space Agency (PhilSA)** proposed and implemented the **Adoption of OPTIKAL and PHL-50 Developed Technologies (ADOPT) Project**
- Aims to contribute to the **SSTA research and development (R&D)** capabilities of PhilSA by collaborating with two institutes from the **University of the Philippines Diliman (UPD)**




Rotation rate
-7.29E-2
2.67E0
1.28E-1
Error Angle
125.35 deg
Source: FDG


SALIKSIKHAY
16-17 January 2020
8:00 AM to 5:00 PM

Philippine Space Agency

Our Vision

The PhilSA envisions a Filipino nation **bridged, uplifted and empowered** through the **peaceful** use of outer space

Our Mission

We will promote and sustain a robust Philippine space ecosystem that **adds and creates value in space** for and from **filipinos and for the world**

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https://philsa.gov.ph/