Maya CubeSats Catch Up:
An Overview of Maya-7 and Operations Status of Maya-5 & Maya-6

#MAYA72U

13 September 2023 | 10:00 PM (JST) 9:00 PM (PHST)

Photo Source: NASA

PRESENTATION OUTLINE

1. Maya-7 2U Cubesat

1.1 ACCESS Nanosat Project introduction and overview

1.2 Missions

1.3 Subsystems

1.4 Milestones achieved

2. Maya-5 & Maya-6 1U Cubesats

2.1 System overview

2.2 Operations status

ACCESS Nanosat Project Introduction and Overview

John Michael Rey Zamora

Advancing Core Competencies and Expertise in Space Studies Nanosatellite (ACCESS Nanosat) Project

Scholarship grants for MS/M.Eng in Electrical Engineering program (Nanosatellite Engineering track) of UP Diliman – Electrical and Electronics Engineering Institute

+

Hands-on satellite project experience with PhilSA personnel serving as mentors

Nanosat Mission Idea Contest 2022

- Provides the academe a chance to propose mission ideas for the Maya-7 CubeSat
- Students, researchers, and faculty members from Philippine universities and colleges were invited to participate
- Winning teams were given the opportunity to realize their proposals and involved in the Maya-7 mission design phase

Source: PhilSA

Meet the
Maya-7 Developers!

ACCESS NANOSAT TEAM

John Michael Rey Zamora

Project Manager,
Attitude Determination & Control Subsystem (ADCS) Lead

Ariel Nopre, Jr.

Project Co-Manager,
Camera Payload (PL-CAM) Missions Lead
Thermal Louver and Thermoelectric Generator Mission Sub Lead

Nadine Macalalad

Systems Engineer
Electric Power Subsystem (EPS) Lead

ACCESS NANOSAT TEAM

Ella Louise Tengco

APRS-DP and S&F Missions Lead

Jonard Jairo Reyes

Thermal & Radiation Design, Analysis & Testing (THR)
Thermal Louver and Thermoelectric Generator Mission Lead

Dave Emmanuel Zuñiga

Structural Design and Testing (STR)
Mechanical Design and Analysis Engineer

ACCESS NANOSAT TEAM

Joannarose Congzon

Deployable Antenna Design and Testing (ANT)

John Abiel Villanueva

On-Board Data Handling Subsystem (OBDHS)
Ground Station Software

Gracielle Capardo

Communications / RF Subsystem (COM/RF)
Backplane Board and Access Board

PRIMARY OBJECTIVES

Programmatic Objectives

- To train and guide students, researchers, and faculty members in the entire process of a satellite project
- To design, build, test, launch, and operate the Philippines' first 2U CubeSat through the collaboration of PhilSA, UPD and the winning NMIC Universities
- To contribute to the effort to bolster the country's indigenous capabilities in nanosatellite technology and R&D

Satellite Technology/Scientific Objectives

Primary Missions

Demonstration of image capture of RGBN camera with commercially-off-the-shelf (COTS) lens and image sensor

Image Classification Units (ICUs)

1. COEUS ICU (MSU-IIT)
2. MASID ICU (UPLB)
3. GREENSAT ICU (DLSU)

COTS APRS-Digipeater demonstration on CubeSat (APRS-DP)

Demonstration of ground data acquisition using Store and Forward (S&F) with Ground Sensing Terminal

- ACCESS S&F
- SOS-KONEK (CTU)

Secondary Missions

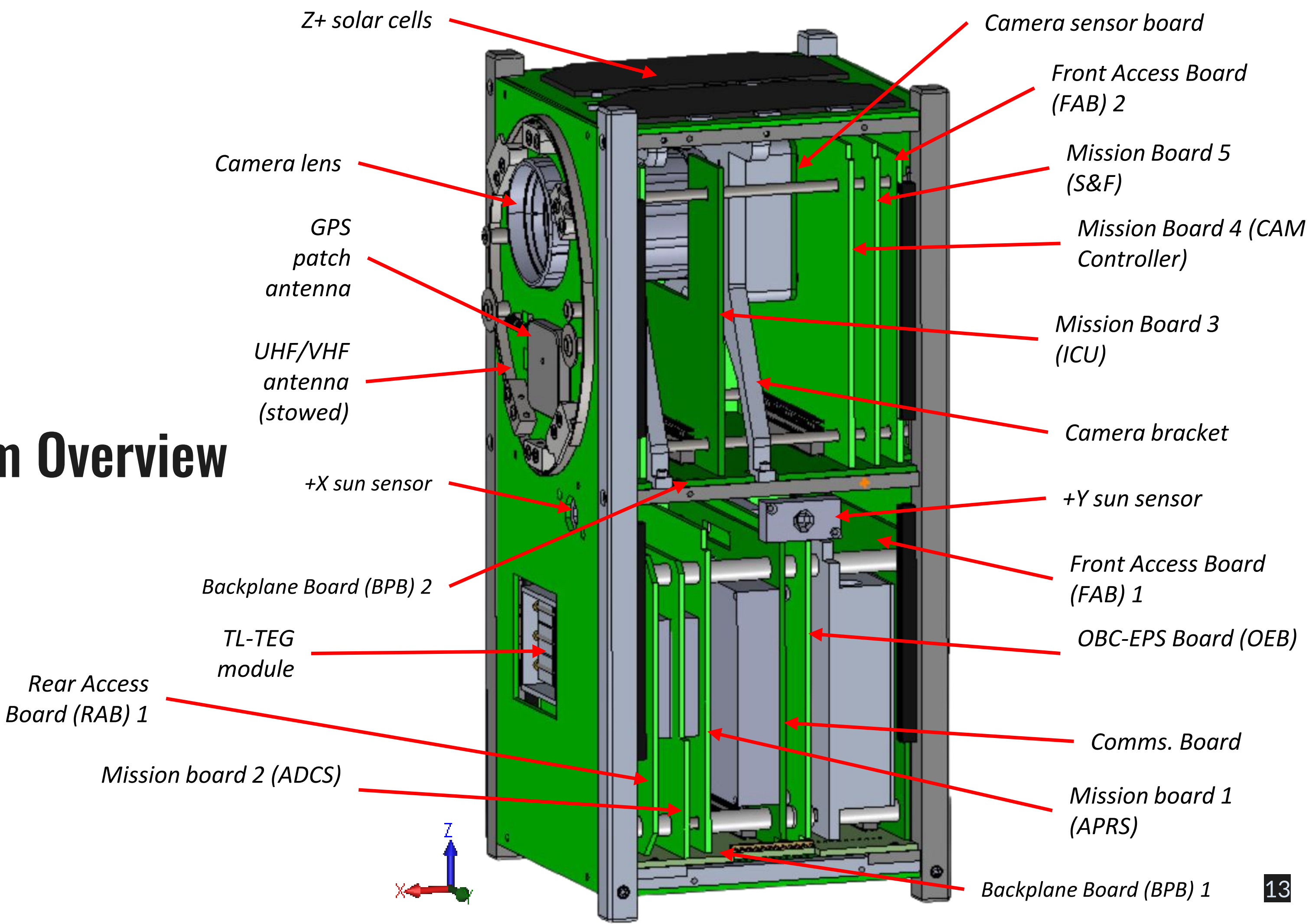
To demonstrate/explore the feasibility of the use of the following for future satellite missions:

- Thermal Louvers (TL)
- Thermoelectric Generators (TEG)
- Hybrid Attitude Determination and Control Subsystem (ADCS)

SUMMARY

❑ Primarily an educational satellite project which will use amateur radio frequencies
❑ 2U CubeSat form factor measuring 10 cm x 10 cm x 22.7 cm and weighing less than 2.7 kg
❑ Adopts the design heritage of the BIRDS-5 bus and Maya-5 & Maya-6 CubeSats
❑ ISS orbit (~400 km, roughly circular, 51.6°inclination)
  O Launch method: Deployment from the ISS
❑ Will mainly utilize the Amateur Radio and Satellite Station (ARSS) facility of UPD EEEI for operation

Satellite System Overview



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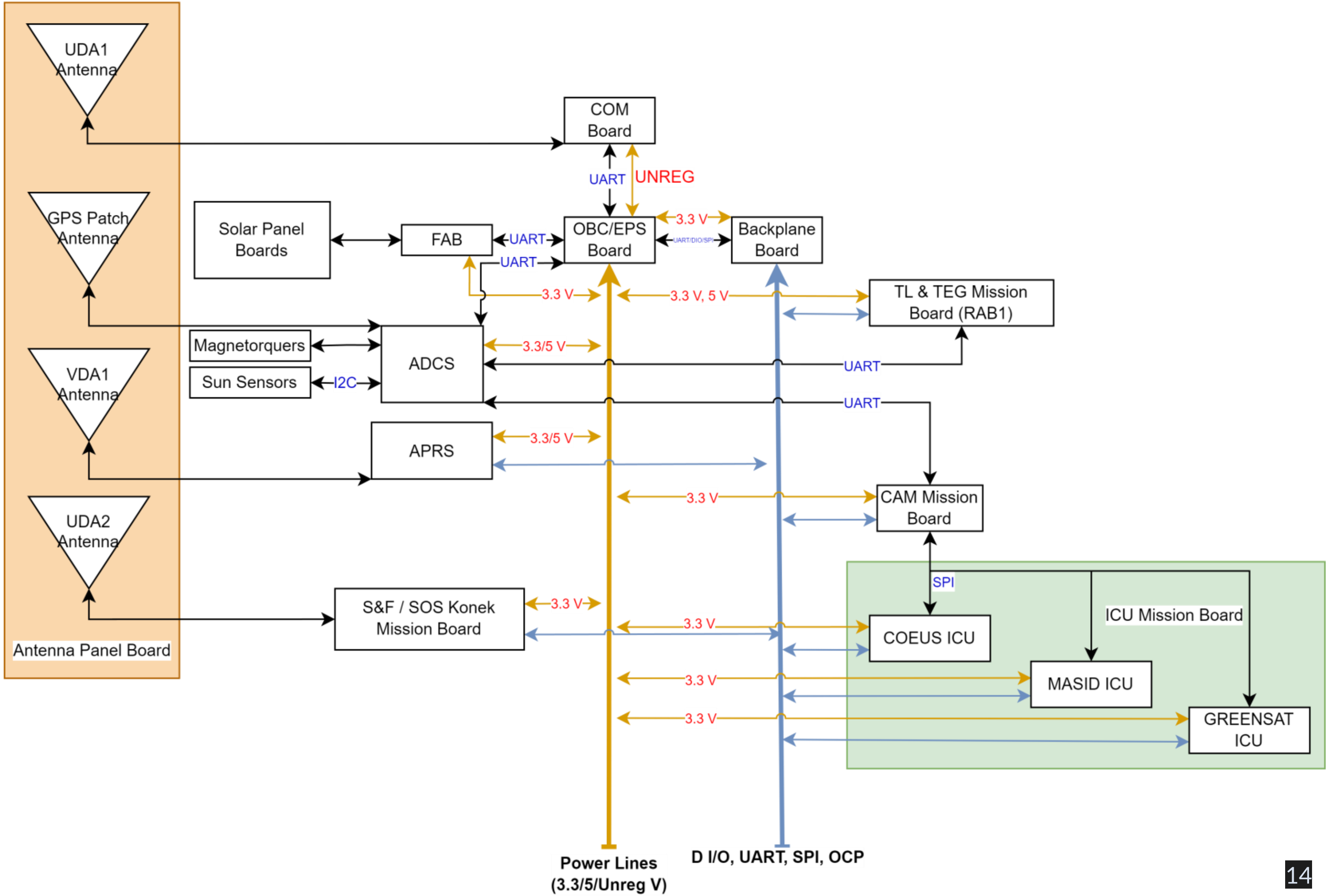
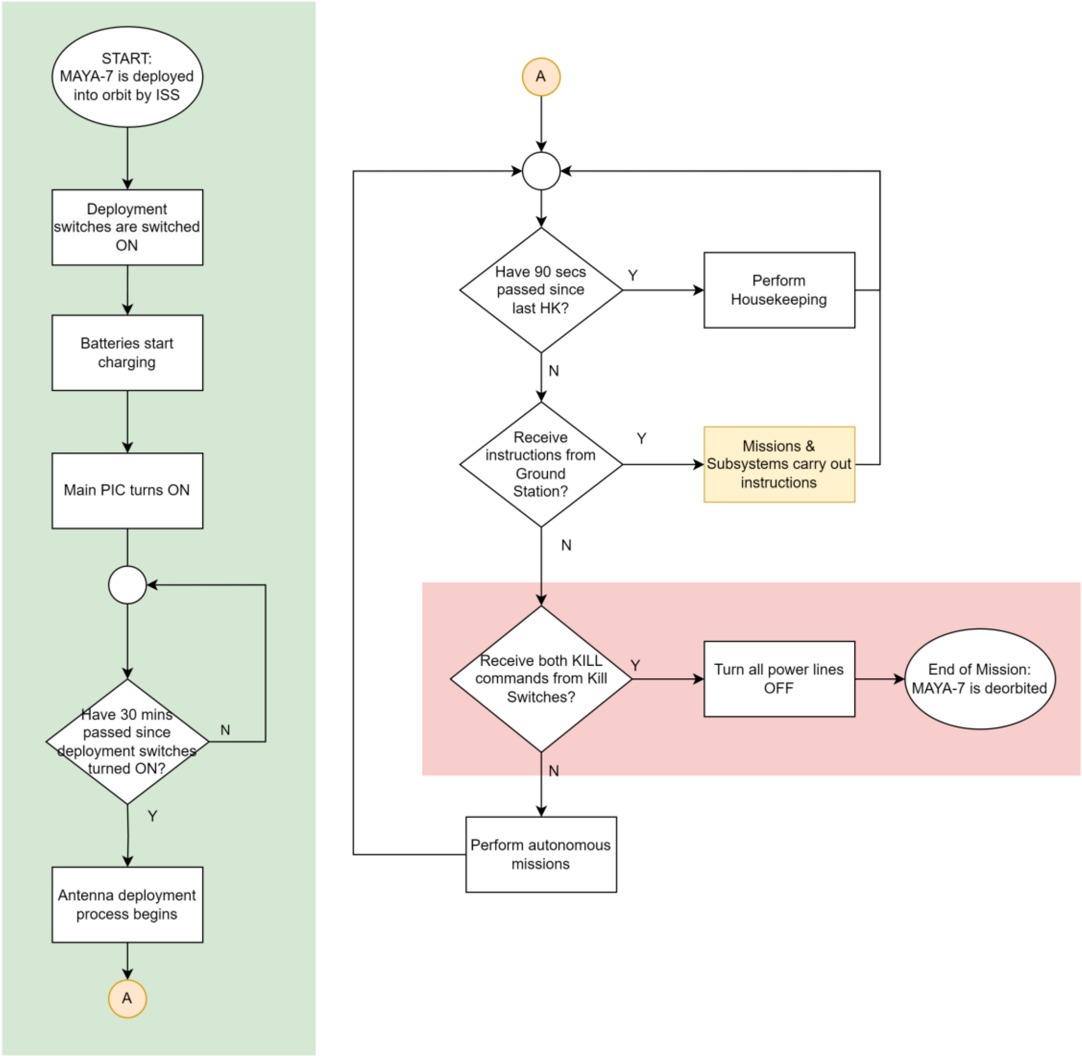
SYSTEM BLOCK DIAGRAM



TOP-LEVEL CONOPS



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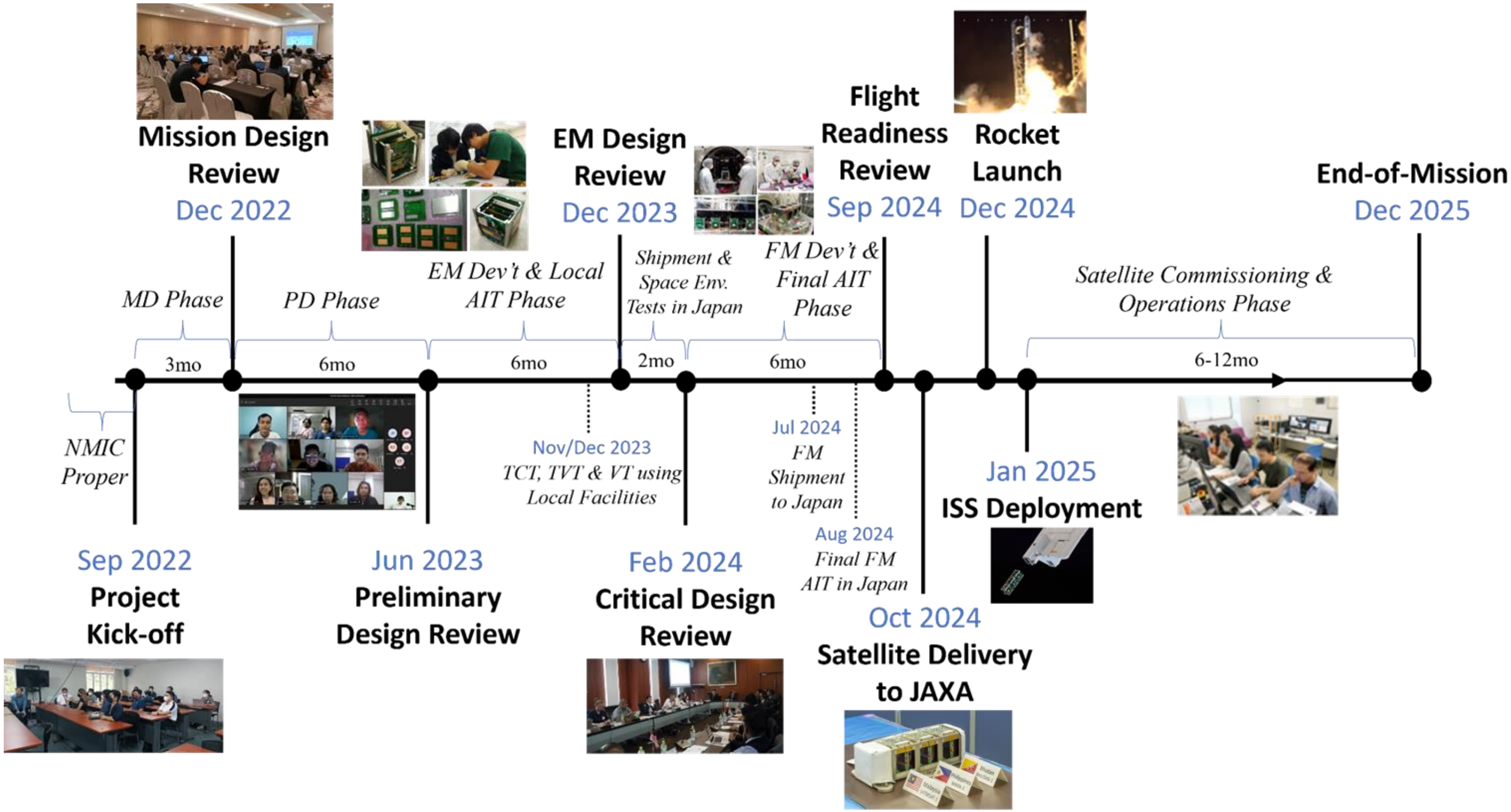
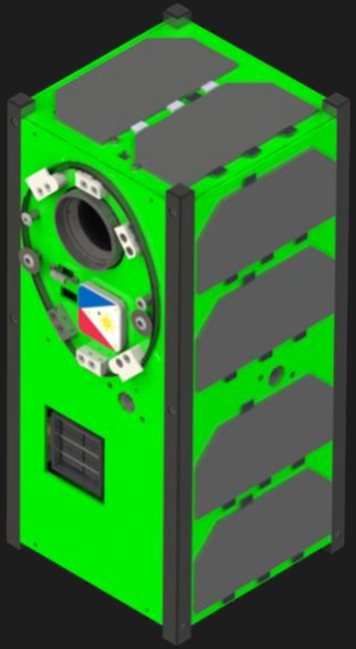
MAYA-7 PROJECT TIMELINE



MD: Mission Design
PD: Preliminary Design & Prototype Development
EM: Engineering Model
FM: Flight Model

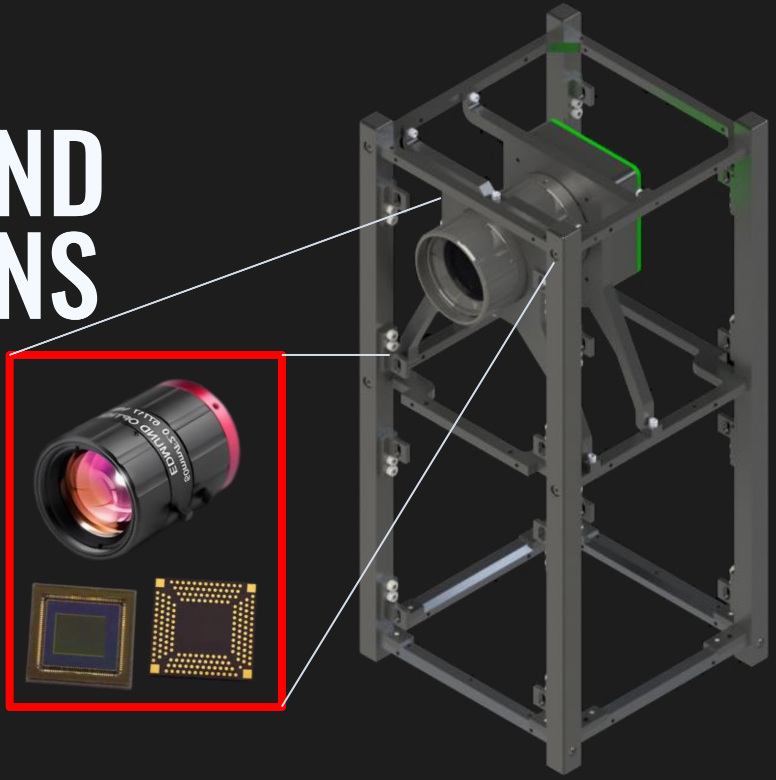
AIT: Assembly, Integration & Test
TCT: Thermal Cycle Test
TVT: Thermal Vacuum Test
VT: Vibration Test



MAYA-7 MISSIONS

Ariel Nopre, Jr.

SENSING UNIT FOR LAND IMAGERY APPLICATIONS PAYLOAD (SULIAP) MISSION



MISSION STATEMENT

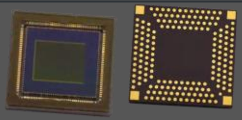
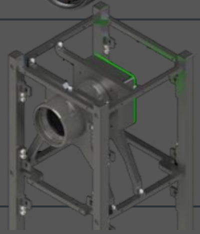
SULIAP is a camera mission (CAM) that introduces the technology demonstration of a camera system using a commercial-off-the-shelf (COTS) lens and image sensor that will capture RGB-NIR (RGBN) images and to provide raw images for the ground station and on-board image classification units missions.

SULIAP will include a Data Handling Unit (DHU) that incorporates Field Programmable Gate Array (FPGA) interfacing with the imager Front-End Electronics (FEE) and is responsible for the configuration of the image sensor and storing image data generated, managing, and making the data available for downlink.

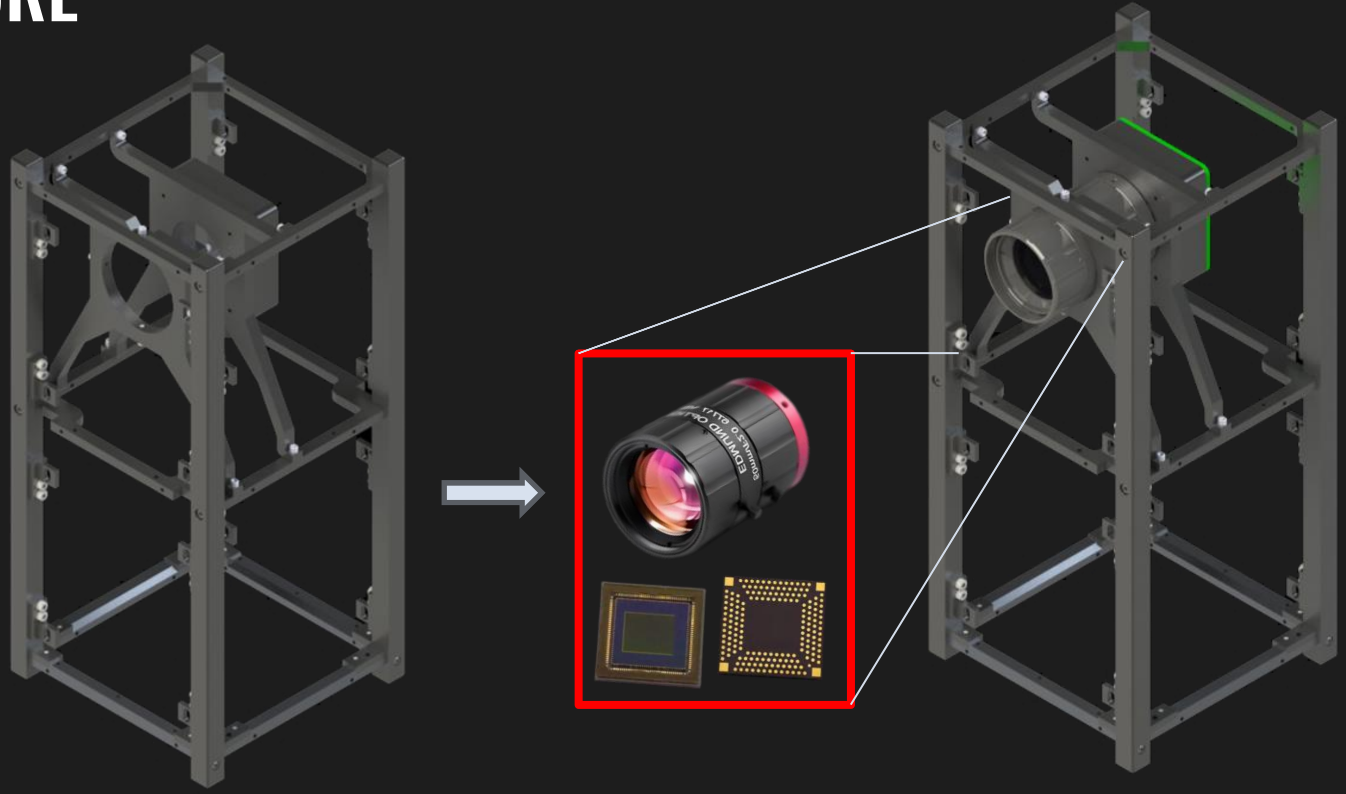
MISSION GOALS

1. To design a special-purpose camera controller, sensor board, and optomechanical assembly for the image sensor and lens that will fit a 2U cubesat platform (100mm x 100mm x 227mm) with mass not exceeding 270g (10% of the total mass).
2. To evaluate the performance of a modified COTS camera system that will qualify for space.
3. To have a ground sensing distance (GSD) resolution of < 80 m or better at nadir on-axis at 400 km altitude.
4. To capture and store raw RGBN image data from space to a desired location in the Philippines and any location of the Earth and space.
5. To send raw image data to the ground station and on-board image classification units (ICU) for mission analysis.

MAYA-5/6 AND MAYA-7 CAM COMPARISON

	MAYA-5/6	MAYA-7
Mission	Can capture in RGB	Can capture in RGBN
MCU	ATmega2560V	FPGA iCE40LP1K
Image Sensor	ArduCAM OV5642 Camera Shield LENS (Lensagon B5M2916C) SD RAM (W9864G) 	CANON LI5040SAI 
Lens		C VIS-NIR Series Fixed Focal Length Lens (Edmund Optics) 
Optomechanics		C-mount Lens bracket and Sensor board housing bracket 
GSD (Spatial Resoluion)	140.77 m	54.4 m
EFL	4.475 mm	50 mm
Weight	18.778g (actual)	107g
Horizontal FOV	44°	10°
Maximum Swath	364.88 km	141 km

SULIAP STRUCTURE



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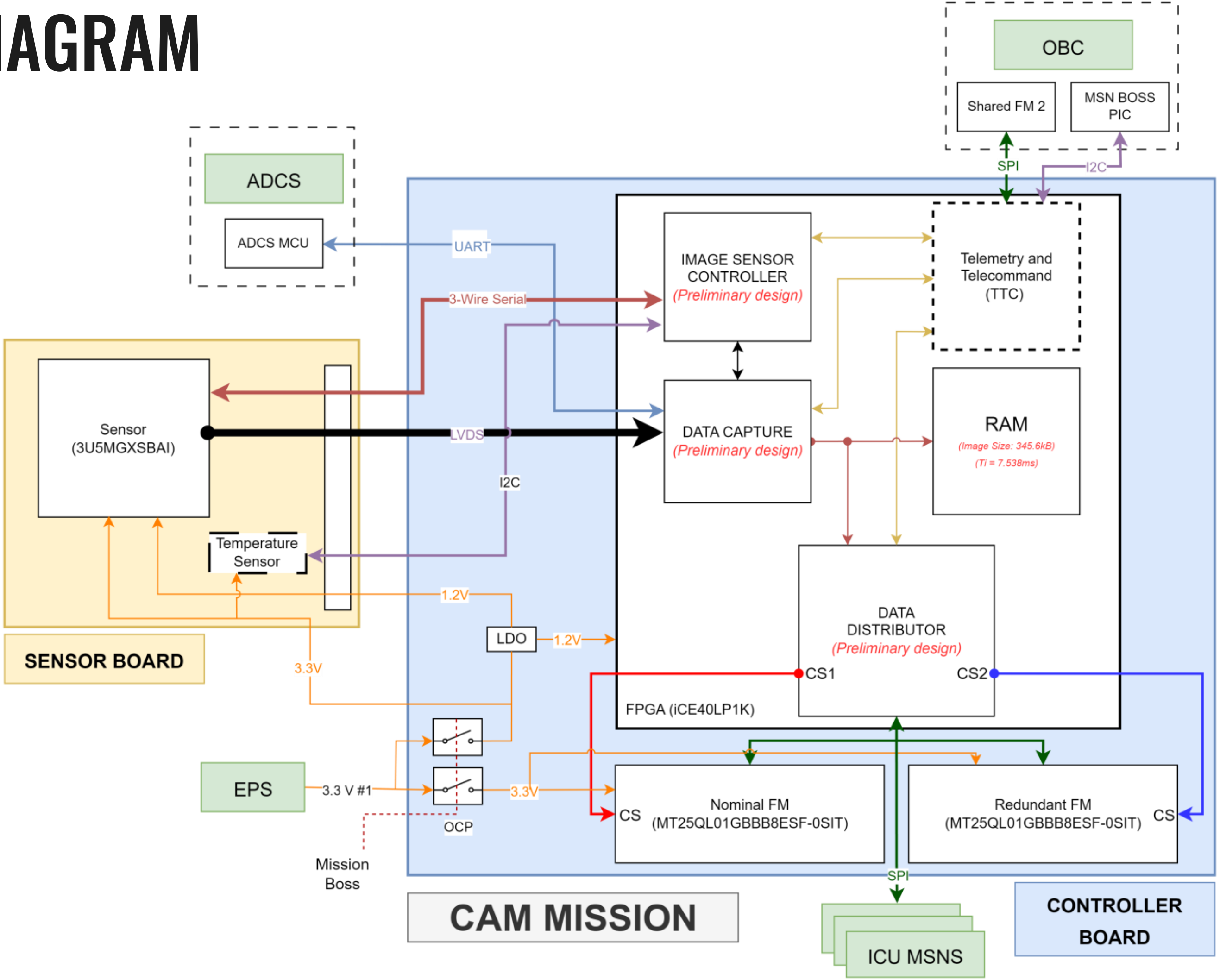
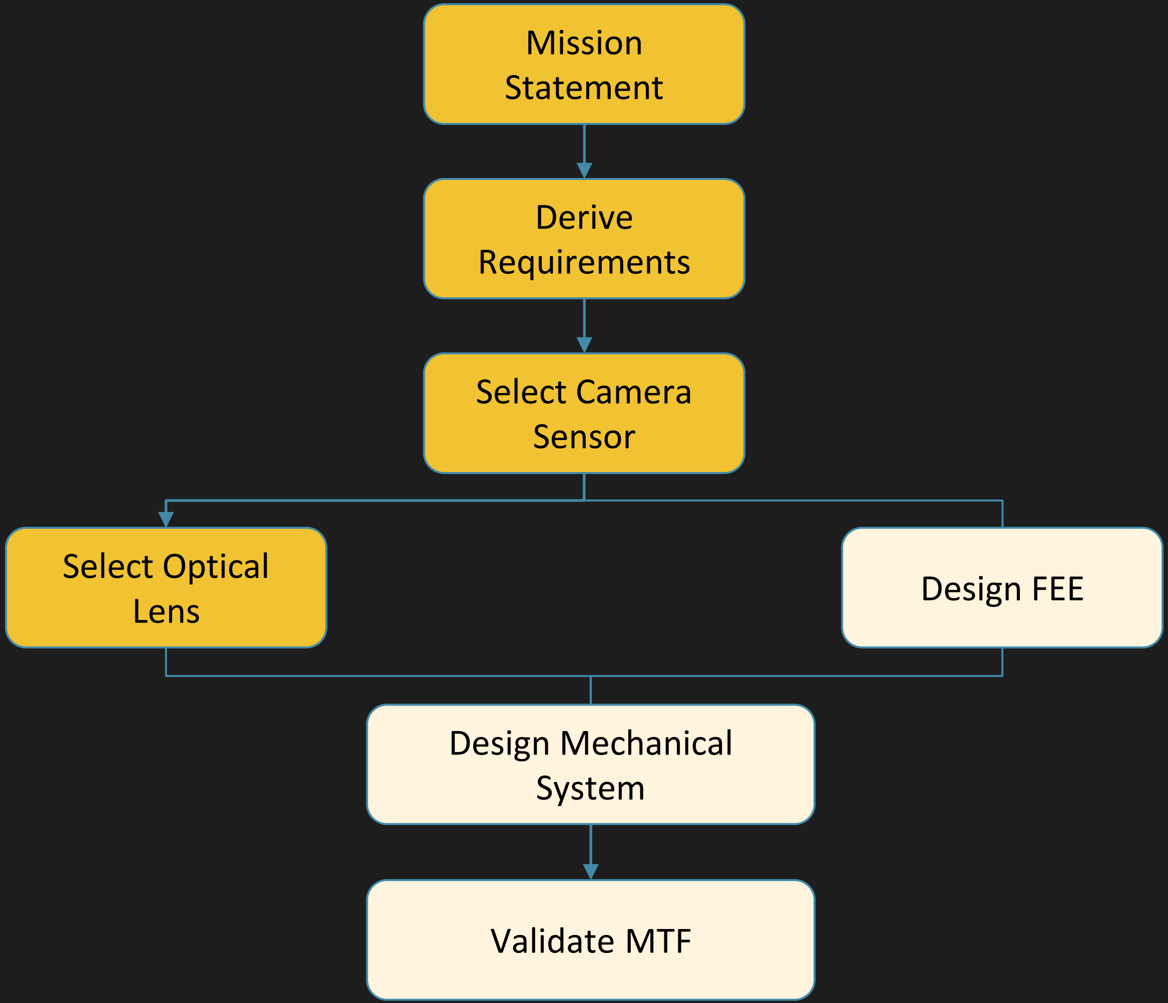


SULIAP DEVELOPMENT



Verified

Partially done/for further tests

Image Classification Units (ICUs)

NMIC Teams

TEAM COEUS

Coastal Observation for Erosion Detection Using Satellite Imagery

TEAM MASID

Observing Vegetation Health Using NDVI from Single RGBN Camera

TEAM GREENSAT

Vegetated Land Cover Mapping and Monitoring Using Optical Remote Sensing and On-Board Image Classification

COASTLINE OBSERVATION FOR EROSION DETECTION USING SATELLITE IMAGERY (COEUS)

MISSION STATEMENT

Coastal erosion or shoreline retreat is currently affecting many coastal areas in the Philippines causing adverse impacts on society, the economy, and the environment. Thus, there is a need to monitor coastal erosion or shoreline retreat in the country. By using an NIR camera on-board a satellite, critical areas at risk to coastal erosion/shoreline retreat can be identified and delineated.

The Image Classification Mission shall require the satellite to classify the captured images as coastline and not coastline. Classifying the captured images before transmitting to the ground station can help in the efficient usage of downlink resources.

MISSION GOALS

1. To employ image classification in a low-memory and low-power microcontroller.

2. To transmit images classified as coastline to the Ground Station for further image processing.

OBSERVING VEGETATION HEALTH USING NDVI FROM SINGLE RGBN CAMERA (MASID)

MISSION STATEMENT

Masid Mission shall require the satellite to capture RGB-NIR images to generate NDVI maps for forest and vegetation health observation

MISSION GOALS

1. To perform onboard channel separation and demosaicing of RBGN images
2. To generate NDVI maps using images captured by the camera
3. To observe the health and coverage of Philippine forests using NDVI

VEGETATED LAND COVER MAPPING AND MONITORING USING OPTICAL REMOTE SENSING AND ON-BOARD IMAGE CLASSIFICATION (GREENSAT)

MISSION STATEMENT

The Vegetated Land Cover Mapping and Monitoring Using Optical Remote Sensing and On-Board Image Classification Mission, shortened as GreenSat ICU, is an experimental capacity building mission aiming to show the potential optimization of satellite resources through on-board image classification of vegetative land.

The ICU mission utilizes a high-performance, low-power microcontroller and artificial intelligence to perform on-board image classification identifying vegetative land.

MISSION GOALS

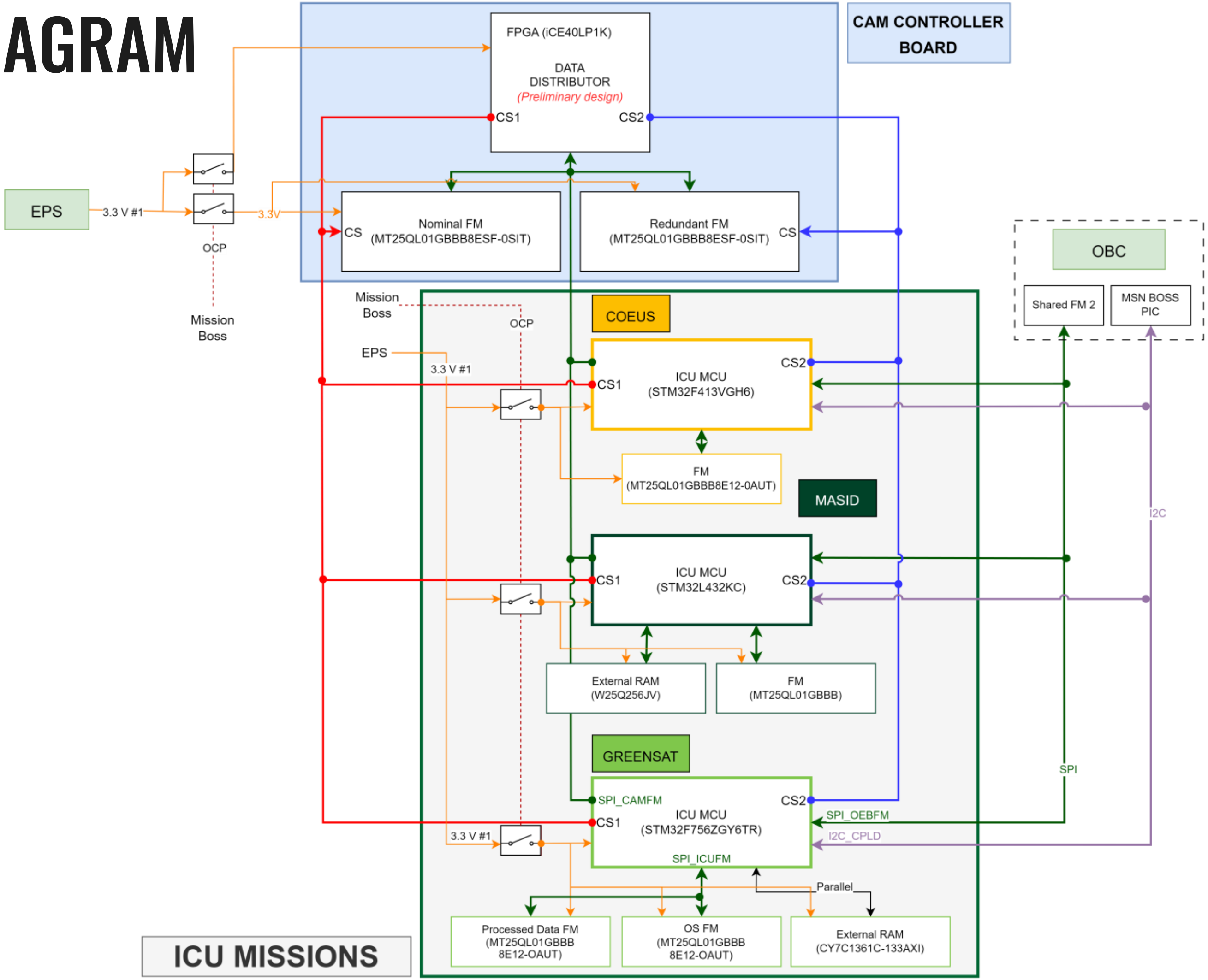
1. To design an on-board image classification unit capable of handling artificial intelligence and image processing
2. To evaluate the performance of artificial intelligence for vegetative land classification
3. To identify vegetated land covers using an on-board image classification unit (ICU) and considering spectral signatures/indices
4. To transmit the images with vegetated land covers to the ground station for storage and/or further processing

MAYA-5/6 AND MAYA-7 ICUs COMPARISON

	MAYA-5/6	MAYA-7		
		COEUS	MASID	GREENSAT
Mission	Earth or space images classification	Shoreline classification	Generate NDVI maps for forest and vegetation health observation	Vegetative land classification
MCU	STM32F429VI	STM32F413VGH6	STM32L432KCU6	STM32F756ZGY6TR
AI Model	MobileNetV2	MCUNetV2	K-means clustering	U-Net model

Read data from Flash Memory (Nominal/Redundant) → Decompress → Classification → Send result

BLOCK DIAGRAM



ICU MISSIONS

STORE AND FORWARD (S&F) WITH GROUND SENSING TERMINAL MISSION

ACCESS NANOSAT

Remote data acquisition from distributed ground terminals

TEAM CTU TRACKERS

(NMIC Team)

SOS KONEK: Maritime Disaster Early-Warning, and Rapid and Precise Response System

STORE AND FORWARD (S&F) MISSION
(ACCESS)

MISSION STATEMENT

The store-and-forward mission shall demonstrate remote data acquisition from distributed ground sensors across the country.

MISSION GOALS

1. To demonstrate practical applications of remote data acquisition from distributed ground sensors
2. To introduce a low-cost, low-power alternative transceiver (LoRa)
3. To foster collaboration with academe and industry partners

MAYA-5/6 AND MAYA-7 S&F COMPARISON

	MAYA-5/6	MAYA-7	
		ACCESS	CTU TRACKERS
Mission	Collect data from ground sensors and send it to the ground station for analysis.	Demonstrate remote data acquisition from distributed ground sensors across the country	Generate NDVI maps for forest and vegetation health observation
MCU	PIC18F67J94	ATMEGA32U4	ATMEGA32U4
Transceiver	BIM1H	SX1278	SX1278
Flash Memory	MT25QL01GBBB8ESF	MT25QL01GBBB8ESF-0SIT	MT25QL01GBBB8ESF-0SIT
Power Amplifier	-	RF5110G	RF5110G
LNA	-	MAR6SM+	MAR6SM+

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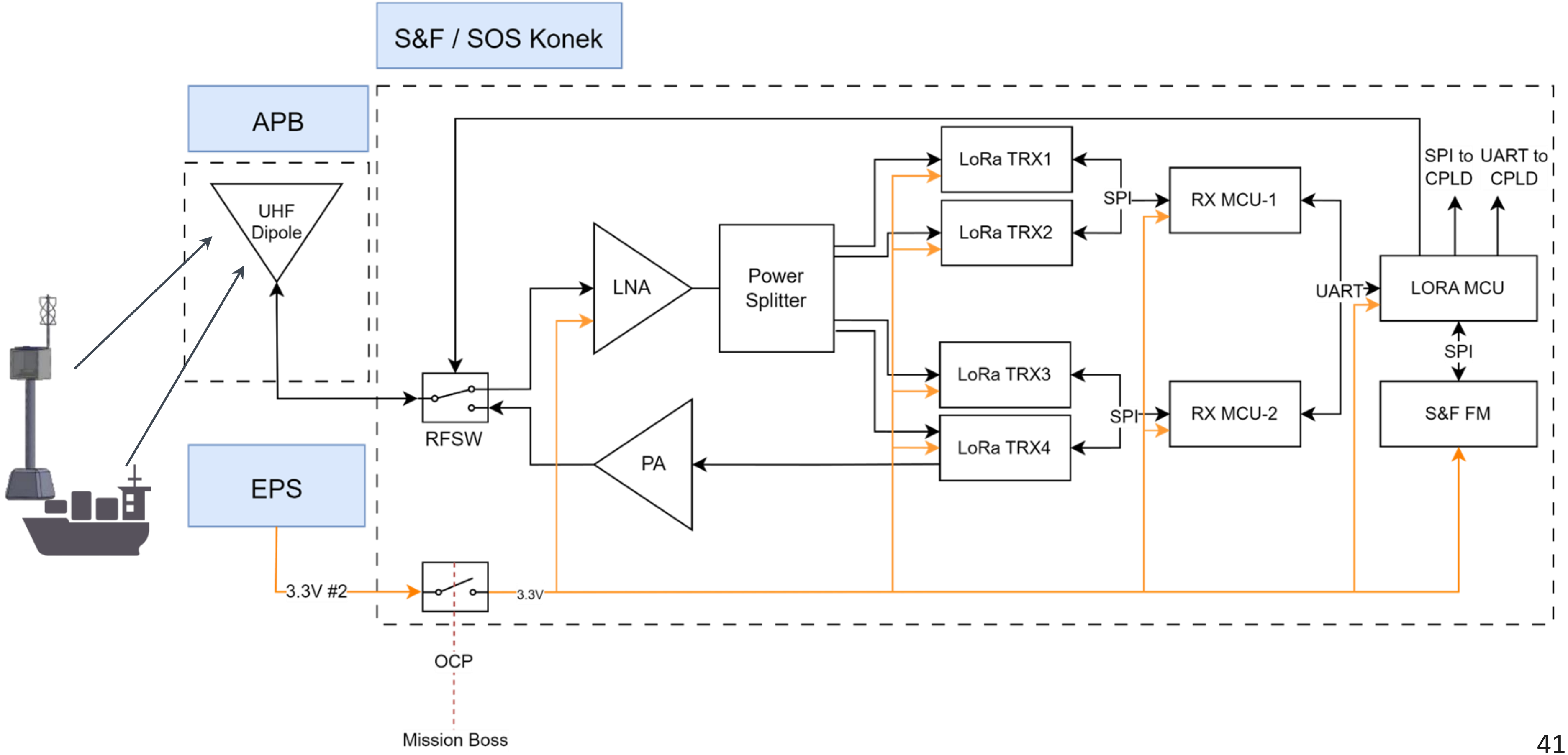

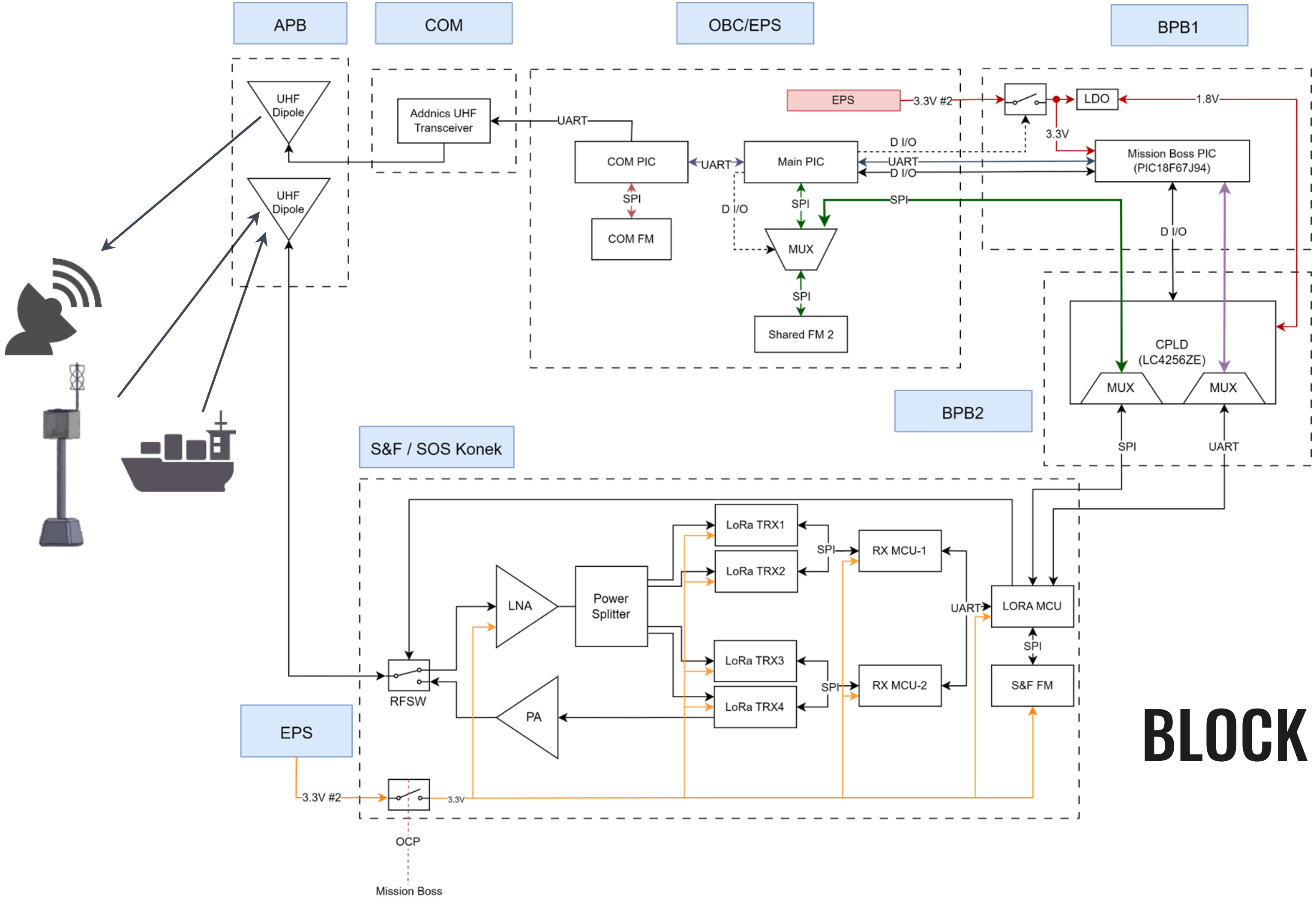

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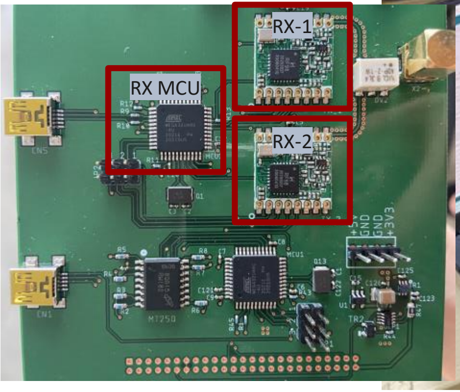
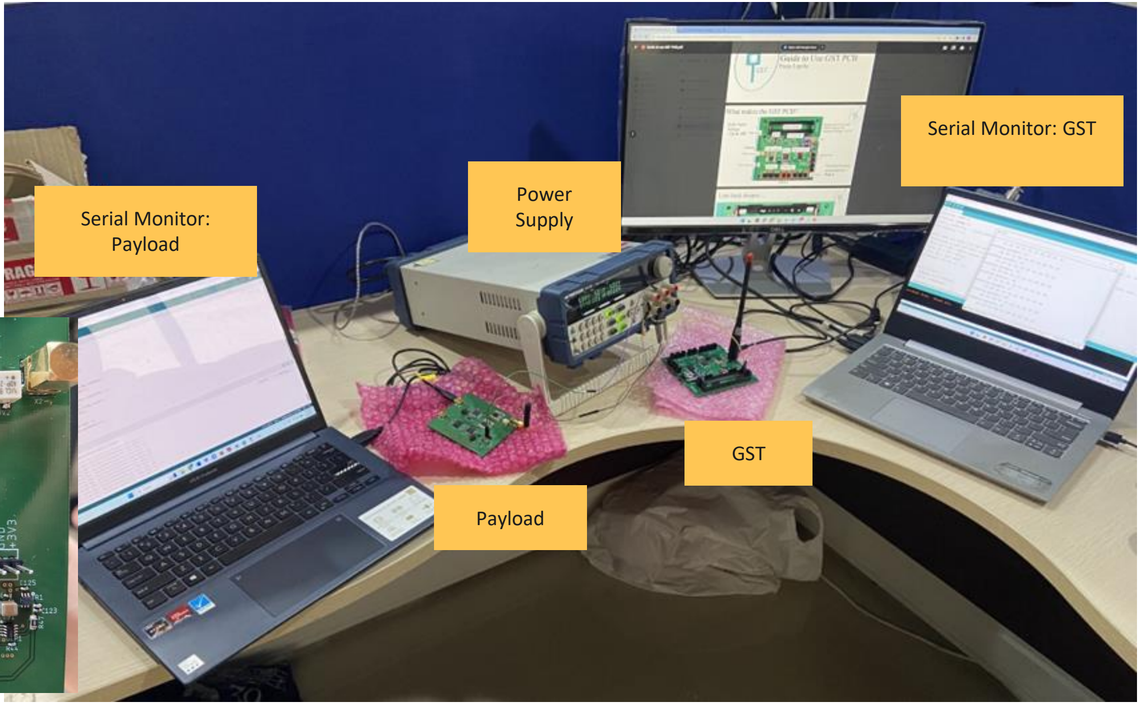
TEST SETUP

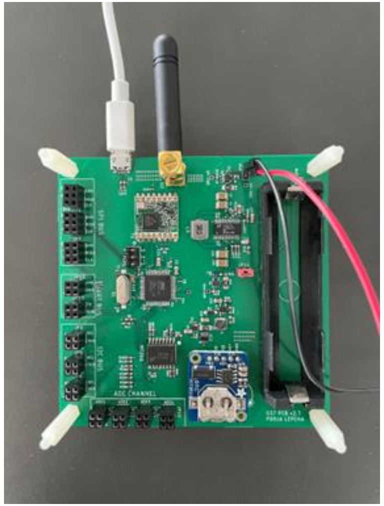
Serial Monitor · · · GST → LoRa Payload · · · Serial Monitor

KITSUNE’s Simplified LoRa Payload



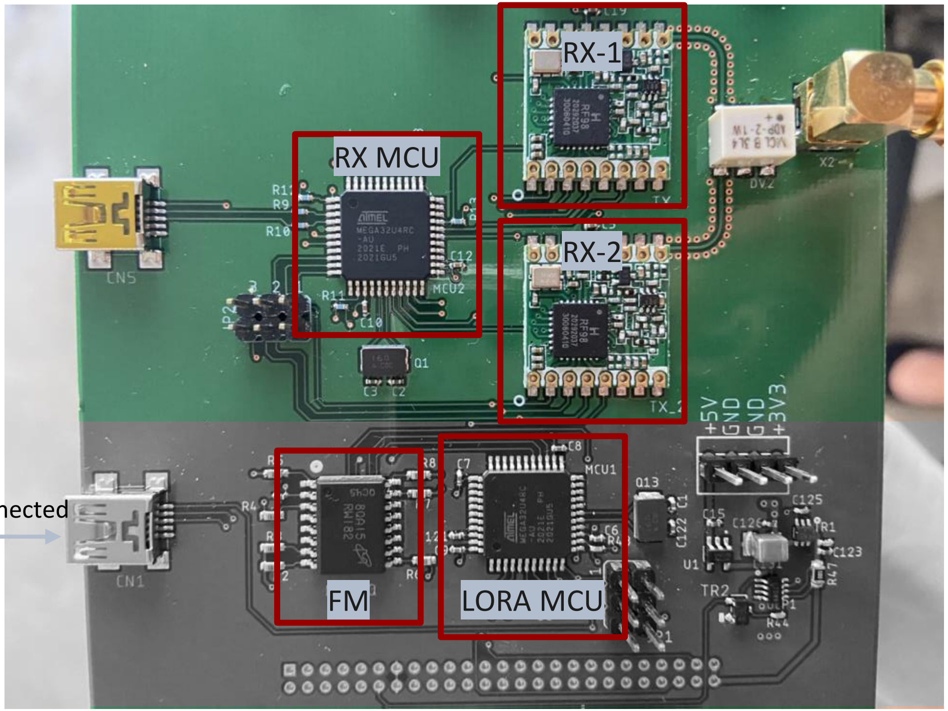


GST PCB from Kyutech



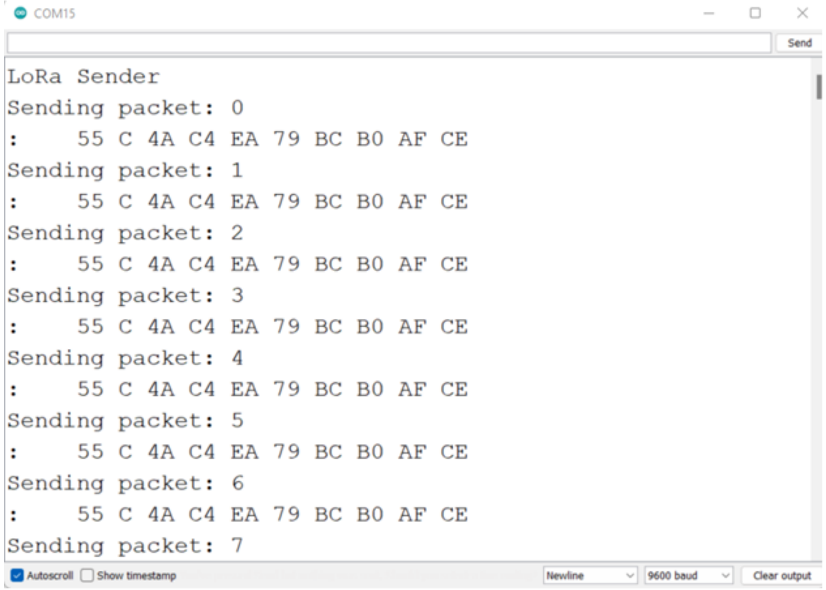
TEST SETUP

The port to which the replaced MCU is connected could not be read.

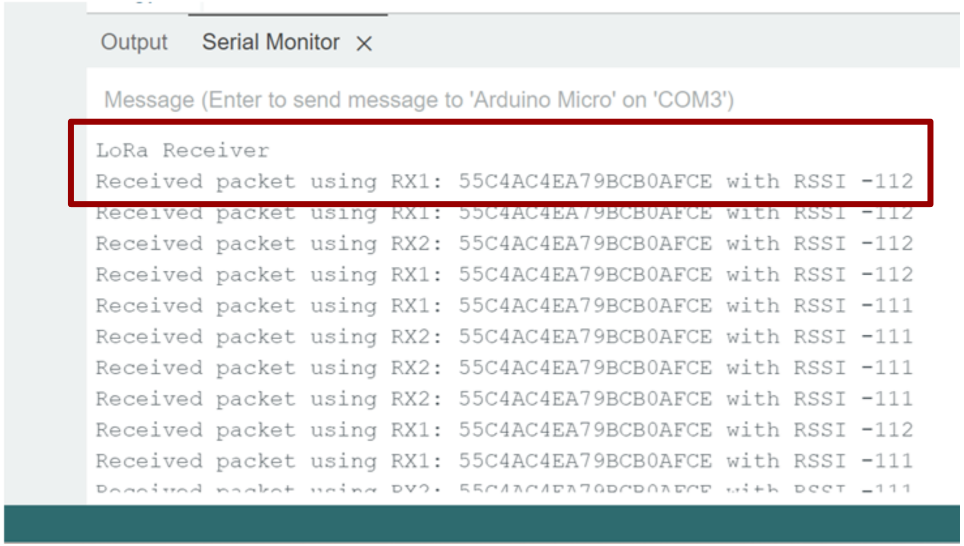


KITSUNE's Simplified LoRa Payload

RESULTS



Packet sent from the GST



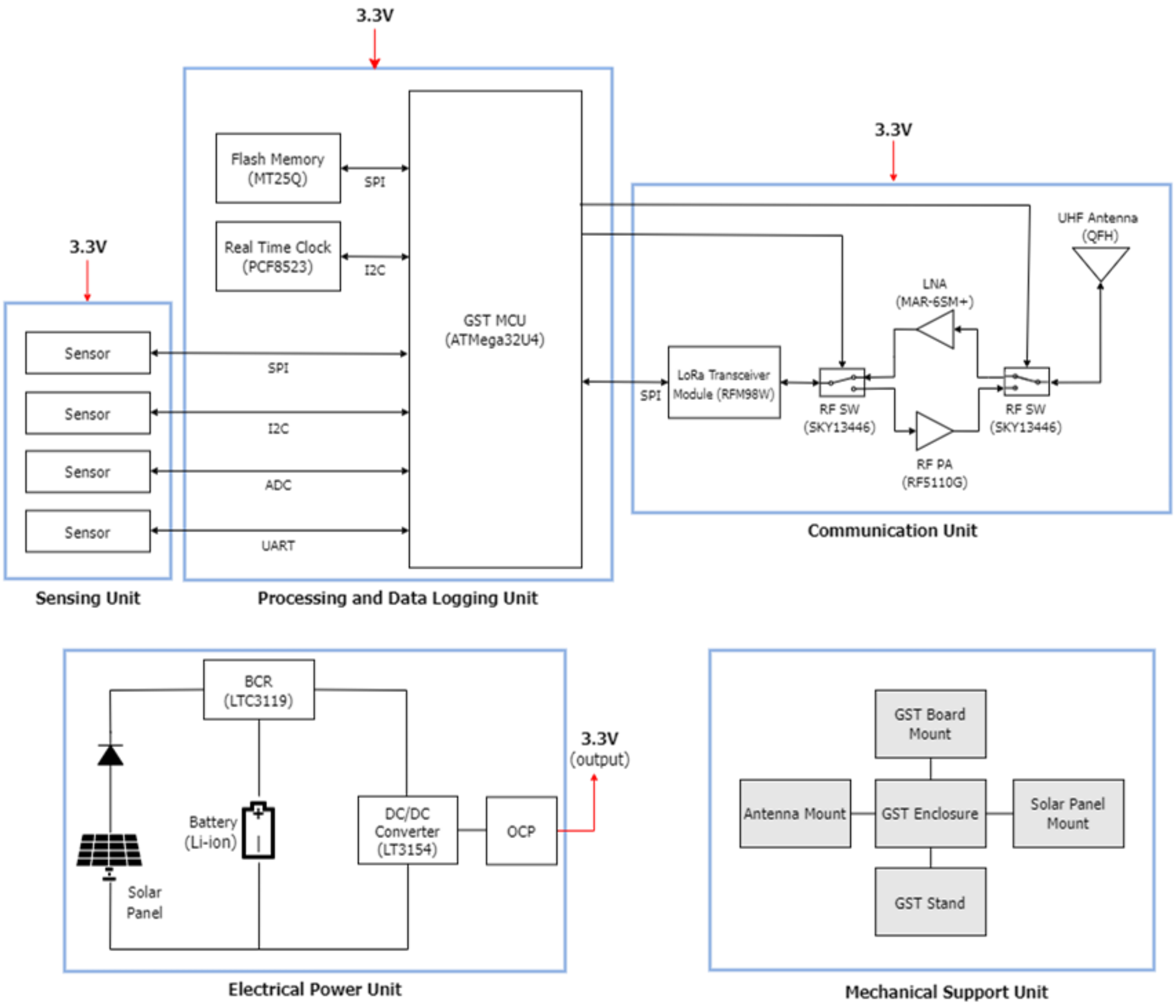
Packet received by the payload

KYUTECH VS ACCESS DESIGN PCB LAYOUT

Kyutech vs ACCESS Design

ITEM	KYUTECH	ACCESS
LNA	MAR6SM+	MAR6SM+
PA	-	RF5110G
POWER SPLITTER	(1) 2-WAY (2) 4-WAY	(1) 4-WAY
LORA TRX	(8) SX1278	(4) SX1278
MAIN MCU	(1) ATMEGA32U4	(1) ATMEGA32U4
RX MCU	(4) ATMEGA32U4	(2) ATMEGA32U4
FLASH MEMORY	NOT ON BOARD	ON BOARD

BLOCK DIAGRAM



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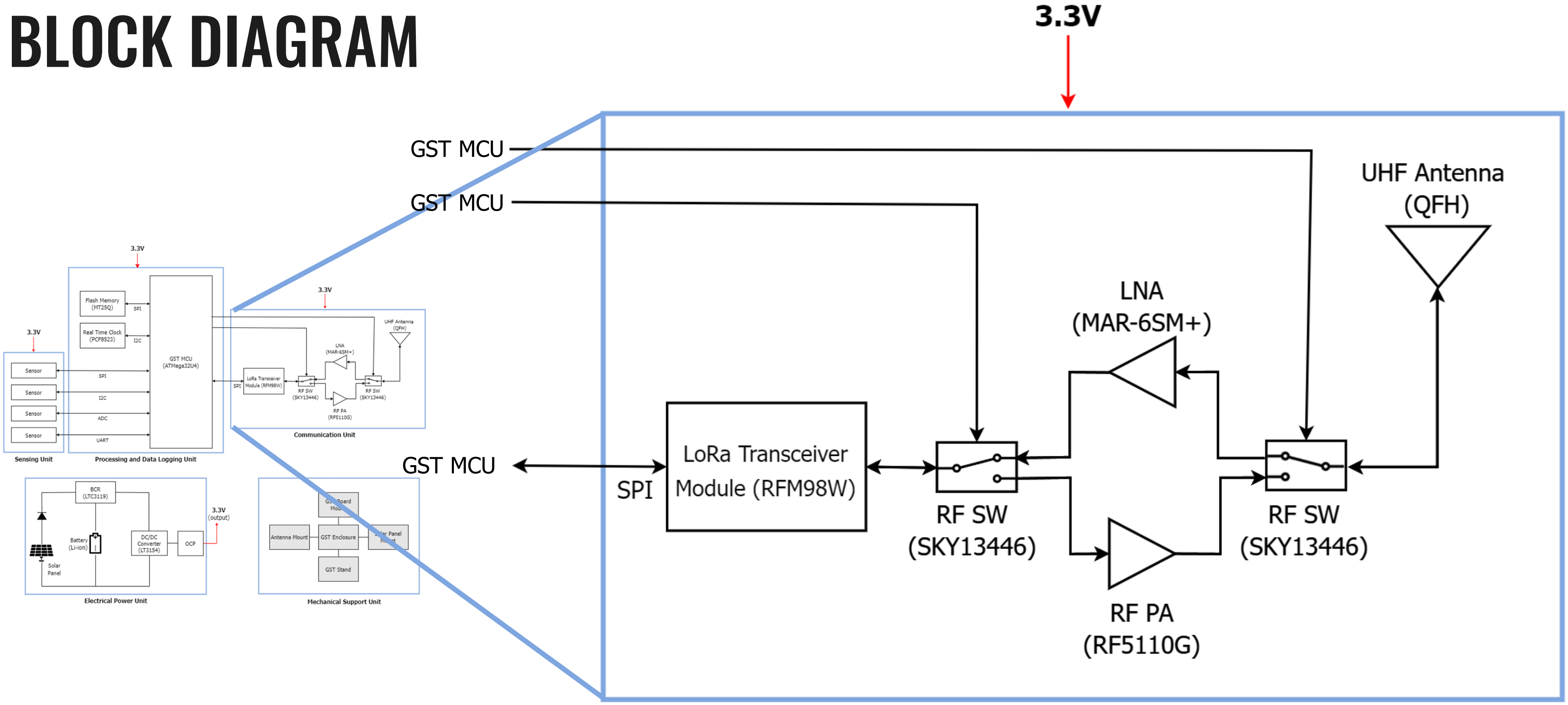

Communication Unit

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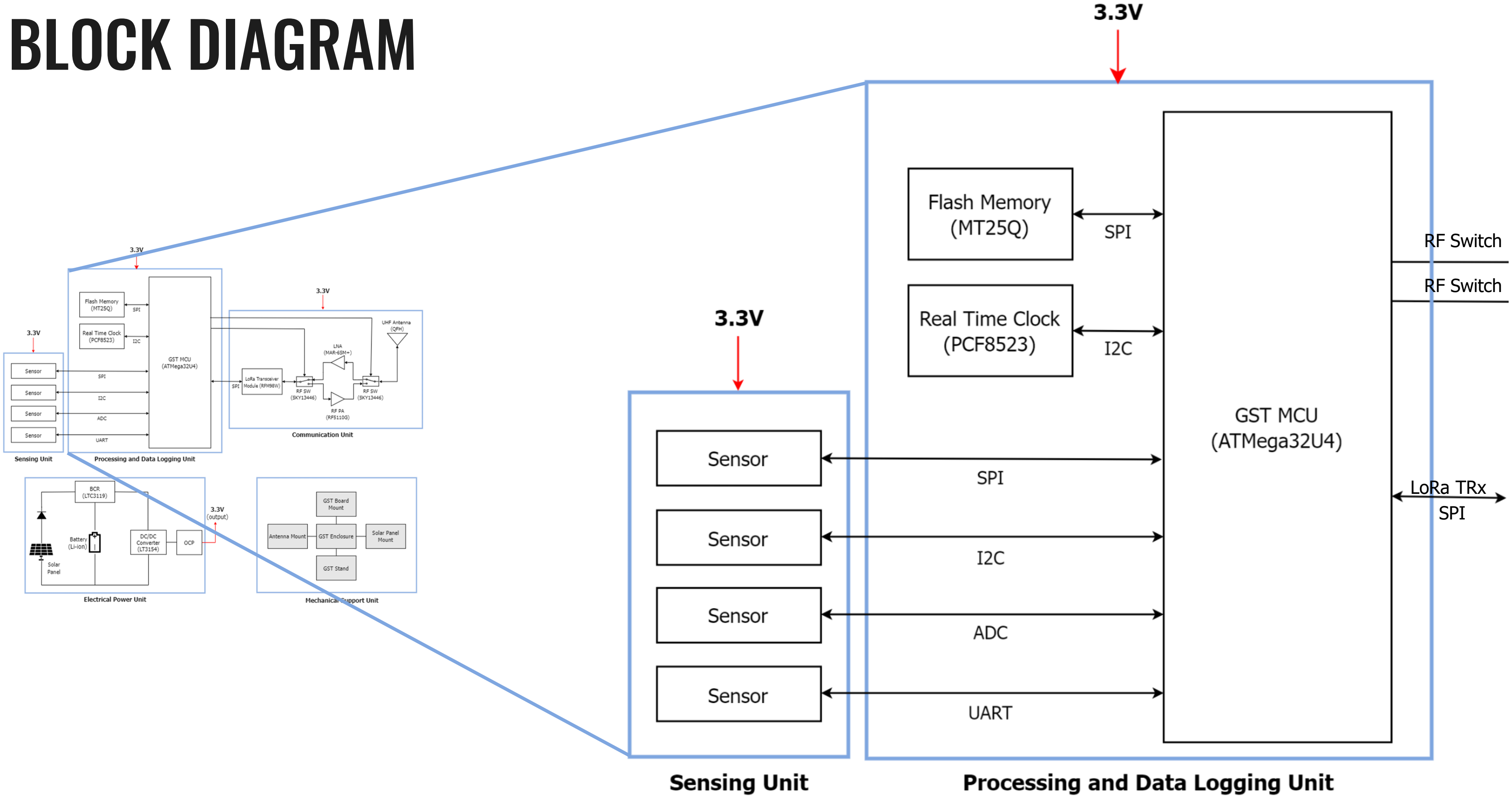

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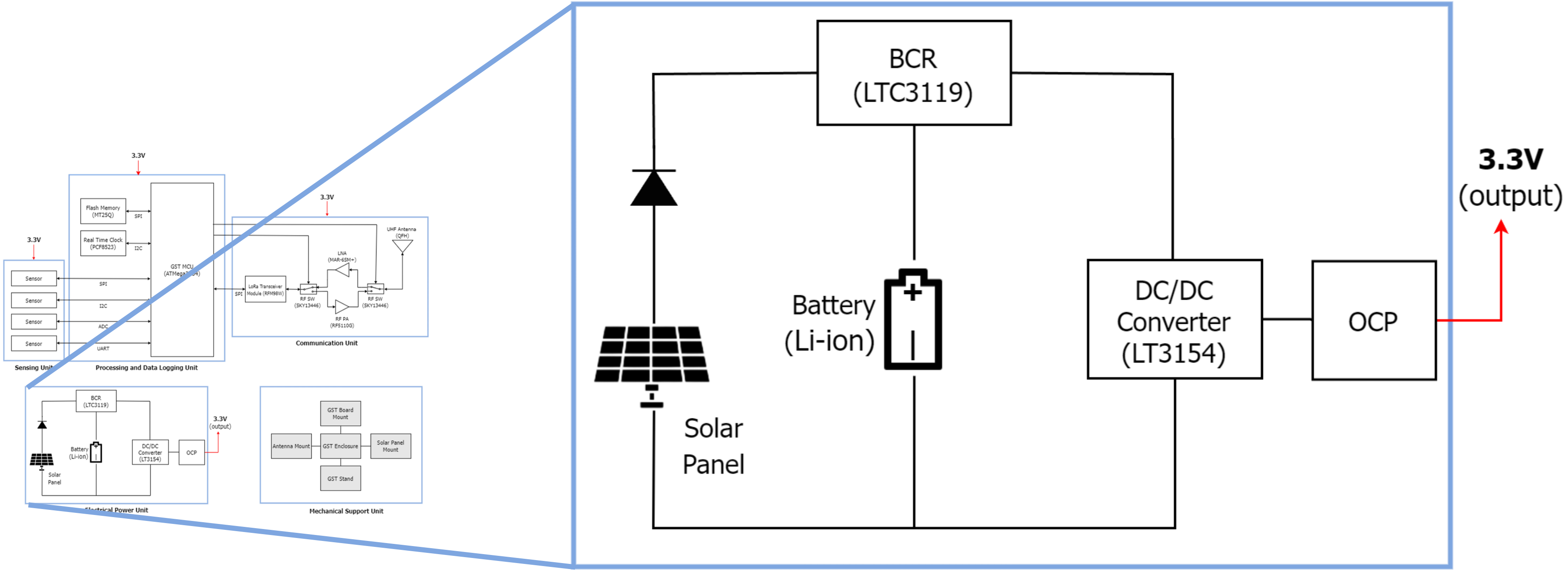

Electrical Power Unit

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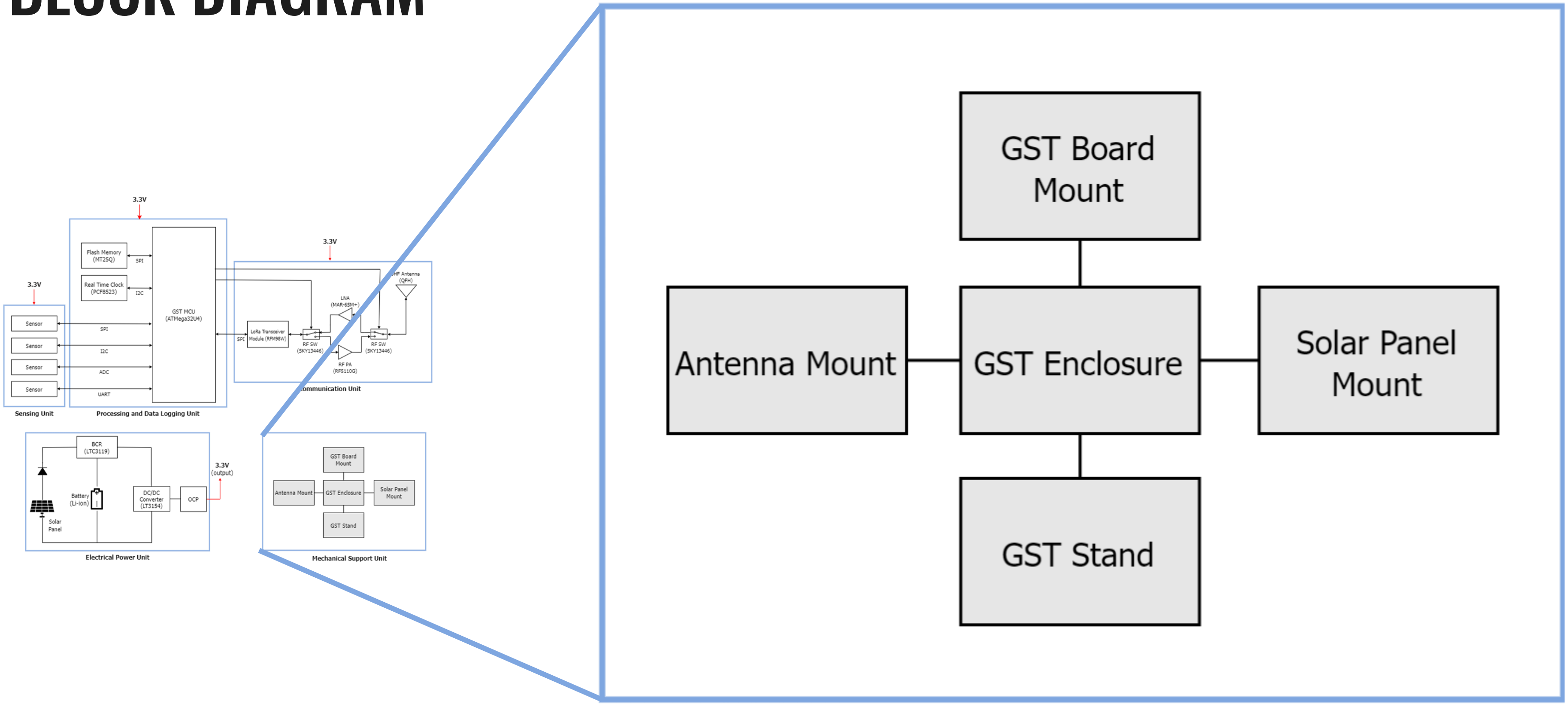


Mechanical Support Unit

POWER BUDGET

Battery Calculation	
Calculated Energy Consumption per day	16.68 Wh
Calculated Energy Consumption for 2-day autonomous operation	34 Wh
Number of 18650 Lithium-ion Batteries ● Nominal voltage: 3.6 V ● Current rating: 3.6 Ah	4 pcs
Total Battery Capacity	51.84 Wh
Solar PV Size Calculation	
Least Peak Sun Hour in a Year [1]	3.4 hr
Solar PV Size = Total Battery Capacity/Least Sun Hour	16 W

Assumptions:

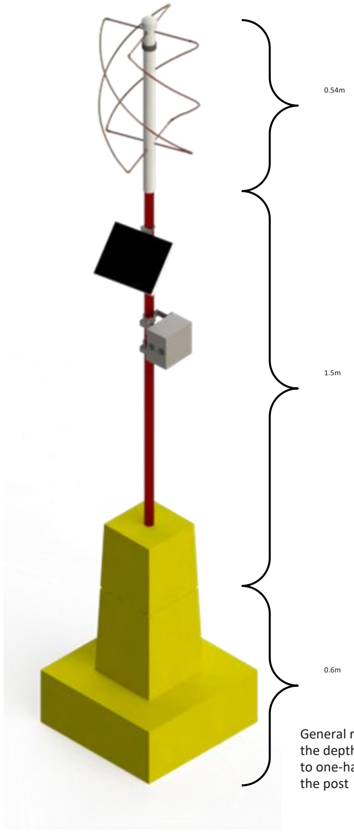
- *Total pass duration of satellite per day:*
  16 minutes/day
- *Total sensor data logging duration per day:*
  8 minutes/day

Notes:

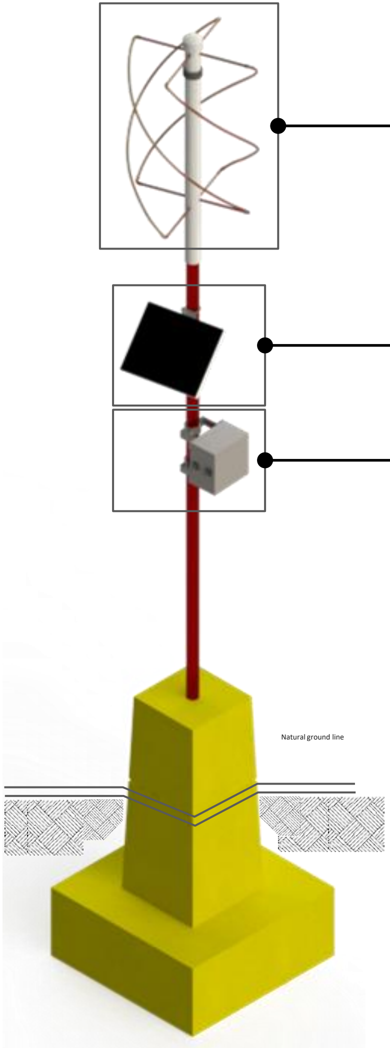
- The computations take into account an 80% system efficiency.
- The values used in the computations are obtained from the datasheet of the GST components.

[1] NREL. "PVWatts Calculator", [Online]. Available: https://pvwatts.nrel.gov/

STRUCTURE



General rule of thumb when setting a post is that the depth of the post’s hole needs to be one-third to one-half of the actual above-ground height of the post



Quadrifilar Helix Antenna

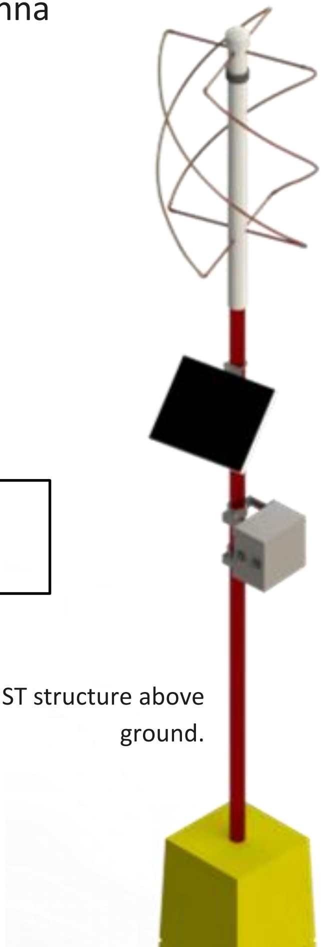
Solar Panel

GST Board Housing

Enclosure IP 6 8 rating (target)

Totally protected against dust

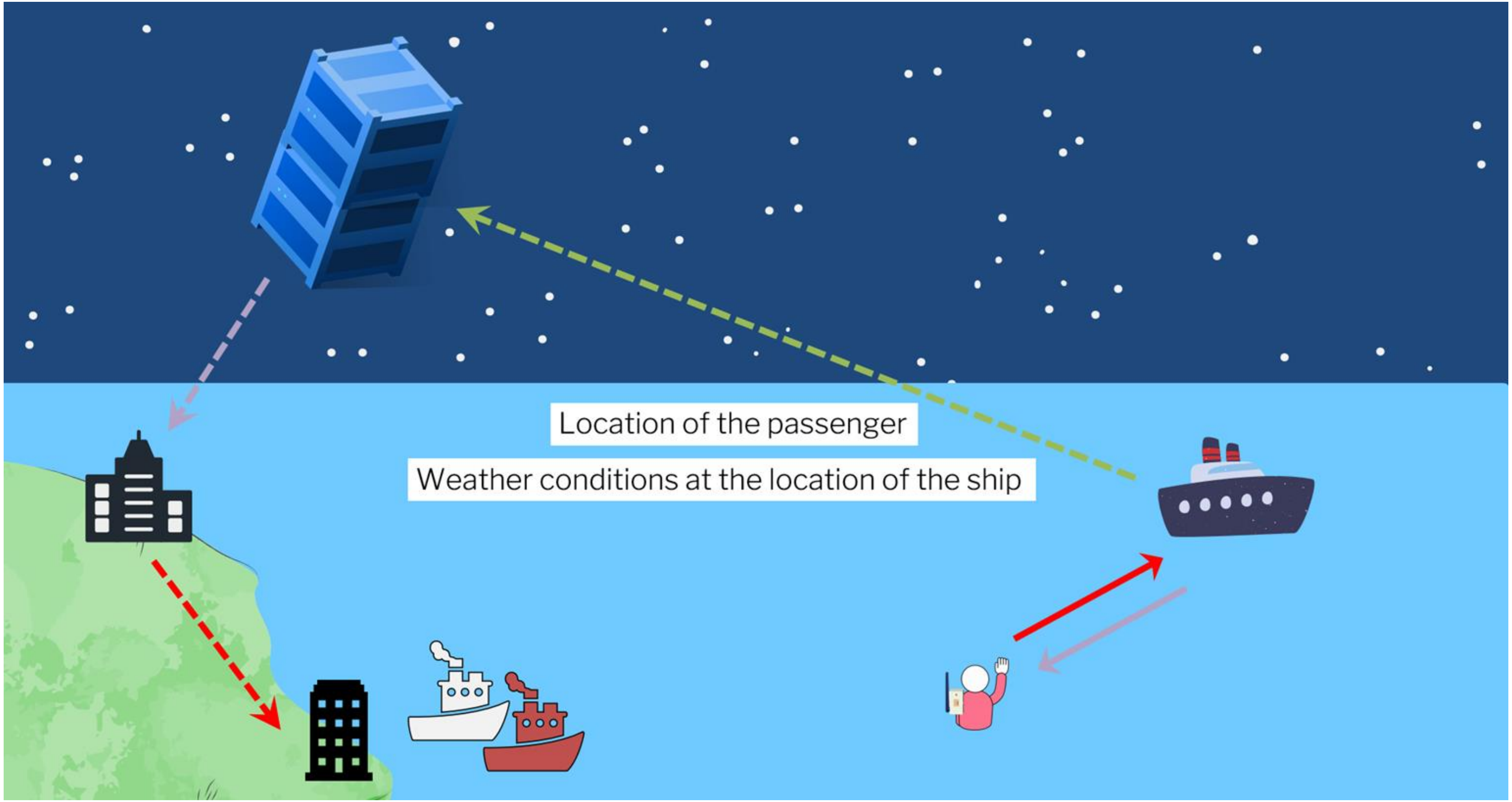
Suitable for continuous immersion in water



View of the GST structure above ground.

SOS KONEK: MARITIME DISASTER EARLY-WARNING, AND RAPID AND PRECISE RESPONSE SYSTEM (CTU TRACKERS)

MISSION CONCEPT



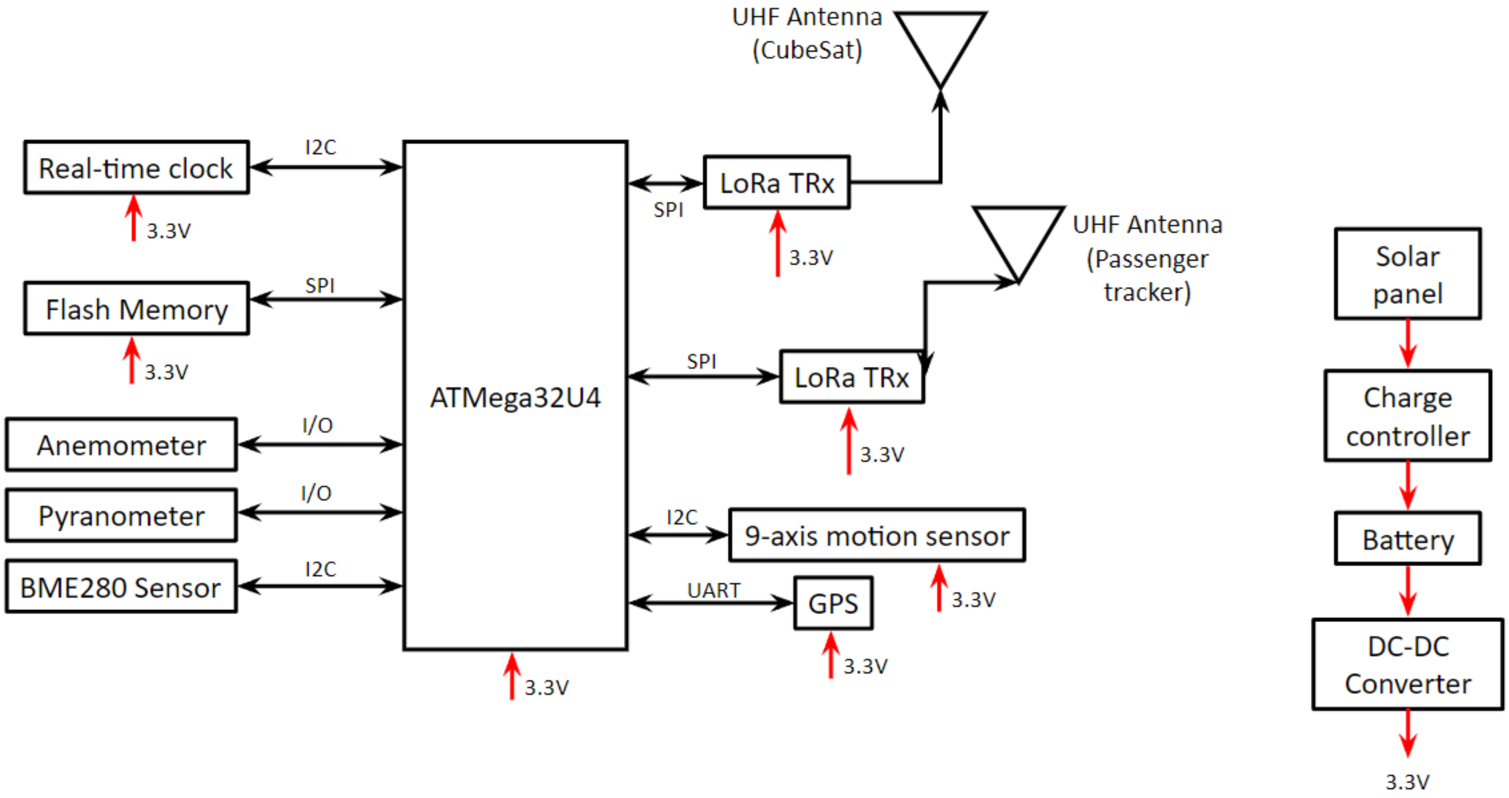
MISSION STATEMENT

To establish a store and forward (S&F) communication system for search-and-tracking with a micro-weather station monitoring.

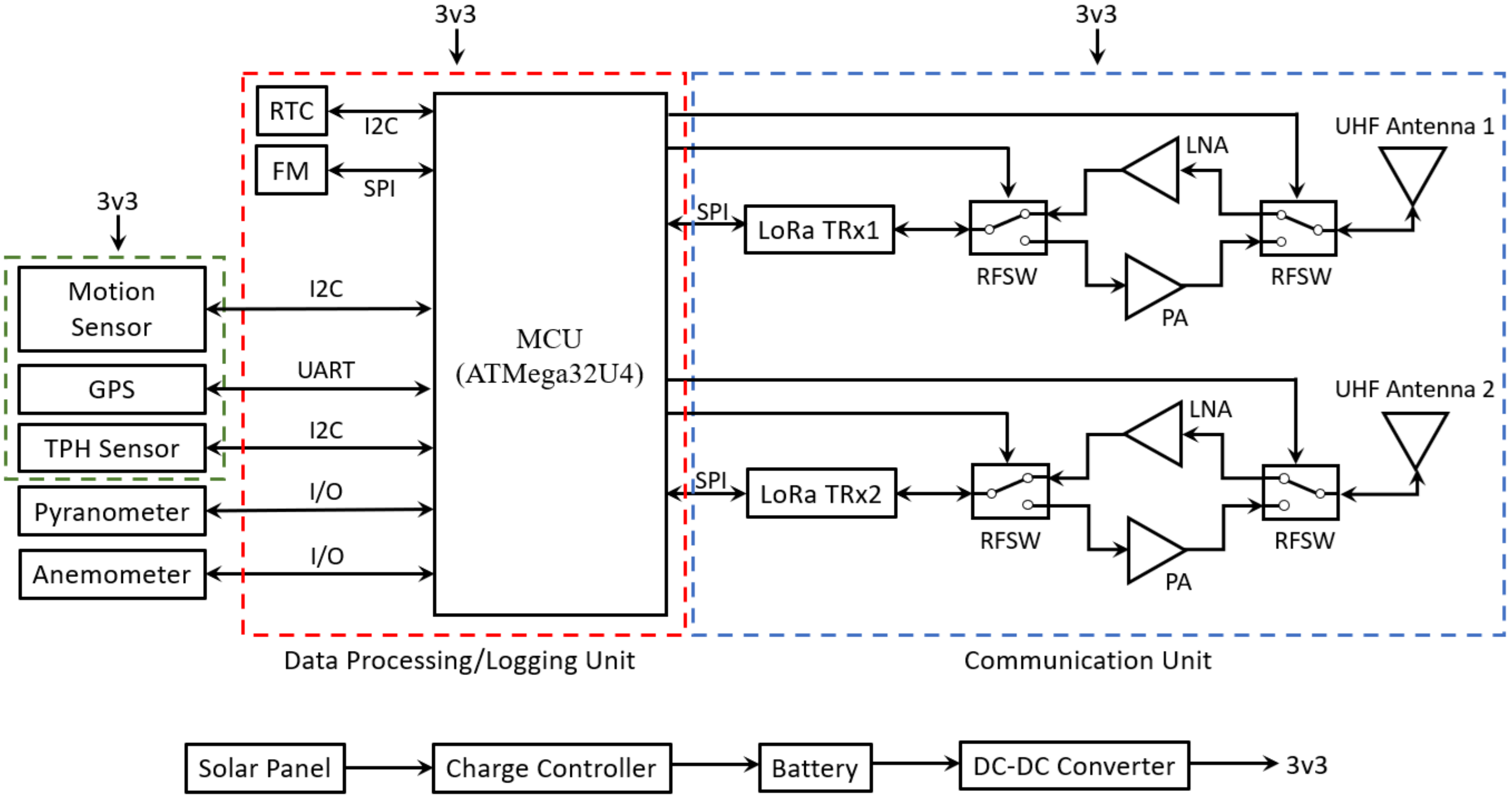
MISSION GOALS

1. A Passenger Tracker that can track the user and send distress signal
2. A mobile ground station terminal (MGST) for vehicles with a system that can store data from a terminal, weather conditions, and send data to the CubeSat
3. Cubesat stores and forwards data from ground stations to command centers

BLOCK DIAGRAM (GST)



BLOCK DIAGRAM (GST)

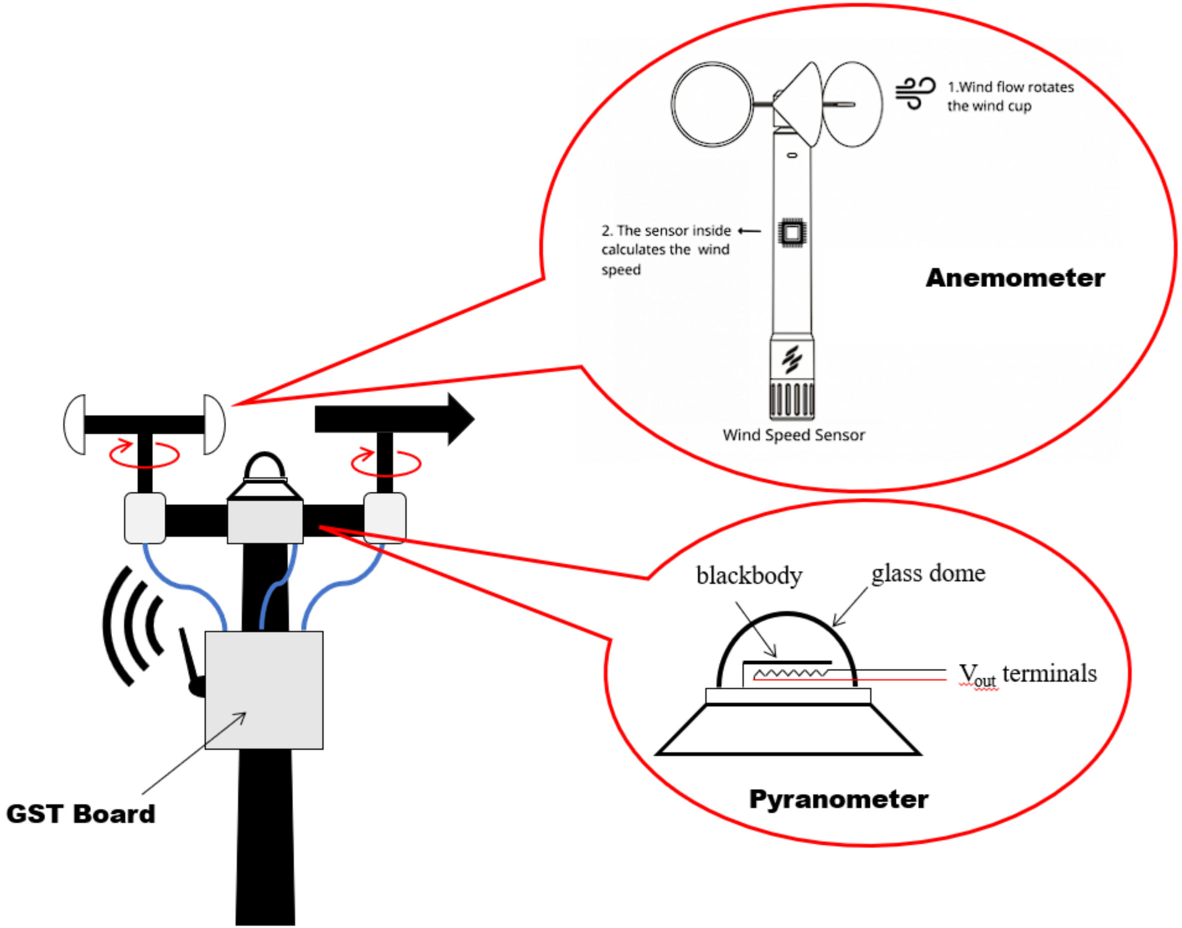


POWER BUDGET (GST)

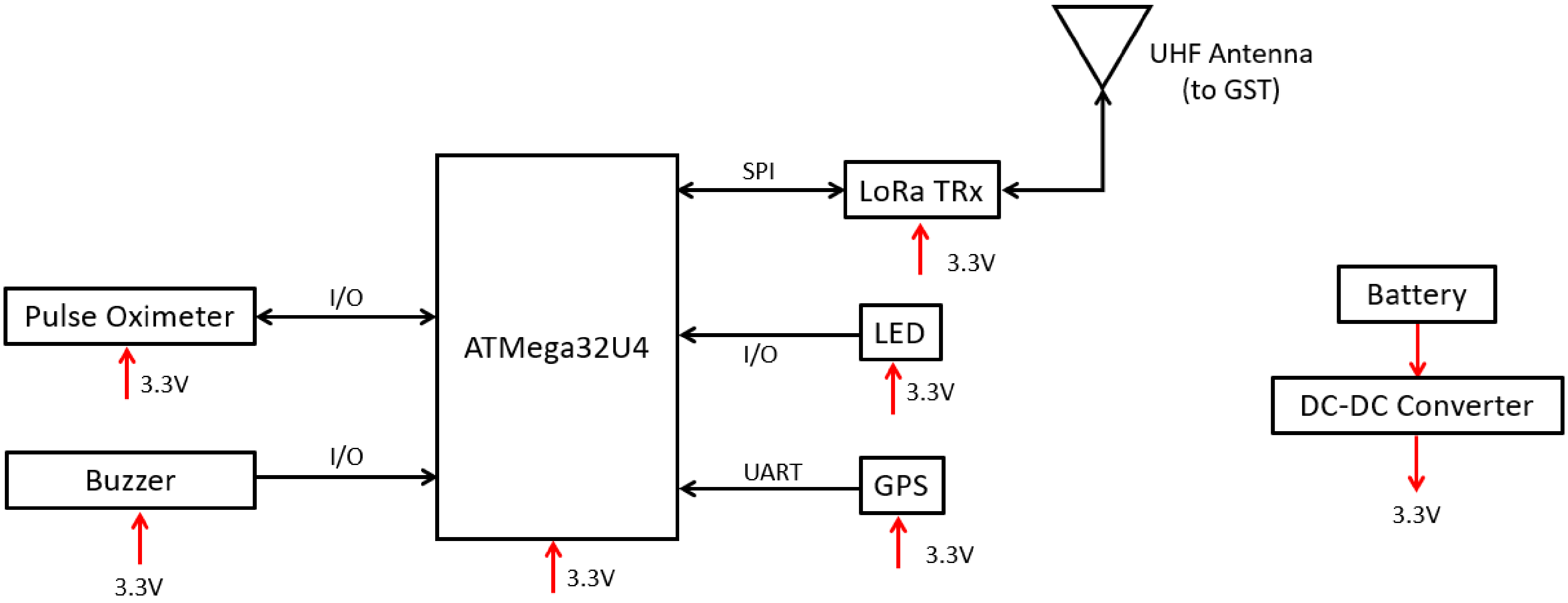
Component	Operating Voltage (V)	Mission Operation		Daily Operation Time (hrs)	Daily Consumption (mWh)
		Consumption Current (mA)	Consumption Energy (mW)		
9-axis IMU	3.3	3.1	10.263	24	246.312
GPS	3.3	26.0	85.8	24	2059.2
LoRa (Sat, Transmit mode)	3.3	120.0	396	3	1188
LoRa (Track, Transmit mode)	3.3	120.0	396	3	1188
LoRa (Track, Receive mode)	3.3	12.0	39.6	3	118.8
Flash Memory	3.3	55.0	181.5	24	4356
MCU (ATMEGA32U4)	3.3	4.0	13.2	24	316.8
BME280	3.3	3.6	11.88	24	285.12
Anemometer				0	0
Pyranometer				0	0
	Total Current (mA)	343.7		TOTAL Daily Energy Consumed	9758.232
	Operation Time on Battery (hrs)	18			
	Battery Capacity (mAh)	6186.78			

*Values for voltage and current consumption for each components were based on their datasheets.

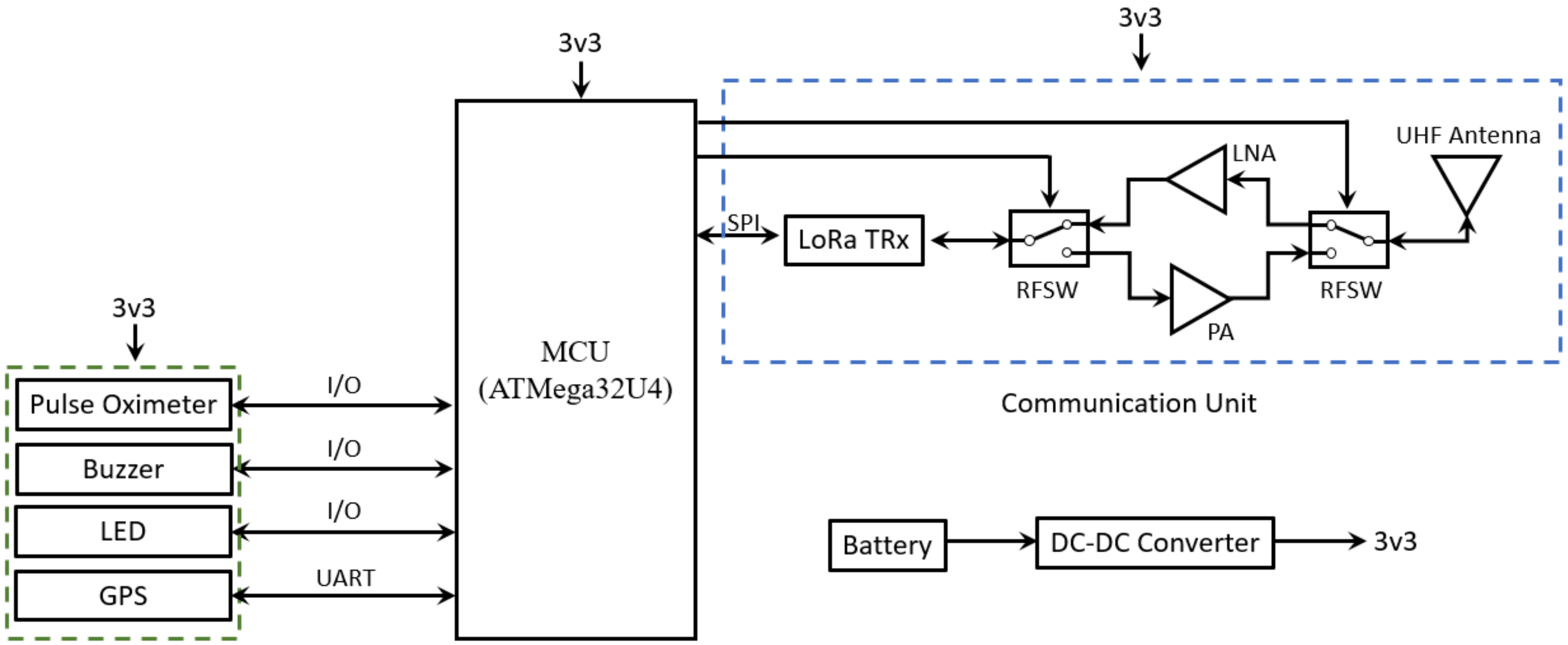
GST STRUCTURE



BLOCK DIAGRAM (Passenger Tracker)



BLOCK DIAGRAM (Passenger Tracker)



AUTOMATIC PACKET REPORTING SYSTEM MESSAGE DIGIPEATER (APRS-DP) MISSION

MISSION STATEMENT

To facilitate connectivity and information exchange among amateur radio operators worldwide.

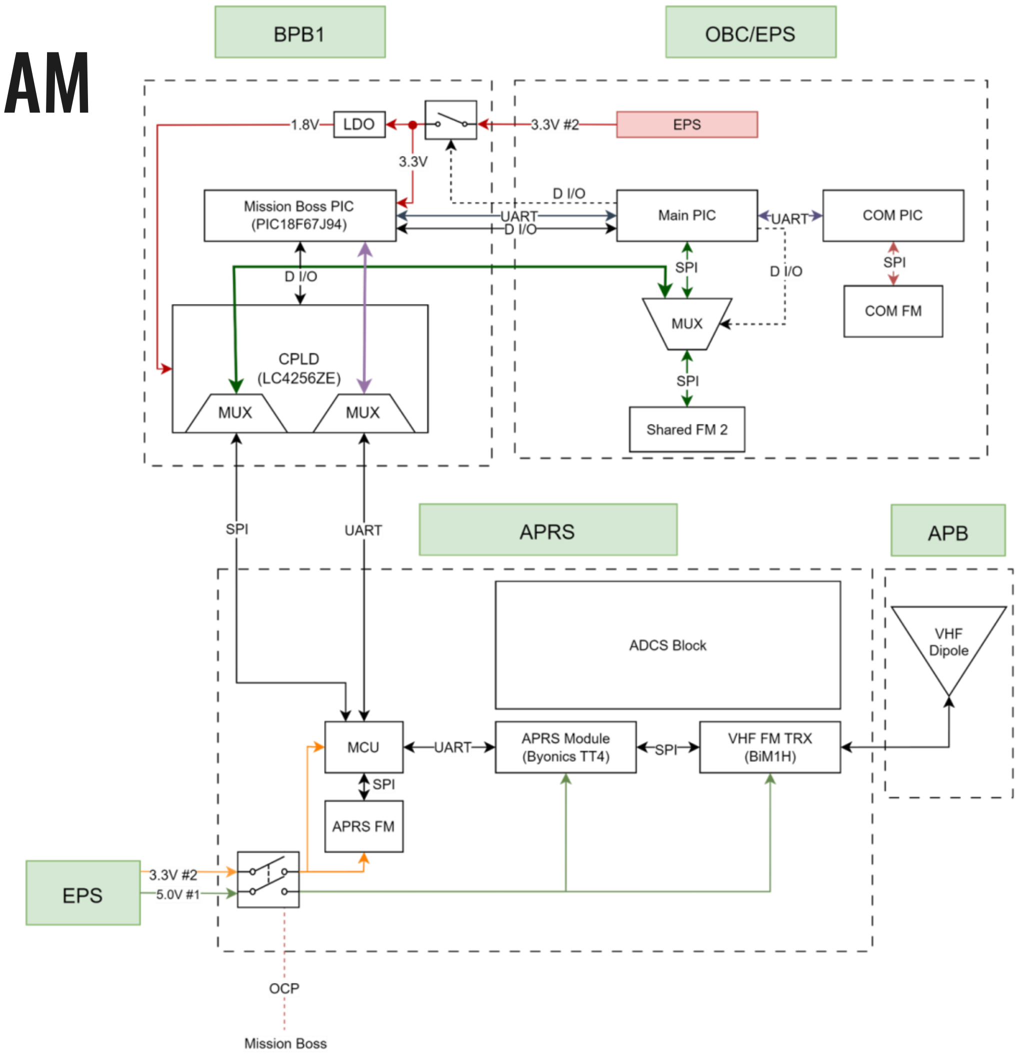
MISSION GOALS

1. To provide amateur radio service to amateur radio community, especially in times of disaster.
2. To demonstrate functionality of APRS-DP low cost COTS components.

MAYA-5/6 AND MAYA-7 APRS-DP COMPARISON

	MAYA-5/6	MAYA-7
Mission	The utilization of amateur radio in times of disaster as a backup link when other communication networks are down presents importance to provide amateur radio service.	To facilitate connectivity and information exchange among amateur radio operators worldwide.
MCU	TinyTrak4	TinyTrak4
Frequency band	VHF	UHF

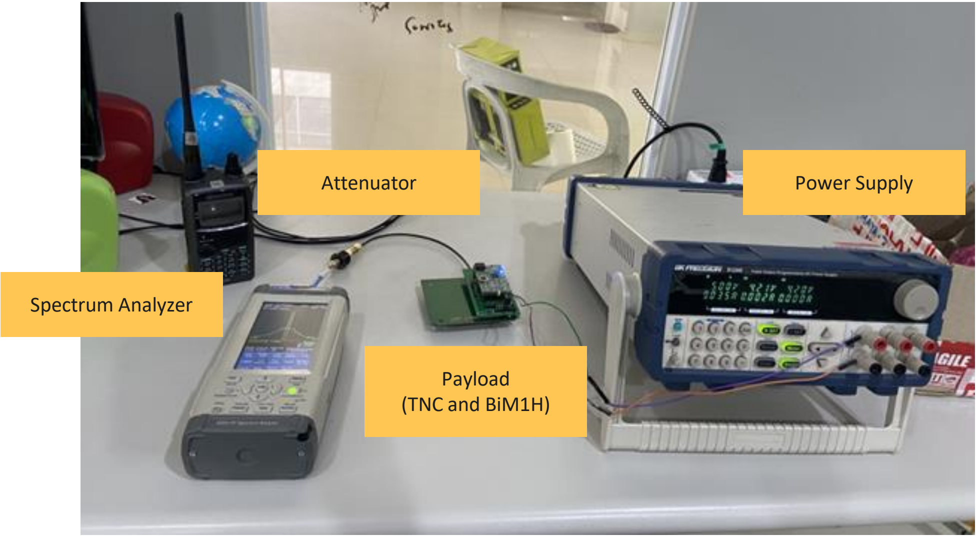
BLOCK DIAGRAM



TEST SETUP

(Center frequency, Tx power, Bandwidth)

Byonics TT4 (TNC) → BiM1H (Tx Power: 0.5 W/27 dBm) → Attenuator (20 dB) → Spectrum Analyzer



RESULTS

(Center frequency, Tx power, Bandwidth)

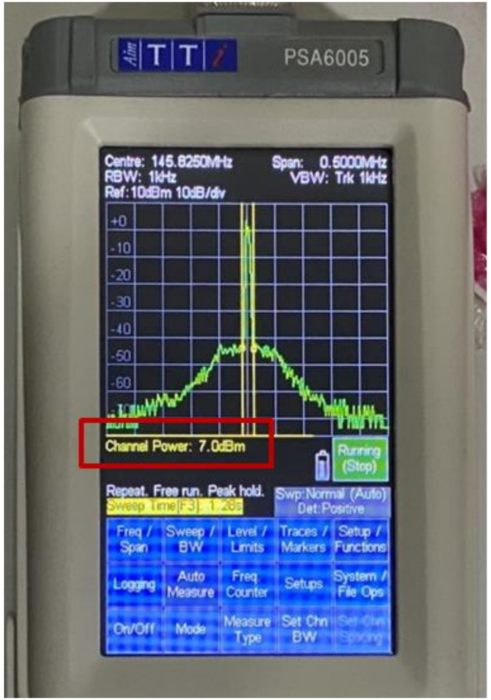
BiM1H specified output power:
0.5W (27 dBm)

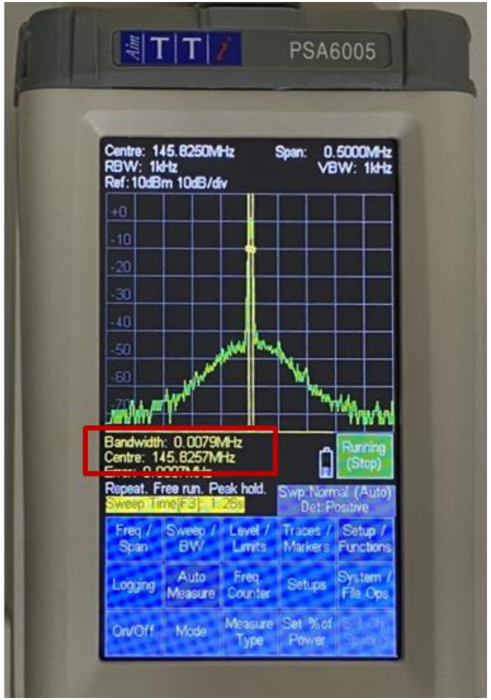
Attenuator attached:
20 dB

Measured power:
7 dBm

Center frequency:
145.8257 MHz

Tx Bandwidth:
7.9 kHz

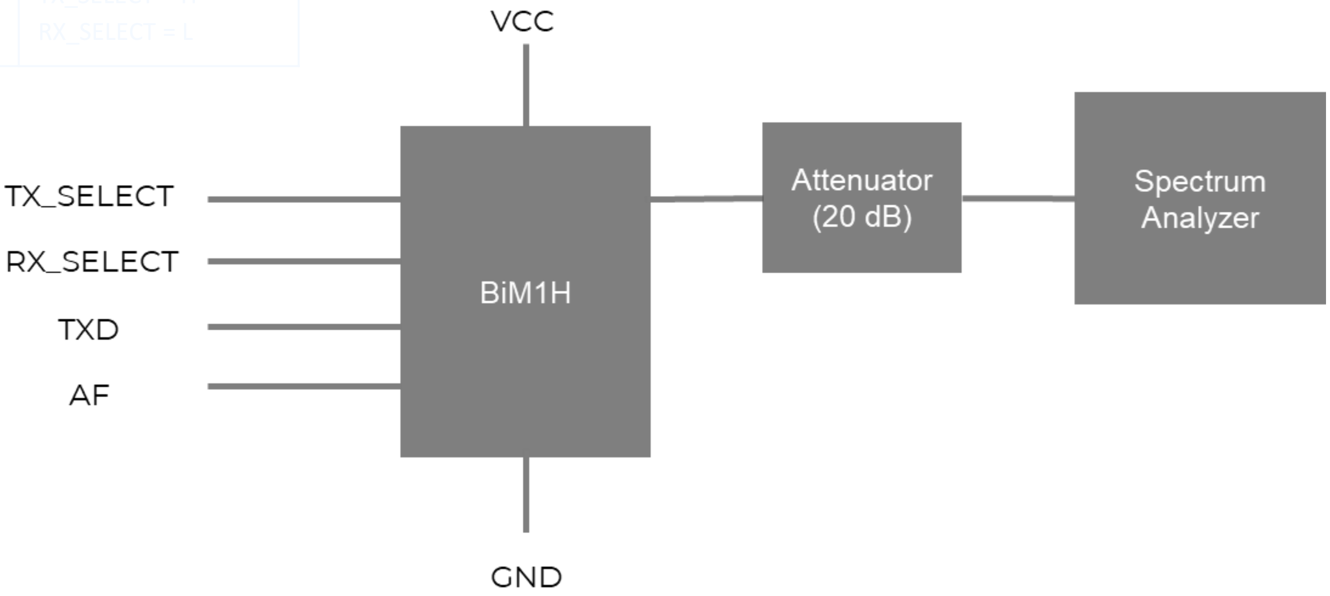




TEST SETUP

(Frequency deviation, Half-duplex)

Tx	Rx
TX_SELECT = L RX_SELECT = H	TX_SELECT = H RX_SELECT = L



RESULTS

(Half-duplex)

Presence/absence of carrier was observed during APRS beacon transmission:

@ Tx Mode: with carrier
@ Rx Mode: no carrier

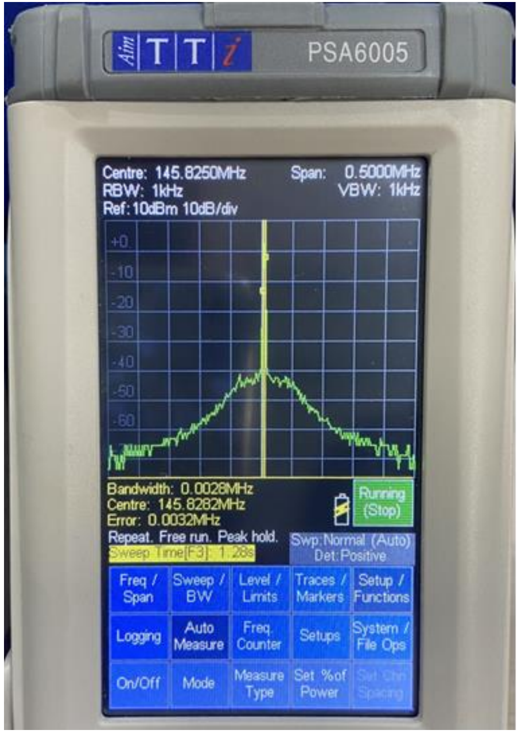
Tx Mode

Rx Mode

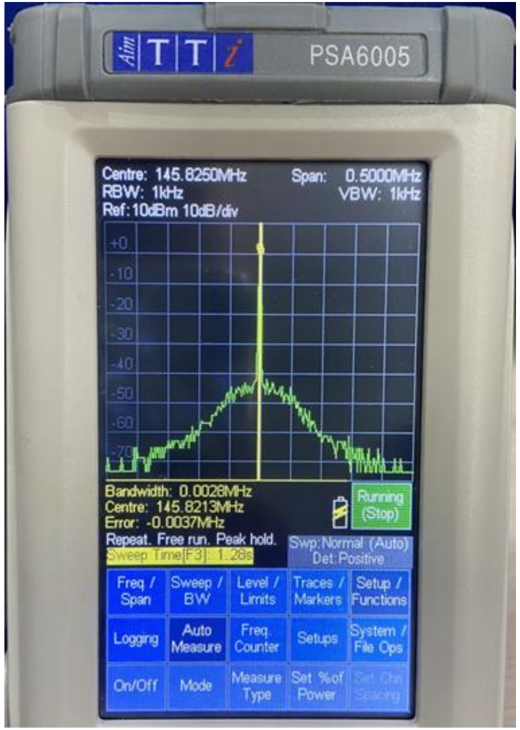
RESULTS

(Frequency deviation)

Frequency deviation = 3.2 kHz



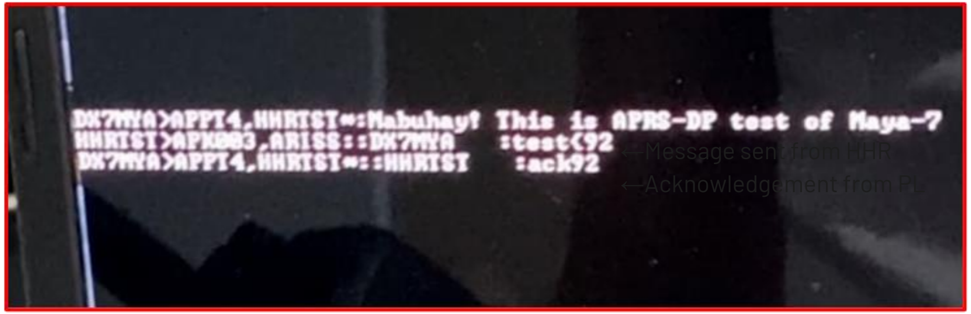
TXD = 0

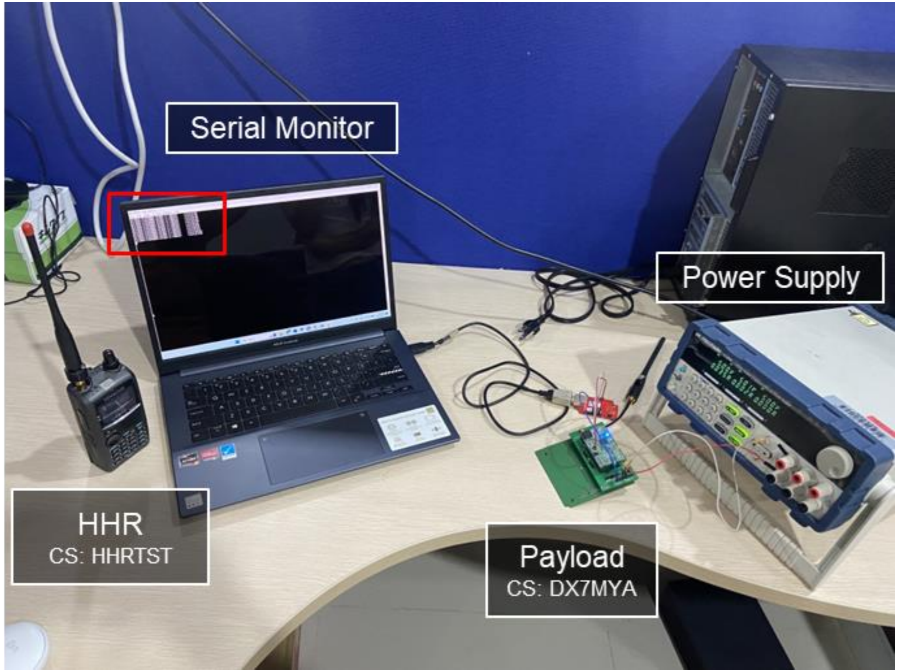


TXD = 1

TEST SETUP

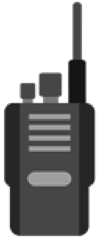
(TT4 Configuration, HHR-Payload Handshake)





TEST SETUP

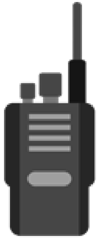
(Full-digipeating functionality)

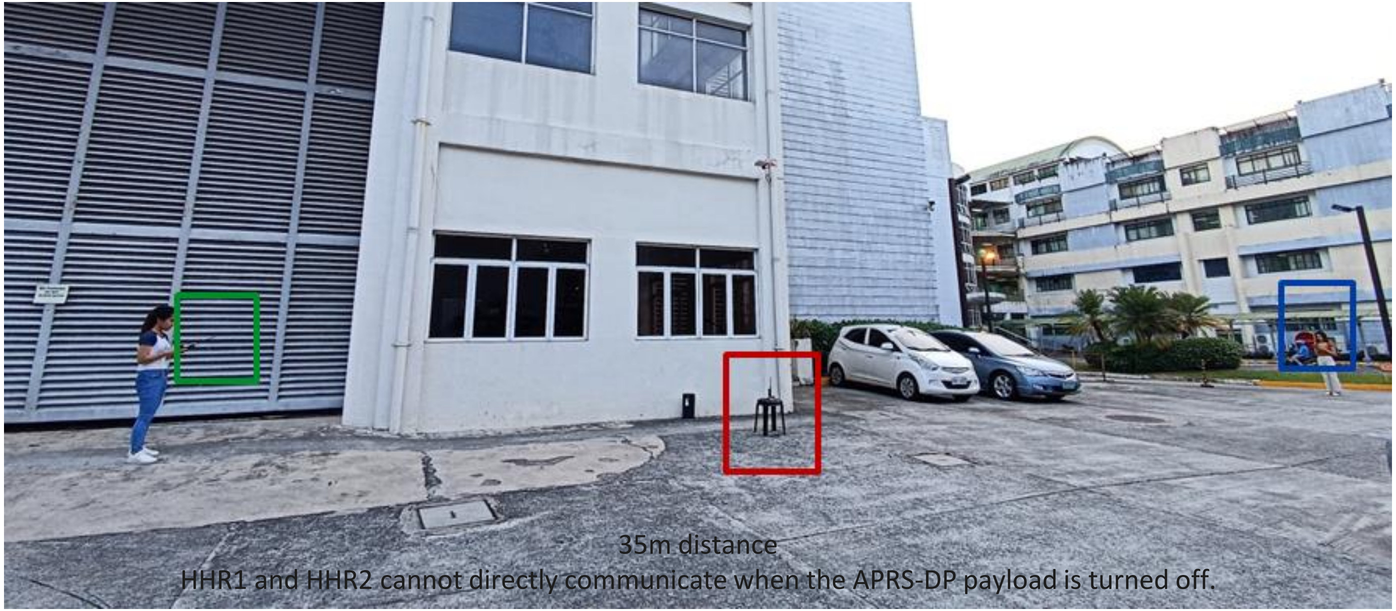


HHR1 PTx: ~17 dBm
Attenuator: 20 dB
CS: 41IDVK-7

APRS-DP
Payload

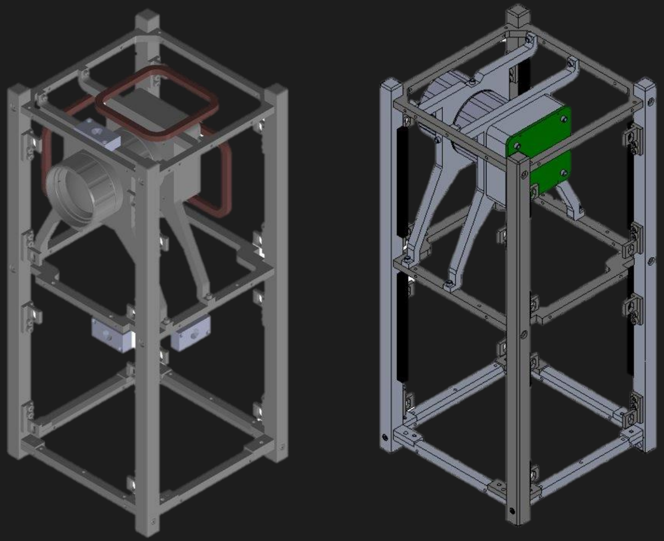
HHR2 PTx: ~17 dBm
Attenuator: 50 dB
CS: 41IDDB-7





35m distance
HHR1 and HHR2 cannot directly communicate when the APRS-DP payload is turned off.

Hybrid Attitude Determination and Control System (HADCS) Mission



MISSION STATEMENT

This mission shall demonstrate a hybrid attitude determination and control using magnetic components which will serve as heritage for future Philippine nanosatellites.

Additionally, this will also support Maya-7's CAM and TL-TEG missions by providing attitude data, cubesat location, and payload orientation necessary for performing and ensuring the success of these missions.

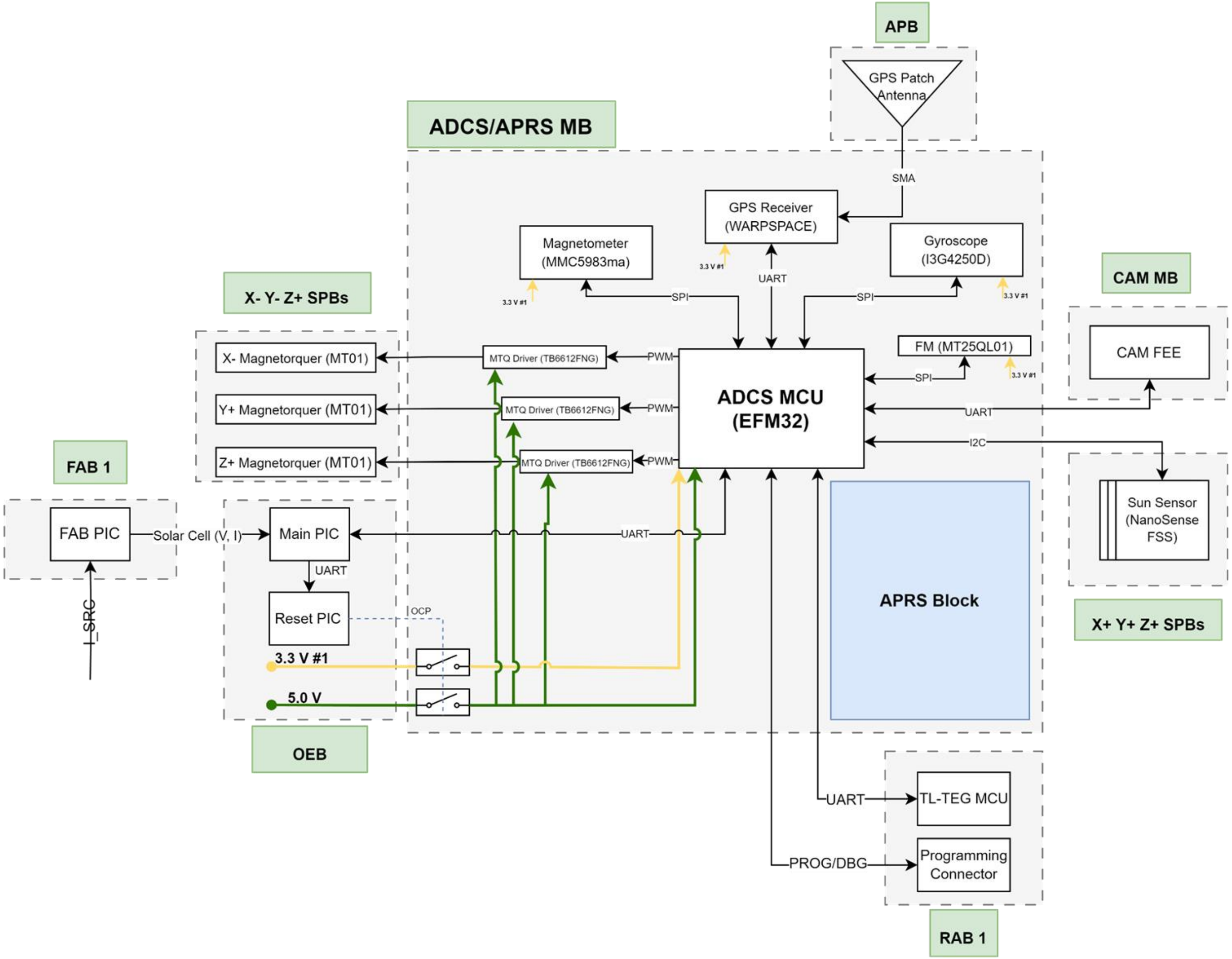
MISSION GOALS

1. To provide stable attitude and orientation using hybrid (passive and active) magnetic control system while capturing the necessary data to carry out the CAM and TL-TEG missions
2. To determine the orientation and location of the cubesat in orbit
3. To detumble the satellite after being deployed from ISS and performing antenna deployment mechanism

MAYA-6 AND MAYA-7 ADCS COMPARISON

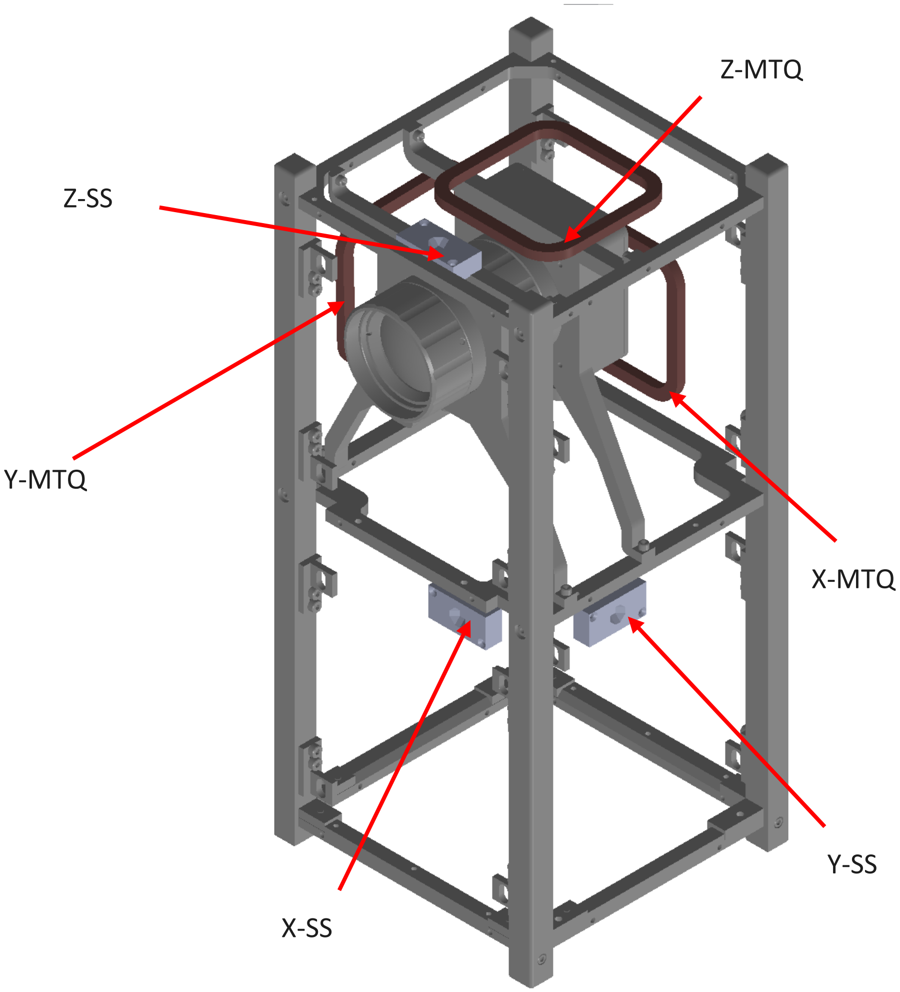
	MAYA-6	MAYA-7
Type of Mission	Part of OBC-EX	Standalone
MCU	EFM32GG280F1024	EFM32GG280F1024
Sensors	Magnetometer, Gyroscope, Solar cell data, GPS	Magnetometer, Gyroscope, Sun Sensors, Solar cell data, GPS
Determination Algorithm	TRIAD	TRIAD
Operation Modes	Stabilization, Sensor Read, Sensor Read + Determination, Camera Mode, TMCR Mode	Attitude Determination, Controlled Spin, CAM Assist (Trigger, Target), TL-TEG Assist
Interface	OBC, CAM, TMCR, FAB	OBC, CAM, TL-TEG
Stabilization	Hysteresis Dampers & Permanent Magnets	Hysteresis Dampers & Permanent Magnets
Pointing Algorithm	None	B-dot (Modified)
Attitude Control	None	Magnetorquers

BLOCK DIAGRAM



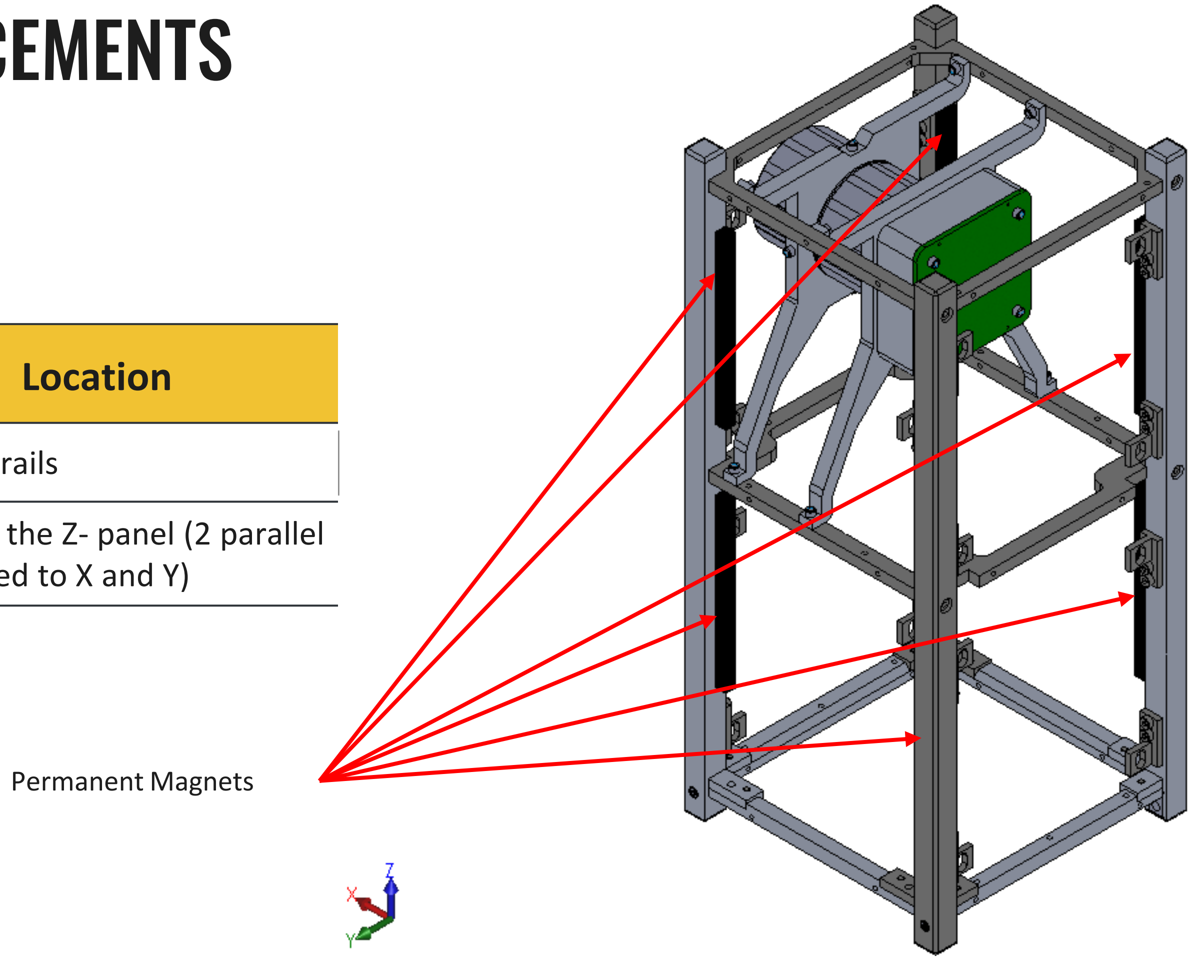
COMPONENT PLACEMENTS

Component	Location
Magnetorquers	X-MTQ: Upper X- panel Y-MTQ: Upper Y- panel Z-MTQ: Z+ panel
Sun Sensors	X-SS: Lower X+ panel Y-SS: Lower Y+ panel Z-SS: Z+ panel

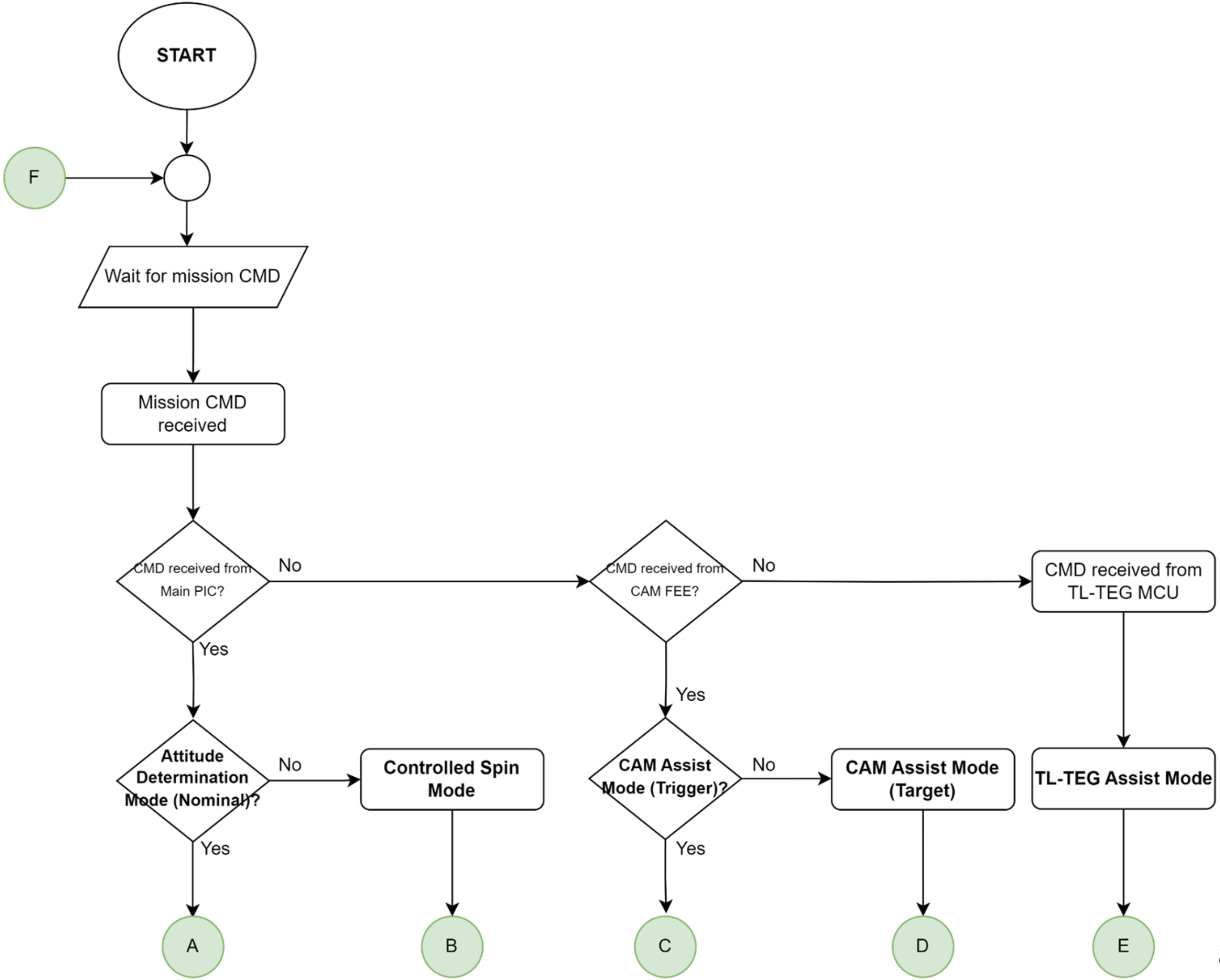


COMPONENT PLACEMENTS

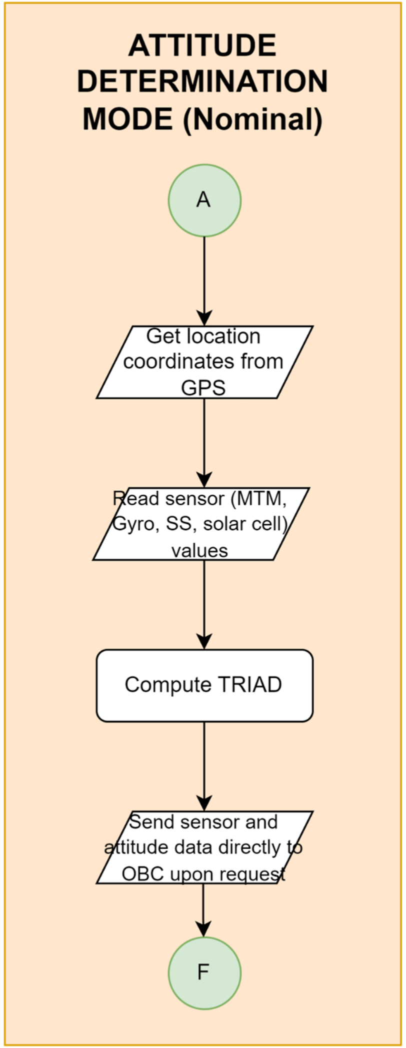
Component	Location
Permanent magnets	Along the Z rails
Hysteresis dampers	Attached to the Z- panel (2 parallel pairs oriented to X and Y)



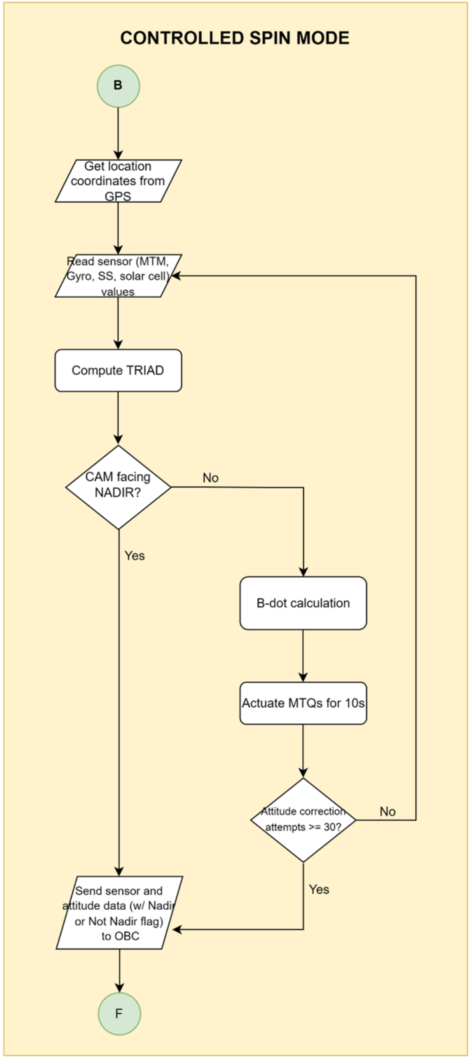
CONCEPT OF OPERATIONS



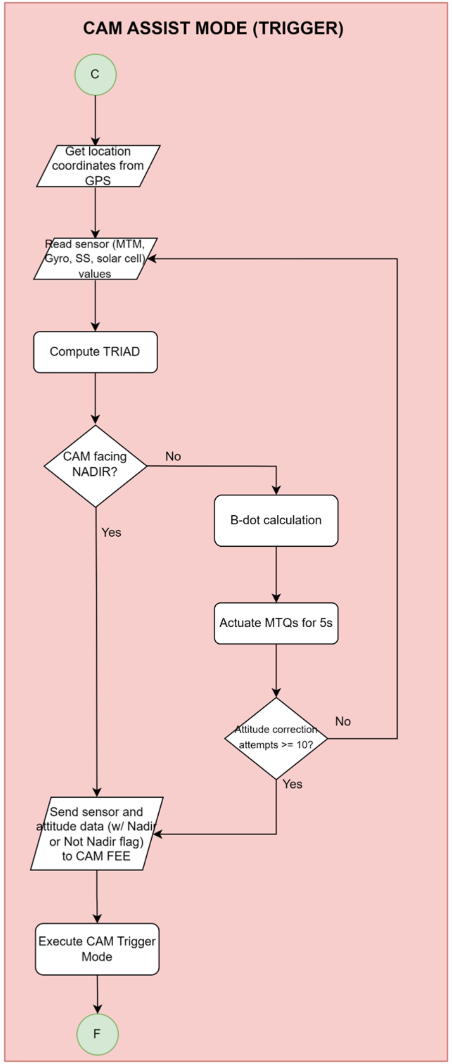
CONCEPT OF OPERATIONS



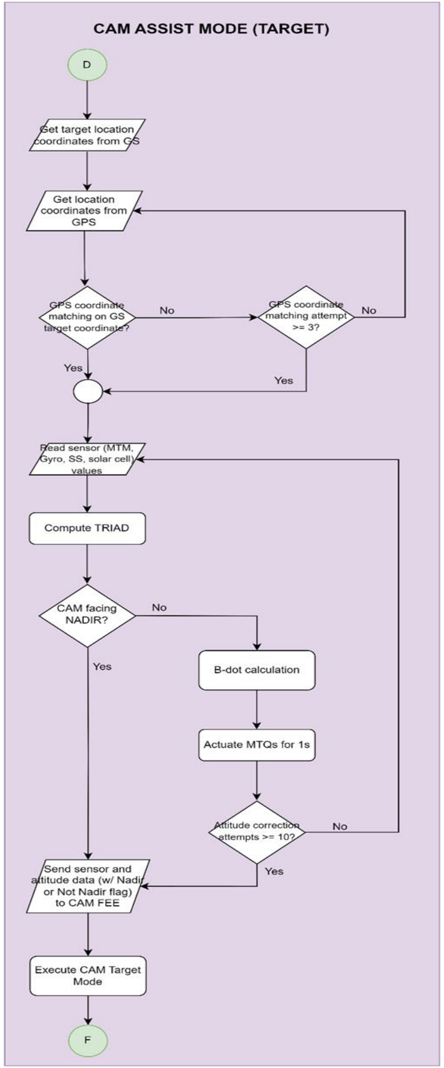
CONCEPT OF OPERATIONS



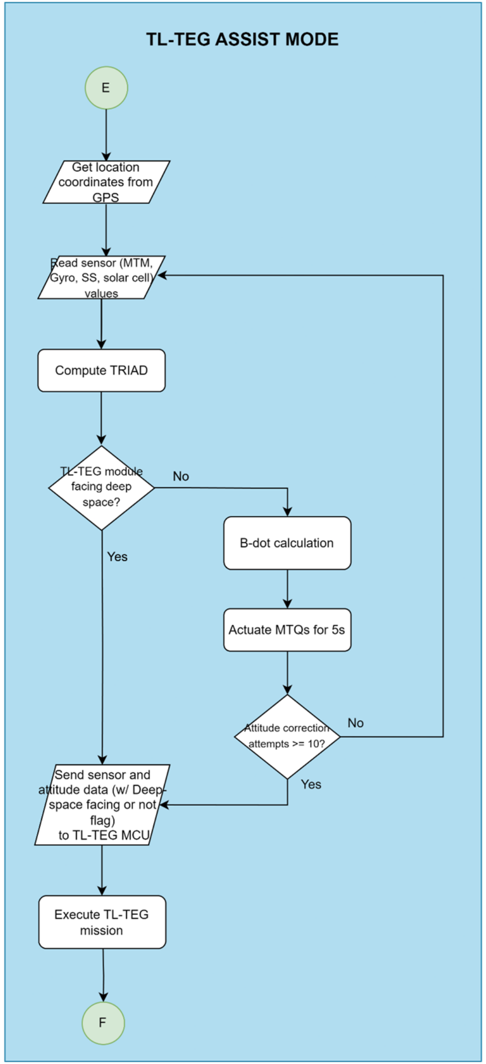
CONCEPT OF OPERATIONS



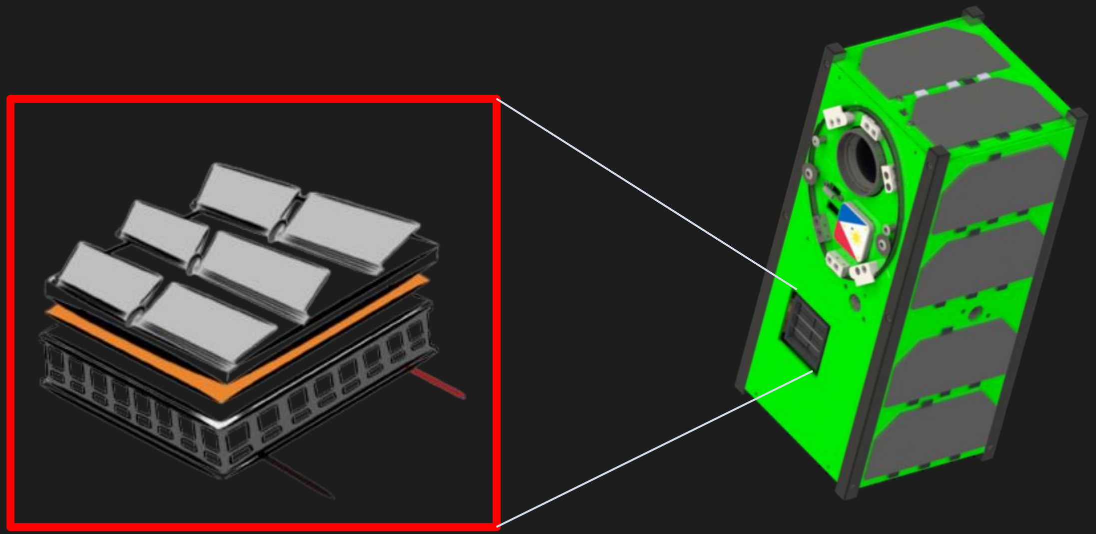
CONCEPT OF OPERATIONS



CONCEPT OF OPERATIONS



THERMAL LOUVERS AND THERMOELECTRIC GENERATOR (TL&TEG) MISSION



MISSION STATEMENT

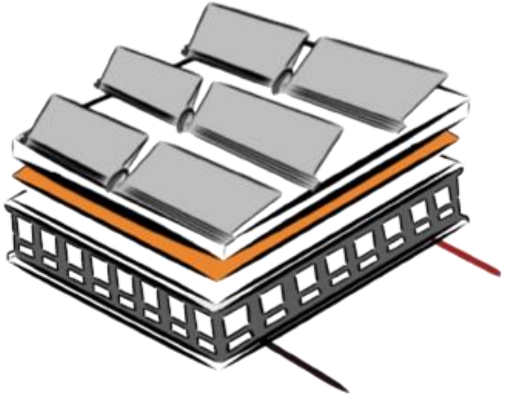
As our country develops more and more satellites, our mastery and know how also increases over time, with the long-term goal of more locally developed satellites. Increasing complexities of CubeSats usually come with increased requirements for power, which consequently leads to increased amounts of heat generation.

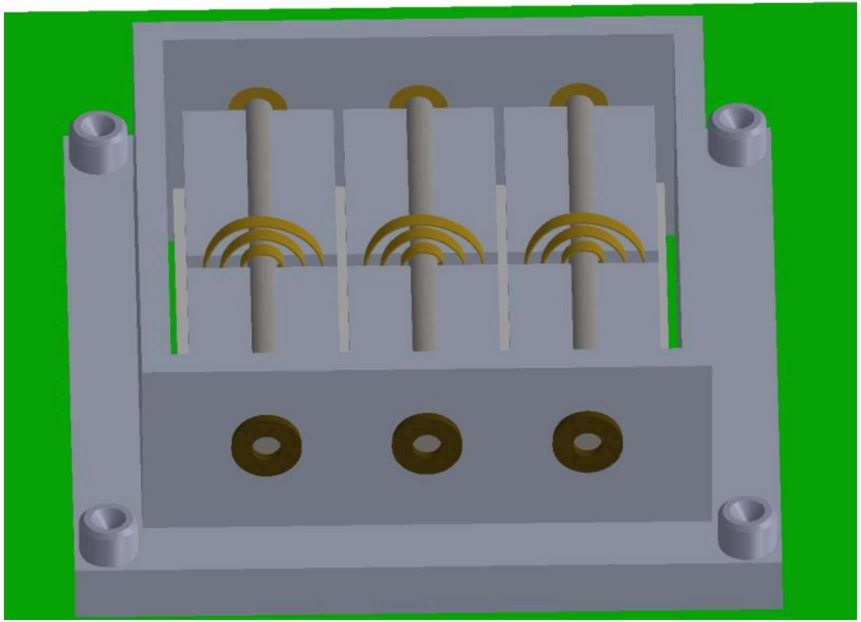
TL&TEG mission shall demonstrate thermal effects, management, and control in Maya-7

MISSION GOALS

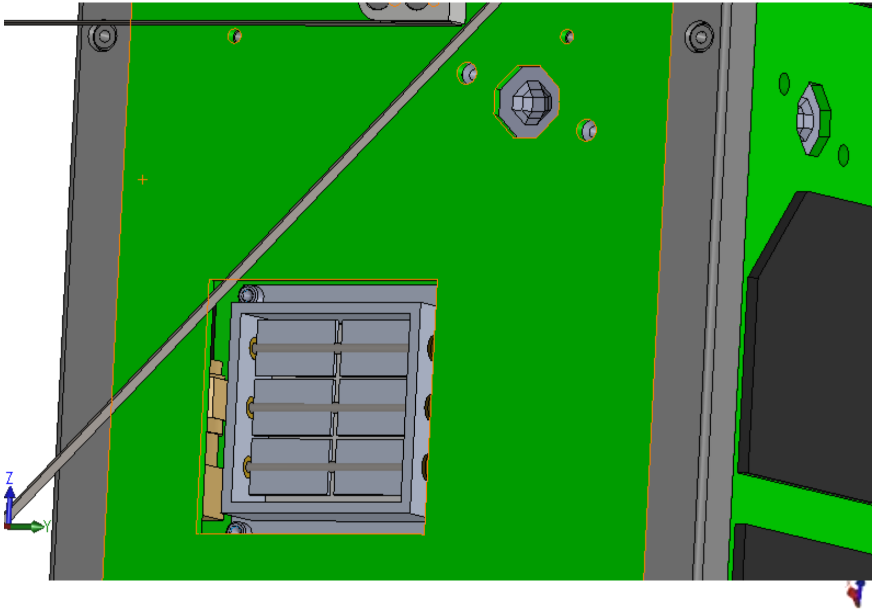
1. To demonstrate passive actuation of thermal louvers via bimetallic springs
2. To demonstrate thermoelectric Seebeck effect using COTS thermoelectric generators (TEGs)
3. To investigate the viability of utilizing aforementioned methods for thermal management in future satellites.

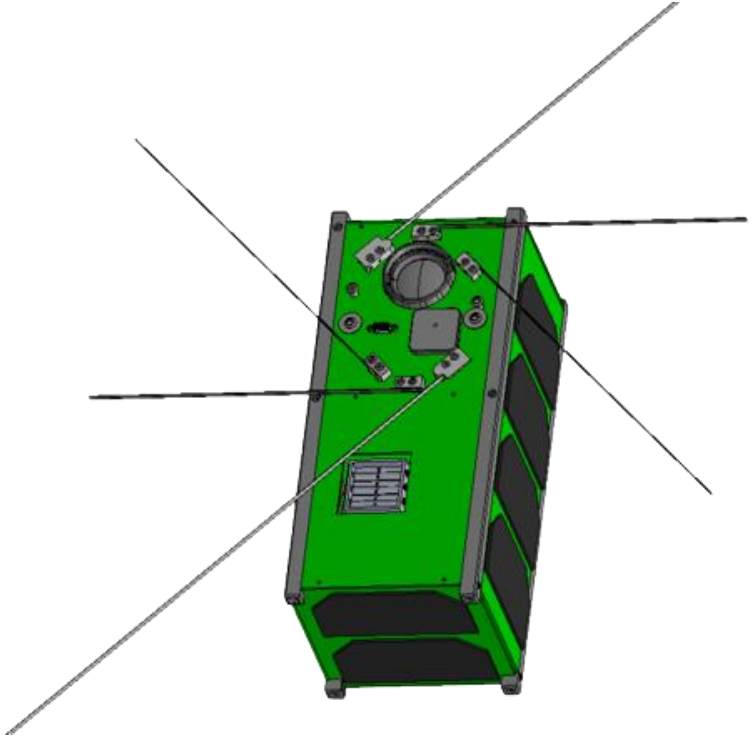
TL&TEG Models



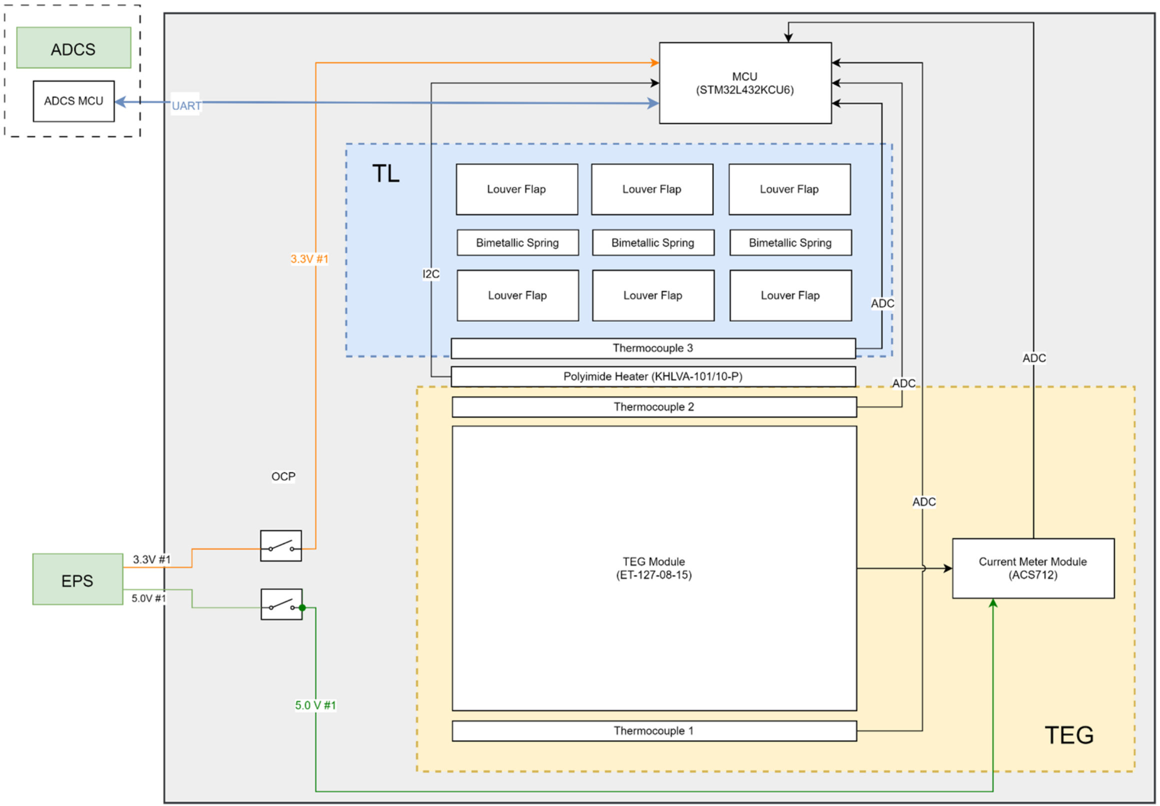


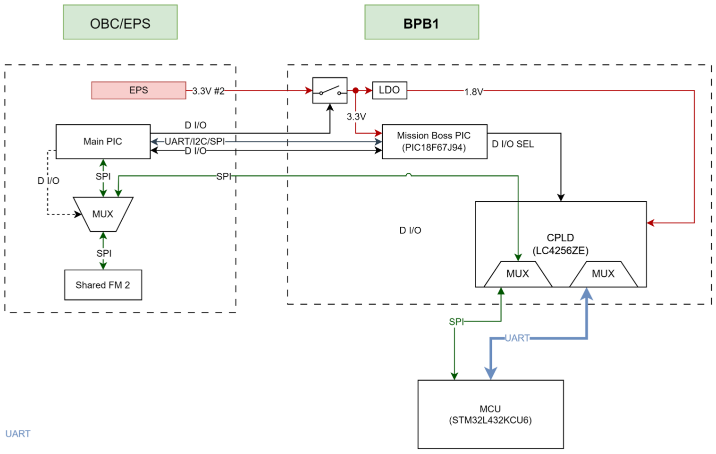
TL-TEG RAB Placement



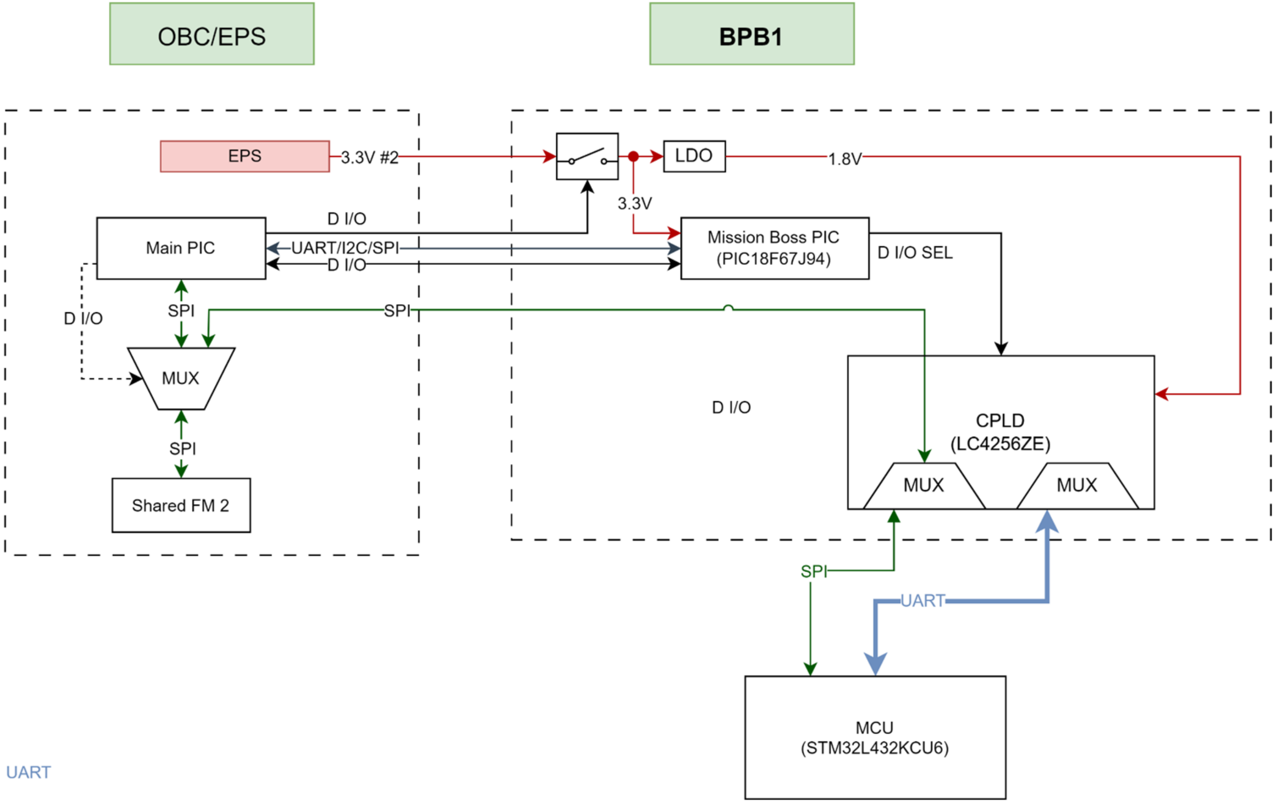


BLOCK DIAGRAM

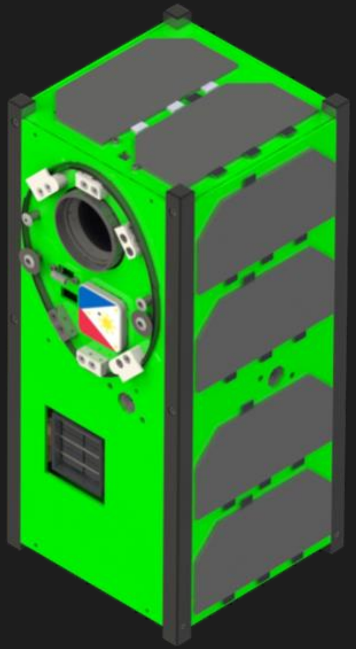




BLOCK DIAGRAM



UART



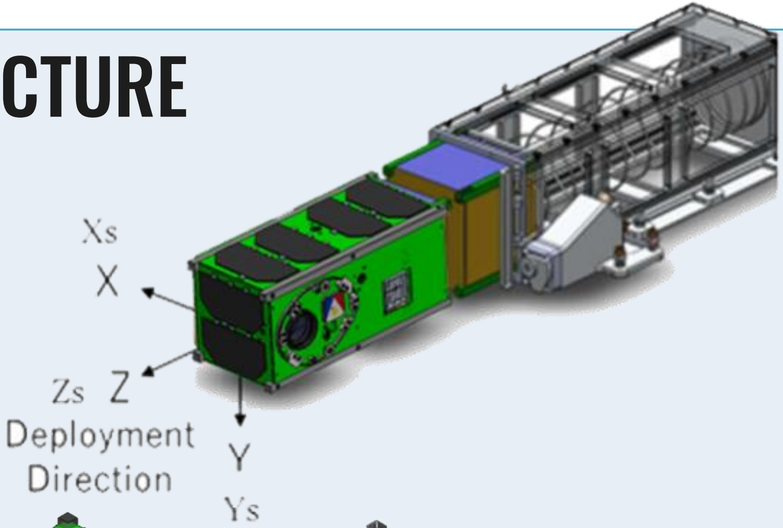
MAYA-7 SUBSYSTEMS

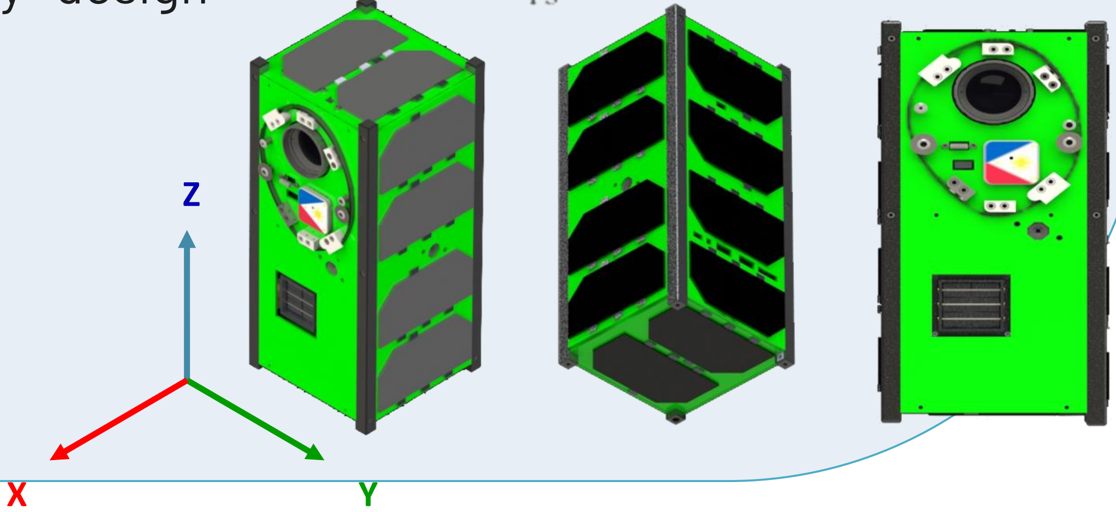
John Michael Rey Zamora

STRUCTURE

Functions

- Mechanical support
- Mechanical interface
- Satisfy JAXA 2U CubeSat safety design and J-SSOD-R

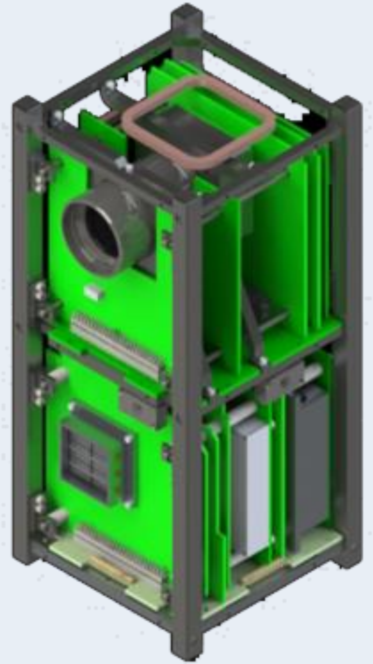




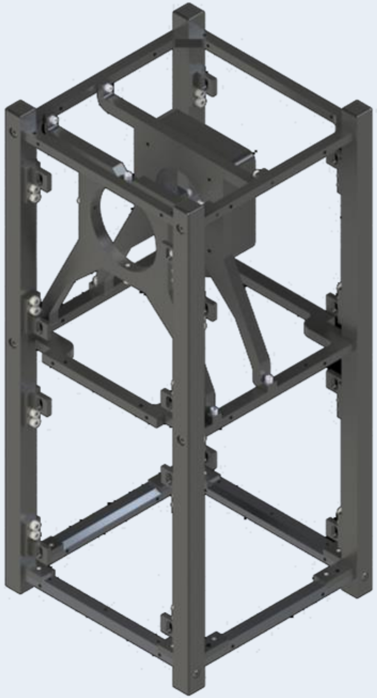
STRUCTURE

CAD Overview

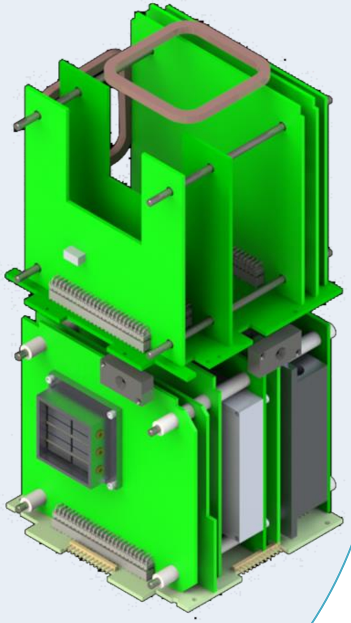
Exterior



Assembly w/o Ext Panels



Main Structure and Accessories



Internal Boards Configuration

ON-BOARD COMPUTER (OBC)

Functions

- Command the satellite to send the data stored in Flash Memory
- Analyze and executes uplink commands
- Forwards the command to the assigned payloads and requests data to get mission data
- Monitor the status of the satellite
- Send the Housekeeping (HK) data to Ground Station (GS)

ON-BOARD COMPUTER (OBC)

Overview

	Maya-5	Maya-6	BIRDS-5	BIRDS-X	Maya-7
Main PIC	X	X	X	X	X
COM PIC	O	O	O	X	O
RESET PIC	O	O	O	X	O
FAB PIC	O	O	O	O	O
MISSION BOSS	O	N/A	O	X	X
Start PIC	N/A	N/A	N/A	O	N/A
Active Watchdogs	Reset	Reset	Reset	Reset & Start	Reset & COM*

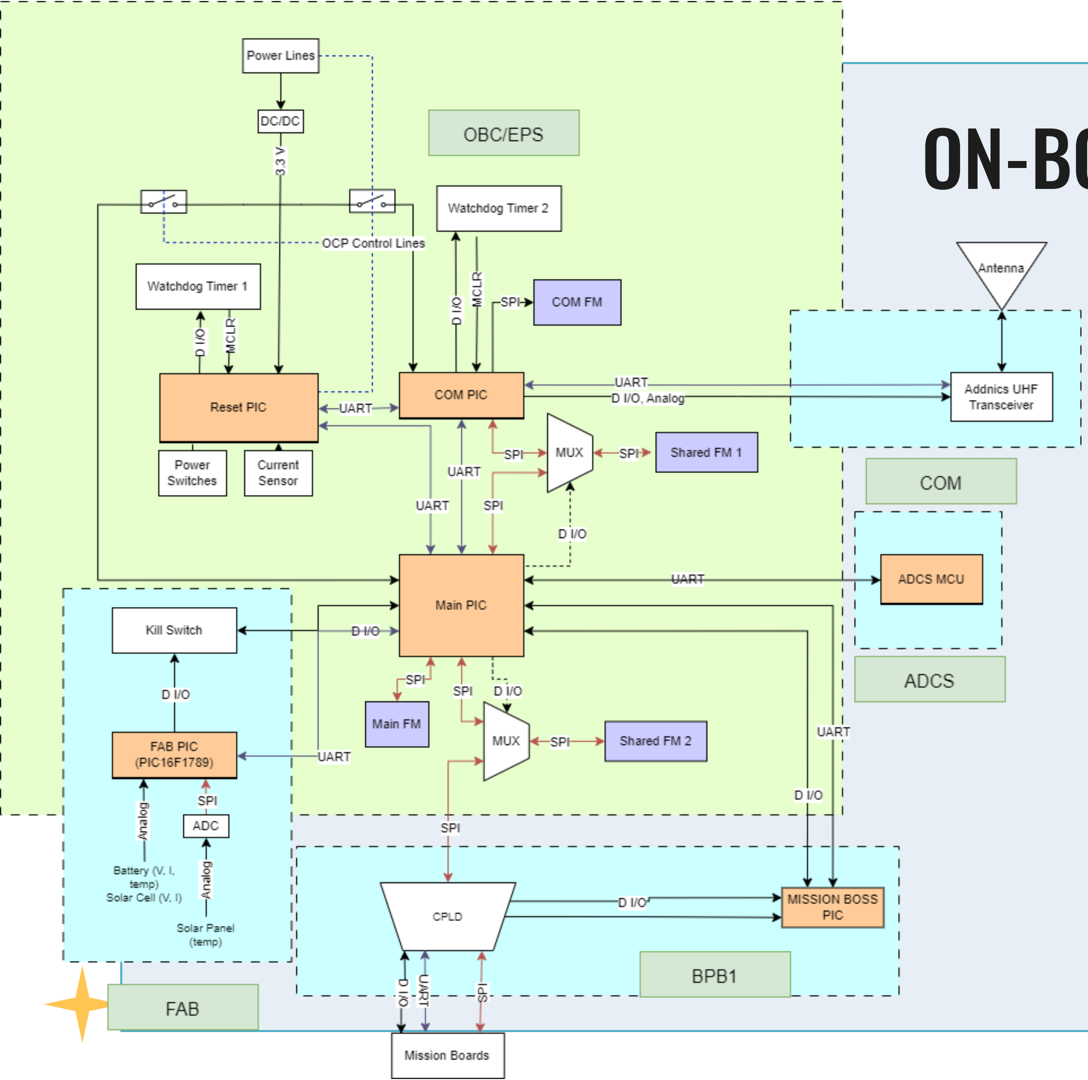
Legend:

X - PIC18F6J94

O - PIC16F1789

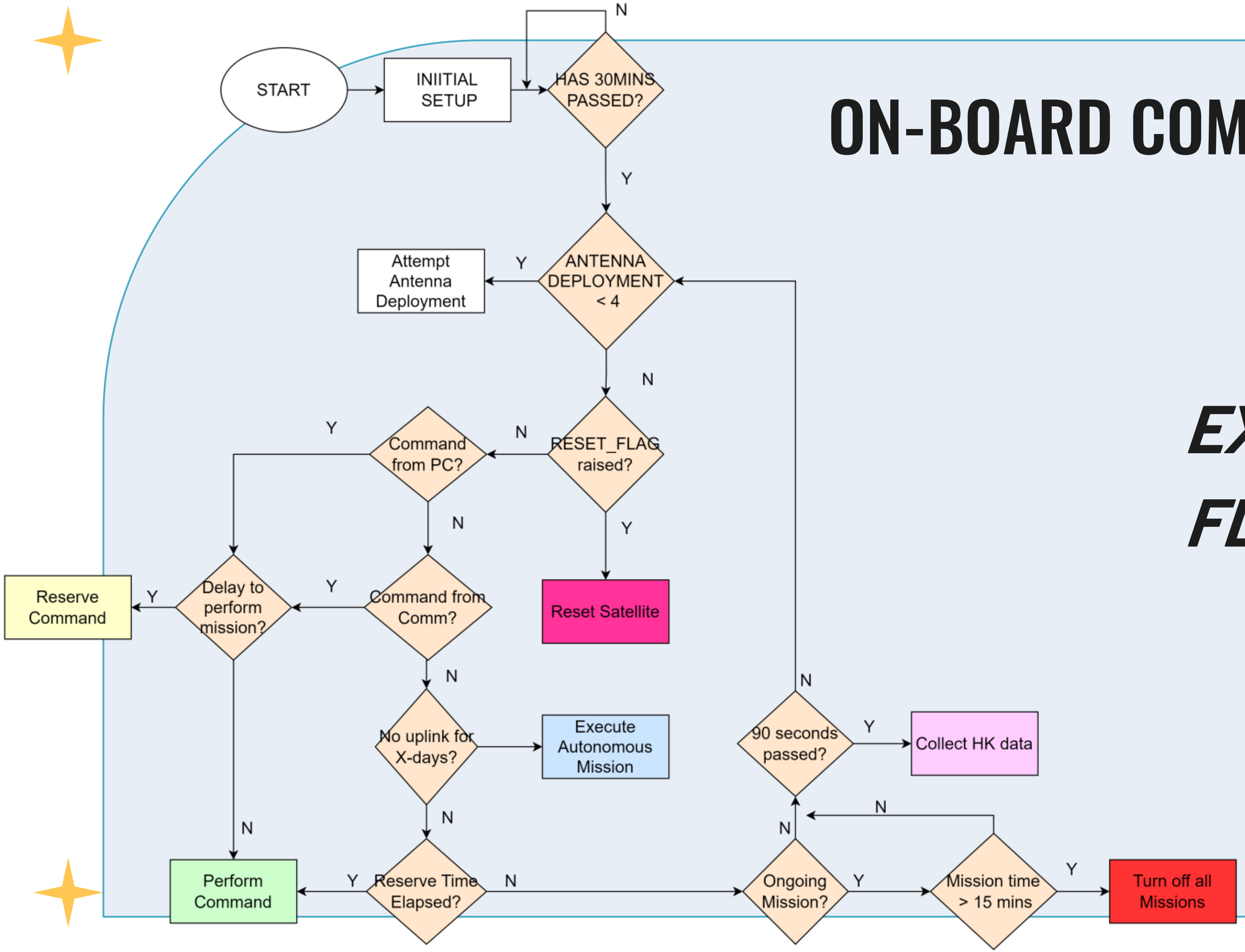
ON-BOARD COMPUTER (OBC)

BLOCK DIAGRAM



ON-BOARD COMPUTER (OBC)

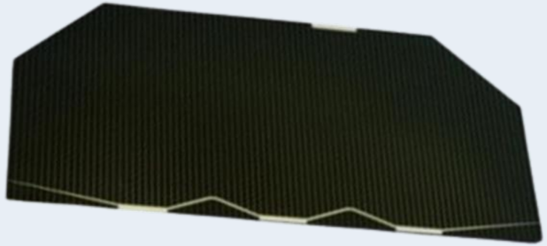
EXECUTION FLOW CHART

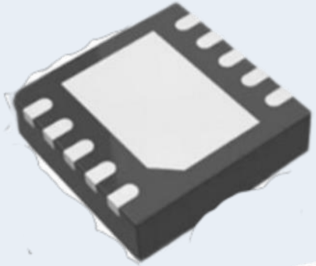


ELECTRICAL POWER SUBSYSTEM (EPS)

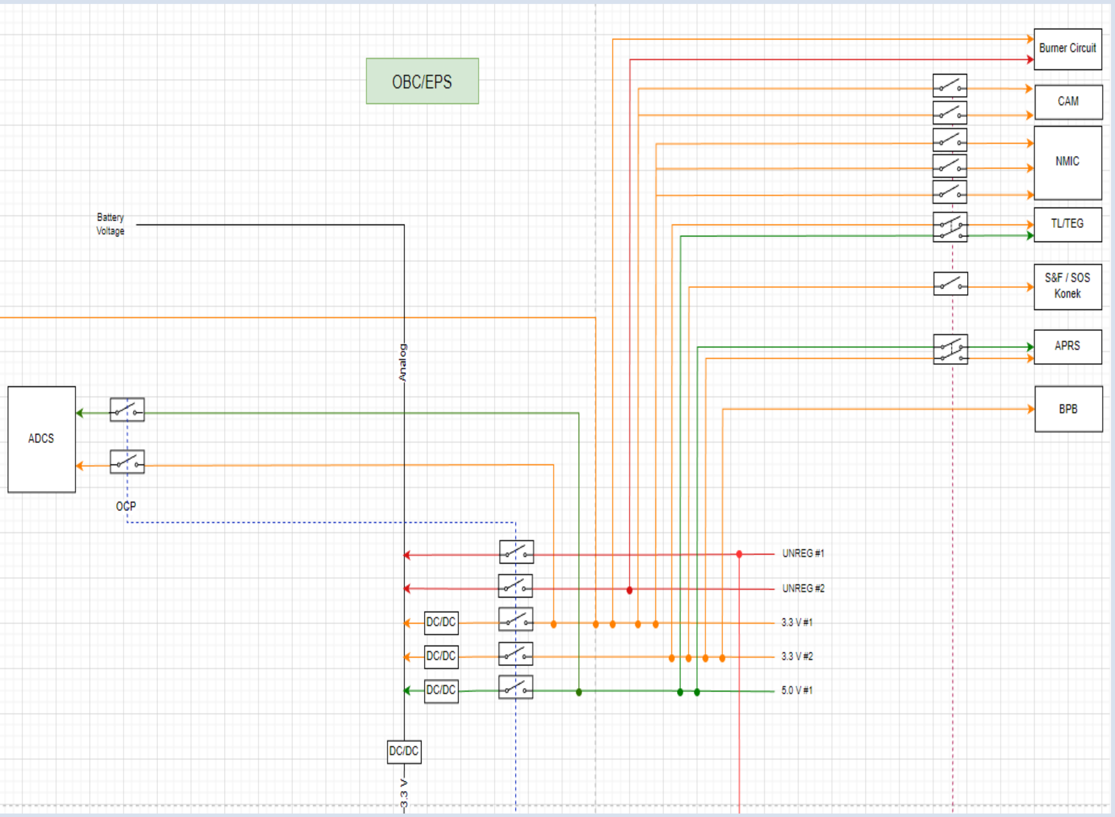
Functions

- Power generation
  - TJ solar cells, 30% efficiency
    - -X = 4 cells (2S2P)
    - +Y = 4 cells (2S2P)
    - -Y = 4 cells (2S2P)
    - -Z = 2 cells (2S)
    - +Z = 2 cells (2S)
- Power Regulation
  - DC/DC Converters step voltage to five power lines
    - 3.3V #1, 3.3v #2, 5.0V #1, UNREG #1, UNREG #2
- Energy Storage
  - 6 NiMH AA Batteries (3S2P)





ELECTRICAL POWER SUBSYSTEM (EPS)



Power Distribution Block Diagram

- OBC and EPS share a board (OEB)
- Power goes from SPBs to FAB1 to OEB to MBs / Subsystems
- ON/OFF of missions is controlled by Mission Boss (BPB)
- ON/OFF of subsystems is controlled by RESET PIC (OEB)

POWER BUDGET

Components	Maximum Power Allocated (mW)	Duration per Orbital Period (h)	Energy per Orbit (mWh)	Connected Power Line	Maximum Voltage (V)	Maximum Current (A)
ADCS Sensors (Gyro, MTM, SS) - *Mission Assist*	34.815	0.0083	0.2889645	3.3V #1	3.3	0.061
ADCS MCU - *Controlled Spin Mode*	50	0.17	8.5	3.3V #1	3.3	0.100
GPS - *Controlled Spin Mode*	148.5	0.0083	1.23255	3.3V #1	3.3	0.045
Magnetorquers (MTQ) and MTQ Drivers - *Controlled Spin Mode*	1980	0.083	164.34	5.0V #1	5	0.400
ADCS Sensors (Gyro, MTM, SS) - *Controlled Spin Mode*	34.815	0.025	0.870375	3.3V #1	3.3	0.061
Current Meter Module	24	0.17	4.08	5.0V #1	5	0.003
TL/TEG Electronics	330	0.17	56.1	3.3V #2	3.3	0.100
S&F RX	337.26	0.17	57.3342	3.3V #2	3.3	0.102
APRS MODULE, VHF TRX and MCU	430	0.17	73.1	5.0V #1	5	0.086
APRS FM		0.17		3.3V #2	3.3	
CTU MODULE	581	0.117	67.977	3.3V #2	3.3	0.18
Burner Circuit Temp Sensor	0.165	0.000278	0.00004587	3.3V #1	3.3	0.00
Burner Circuit (One Time)	12600	0.000278	3.5028	UNREG #2	4	3.15

Energy Consumption (mWh) & Operational Status per Orbit

Components	Safe Mode	Nominal Mode	Mission / Telemetry Data Downlink	ADCS Controlled Spin Mode	RGBN Cam Mission	RGBN Cam Mission (Data Transfer)	Store and Forward Mission	APRS Mission	TEG Mission
ADCS Sensors (Gyro, MTM, SS) - *Mission Assist*	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
ADCS MCU - *Controlled Spin Mode*	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
GPS - *Controlled Spin Mode*	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
Magnetorquers (MTQ) and MTQ Drivers - *Controlled Spin Mode*	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
ADCS Sensors (Gyro, MTM, SS) - *Controlled Spin Mode*	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
Current Meter Module	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
TL/TEG Electronics	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
S&F RX	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
APRS MODULE, VHF TRX and MCU	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF
APRS FM	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF
CTU MODULE	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
Burner Circuit Temp Sensor	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Burner Circuit (One Time)	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Total Energy consumption per mission (mWh)	885.00	1523.37	2033.63	1351.57	1560.47	1516.63	1301.94	1249.73	1236.81
Total Current during mission	0.31	0.60	1.75	0.86	1.25	0.64	0.53	0.34	0.36
		1904.213438	2542.0375	1689.466156	1950.593581	1895.7875	1627.4265	1562.1625	1546.0125

Components	Thermal Louvers Mission	Coastal Monitoring Mission (Data Transfer)	Vegetation Monitoring Mission (Data Transfer)	Agricultural Land Detection Mission (Data Transfer)	Coastal Monitoring Mission (Processing)	Vegetation Monitoring Mission (Processing)	Agricultural Land Detection Mission (Processing)	Maritime Early Warning Mission
ADCS Sensors (Gyro, MTM, SS) - *Mission Assist*	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
ADCS MCU - *Controlled Spin Mode*	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
GPS - *Controlled Spin Mode*	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Magnetorquers (MTQ) and MTQ Drivers - *Controlled Spin Mode*	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
ADCS Sensors (Gyro, MTM, SS) - *Controlled Spin Mode*	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Current Meter Module	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
TL/TEG Electronics	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
S&F RX	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
APRS MODULE, VHF TRX and MCU	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
APRS FM	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
CTU MODULE	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
Burner Circuit Temp Sensor	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Burner Circuit (One Time)	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Total Energy consumption per mission (mWh)	1280.65	1431.11	1436.72	1602.55	1261.11	1266.72	1432.55	1244.61
Total Current during mission	0.96	0.40	0.41	0.42	0.33	0.34	0.35	0.43
	1600.818581	1788.8875	1795.9	2003.18125	1576.3875	1583.4	1790.68125	1555.75875

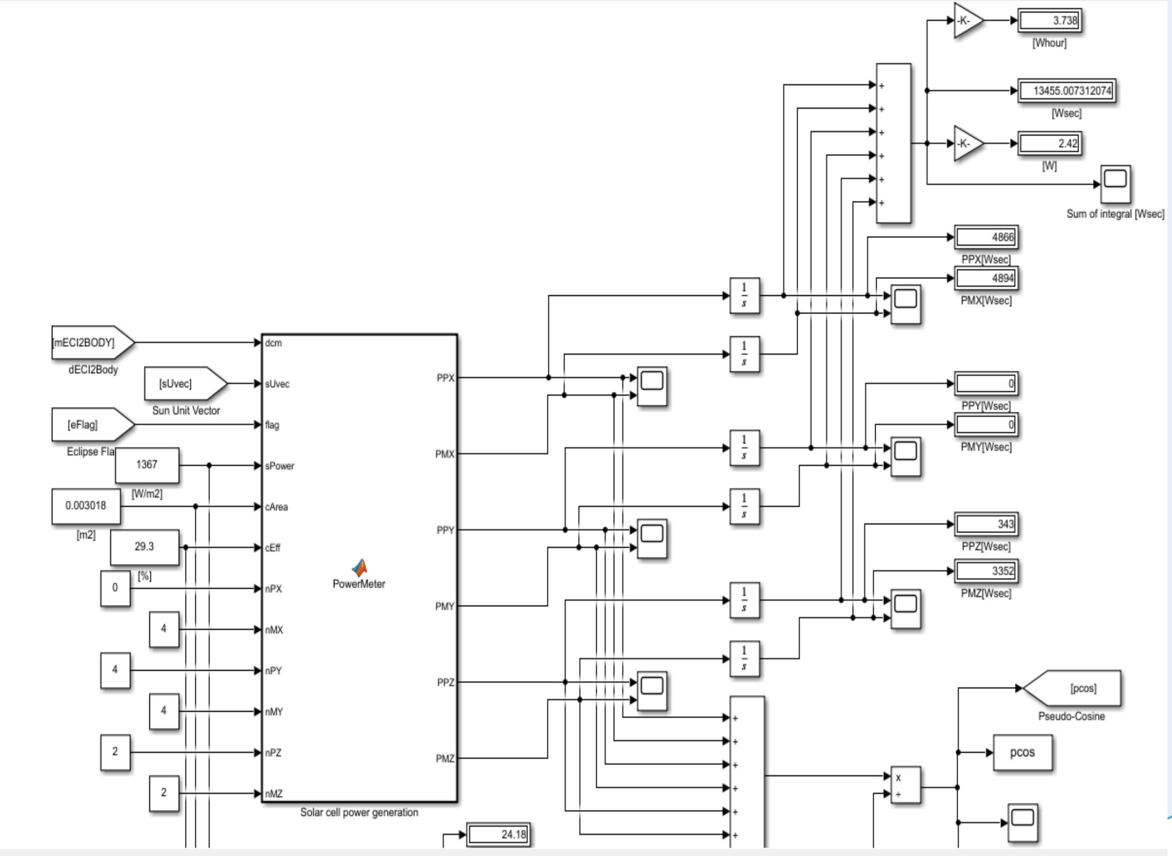
Total Current per Power Line per Mission Mode (A)

	Safe Mode	Nominal Mode	Mission / Telemetry Data Downlink	ADCS Controlled Spin Mode	RGBN Cam Mission	RGBN Cam Mission (Data Transfer)	Store and Forward Mission	APRS Mission	TEG Mission
UNREG #1		0.2333333333	1.445454545	0.05151515152	0.05151515152	0.05151515152	0.05151515152	0.05151515152	0.05151515152
UNREG #2		0	0	0	0	0	0	0	0
3.3V #1		0.161	0.1	0.206	0.59542	0.38942	0	0	0
3.3V #2		0.0774	0.0774	0.0774	0.0774	0.0774	0.3556606061	0.0774	0.1774
5.0V #1		0	0	0.4	0.4	0	0	0.086	0.003
MAX		0.23	1.45	0.40	0.60	0.39	0.36	0.09	0.18

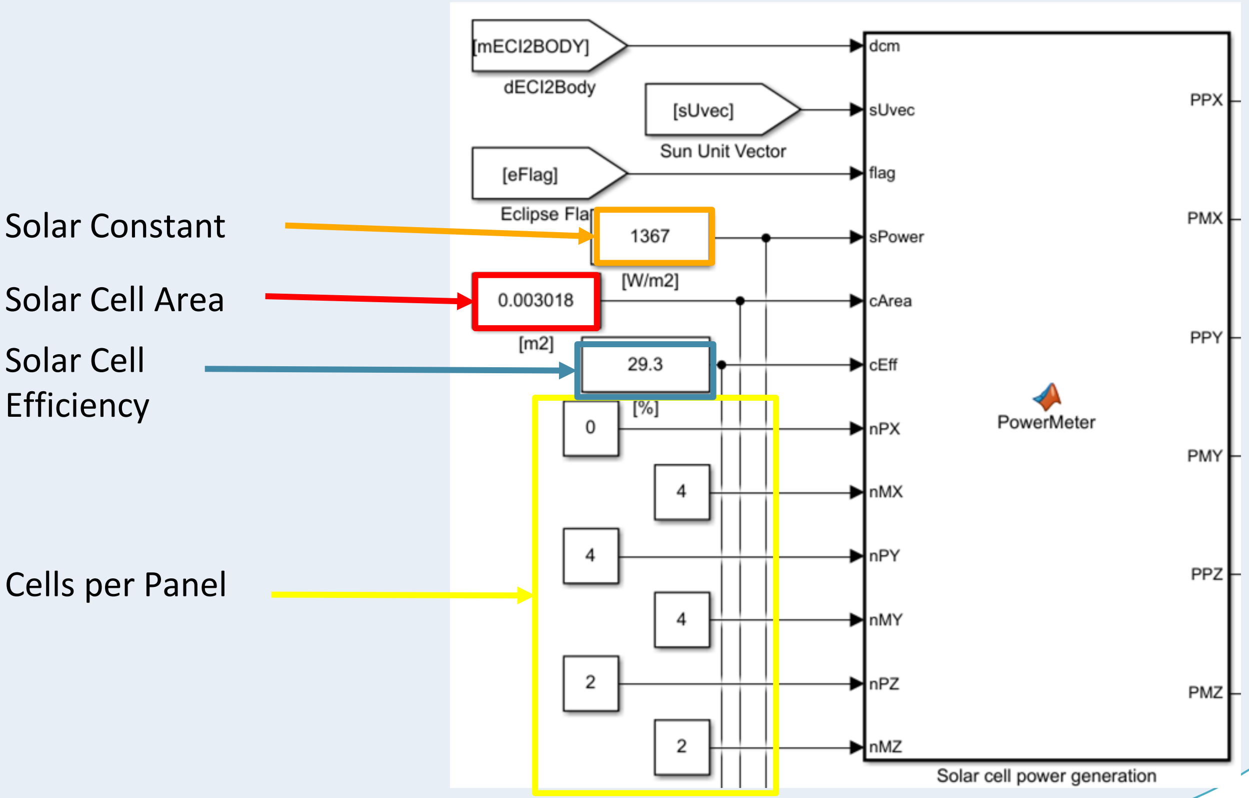
	Thermal Louvers Mission	Coastal Monitoring Mission (Data Transfer)	Vegetation Monitoring Mission (Data Transfer)	Agricultural Land Detection Mission (Data Transfer)	Coastal Monitoring Mission (Processing)	Vegetation Monitoring Mission (Processing)	Agricultural Land Detection Mission (Processing)	Maritime Early Warning Mission
UNREG #1	0.05151515152	0.05151515152	0.05151515152	0.05151515152	0.05151515152	0.05151515152	0.05151515152	0.05151515152
UNREG #2	0	0	0	0	0	0	0	0
3.3V #1	0.206	0.1473	0.1527272727	0.17	0.0773	0.08272727273	0.1	0
3.3V #2	0.1774	0.0774	0.0774	0.0774	0.0774	0.0774	0.0774	0.2534606061
5.0V #1	0.403	0	0	0	0	0	0	0
MAX	0.40	0.15	0.15	0.17	0.08	0.08	0.10	0.25

	Total (per Mode)
Max Energy (mWh)	2033.63
Max Current (A)	1.75

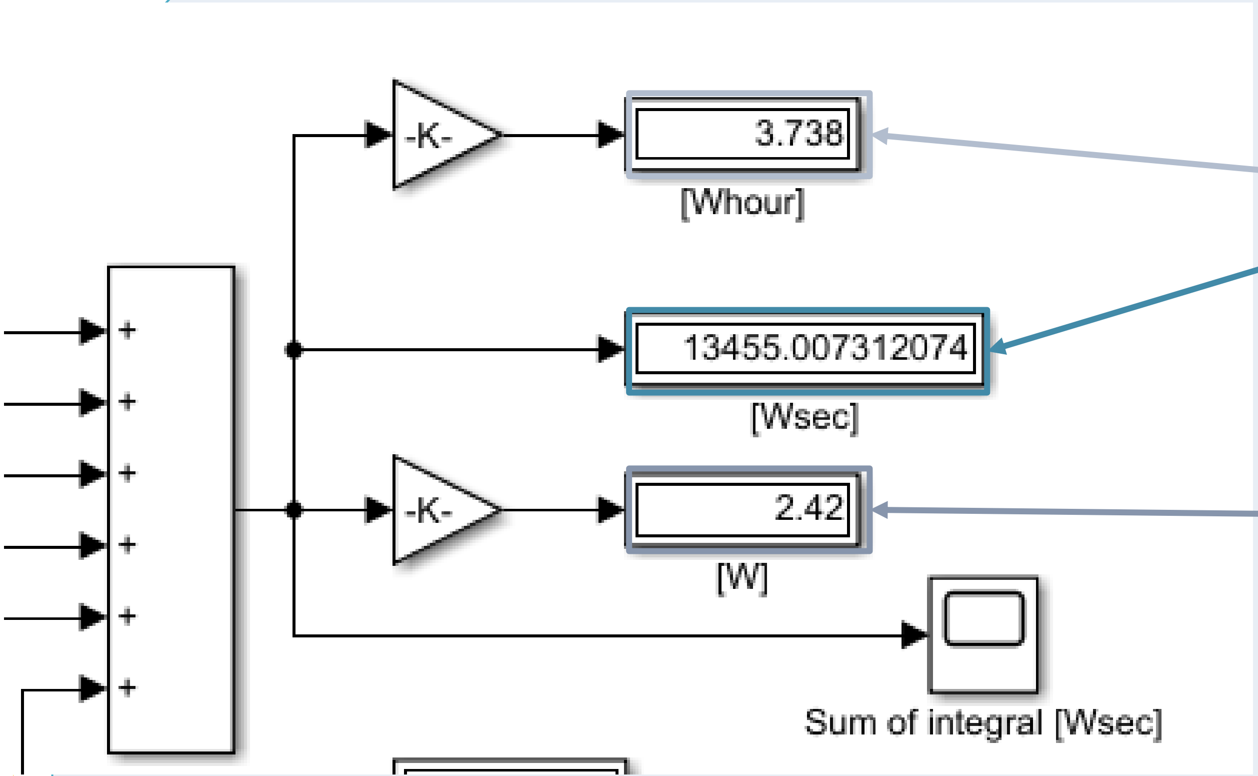
POWER GENERATION SIMULATIONS



POWER GENERATION SIMULATIONS



POWER GENERATION SIMULATIONS



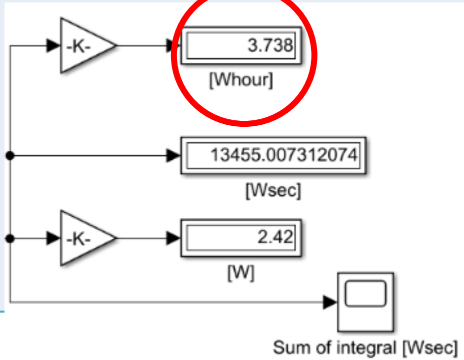
Energy per Orbit

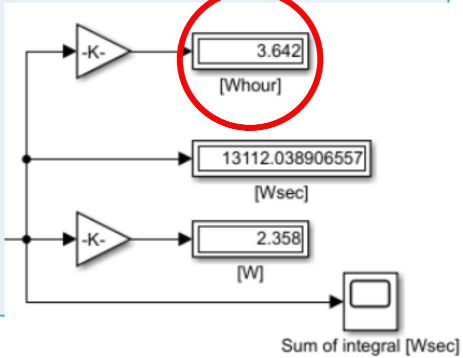
Power per Orbit

POWER GENERATION SIMULATIONS

Final Computations for 16 Solar Cells	
Energy generated from Solar Cells per orbit based on MATLAB Simulation [Wh]	3.738
Power Loss in Blocking Diode per panel [W]	0.34
Energy Loss in Blocking Diode whole system [Wh]	0.51
Efficiency of DC/DC Converters [%]	0.8
Total Energy Generated After DC/DC [Wh]	**2.5824**

Final Computations for 14 Solar Cells	
Energy generated from Solar Cells per orbit based on MATLAB Simulation [Wh]	3.624
Power Loss in Blocking Diode per panel [W]	0.34
Energy Loss in Blocking Diode whole system [Wh]	0.51
Efficiency of DC/DC Converters [%]	0.8
Total Energy Generated After DC/DC [Wh]	**2.4912**





POWER GENERATION SIMULATIONS

- Highlighted in **RED** if it reaches 80% of simulated Total Energy Generated per orbit
- Highlighted in **YELLOW** if it reaches 75% of simulated Total Energy Generated per orbit
- **16 Solar Cells** (2584.2 mWh per orbit)

Maximum Power Allocated (mW)	Duration per Orbital Period (h)	Energy per Orbit (mWh)	Connected Power Line	Maximum Voltage (V)	Maximum Current (A)	Nominal Mode	Mission / Telemetry Data Downlink	ADCS Controlled Spin Mode	RGBN Cam Mission (Capturing)	RGBN Cam Mission (Data Transfer)
	0.17		3.3V #2	3.3		OFF	OFF	OFF	OFF	OFF
581	0.117	67.977	3.3V #2	3.3	0.18	OFF	OFF	OFF	OFF	OFF
12600	0.000278	3.5028	UNREG #2			OFF	OFF	OFF	OFF	OFF
12600	0.000278	3.5028	UNREG #2			OFF	OFF	OFF	OFF	OFF
Total Energy consumption per mission (mWh)						1599.87	2065.87	1629.39	1884.39	1593.13
Total Current during mission						0.60	1.81	0.86	1.18	0.49

POWER GENERATION SIMULATIONS

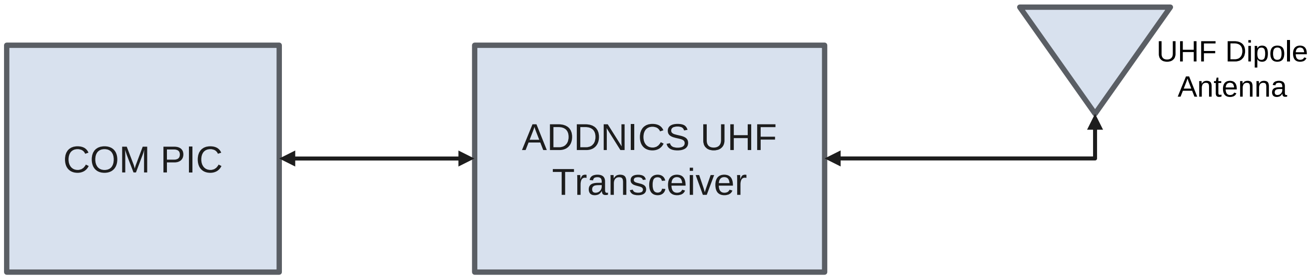
- Highlighted in **RED** if it reaches 80% of simulated Total Energy Generated per orbit
- Highlighted in **YELLOW** if it reaches 75% of simulated Total Energy Generated per orbit
- **14 Solar Cells** (2491.2 mWh per orbit)
- Goes above the 80% safety threshold

Maximum Power Allocated (mW)	Duration per Orbital Period (h)	Energy per Orbit (mWh)	Connected Power Line	Maximum Voltage (V)	Maximum Current (A)	Nominal Mode	Mission / Telemetry Data Downlink	ADCS Controlled Spin Mode	RGBN Cam Mission (Capturing)	RGBN Cam Mission (Data Transfer)
	0.17		3.3V #2	3.3		OFF	OFF	OFF	OFF	OFF
581	0.117	67.977	3.3V #2	3.3	0.18	OFF	OFF	OFF	OFF	OFF
12600	0.000278	3.5028	UNREG #2			OFF	OFF	OFF	OFF	OFF
12600	0.000278	3.5028	UNREG #2			OFF	OFF	OFF	OFF	OFF
Total Energy consumption per mission (mWh)						1599.87	2065.87	1629.39	1884.39	1593.13
Total Current during mission						0.60	1.81	0.86	1.18	0.49

COMMUNICATIONS SUBSYSTEM

Functions

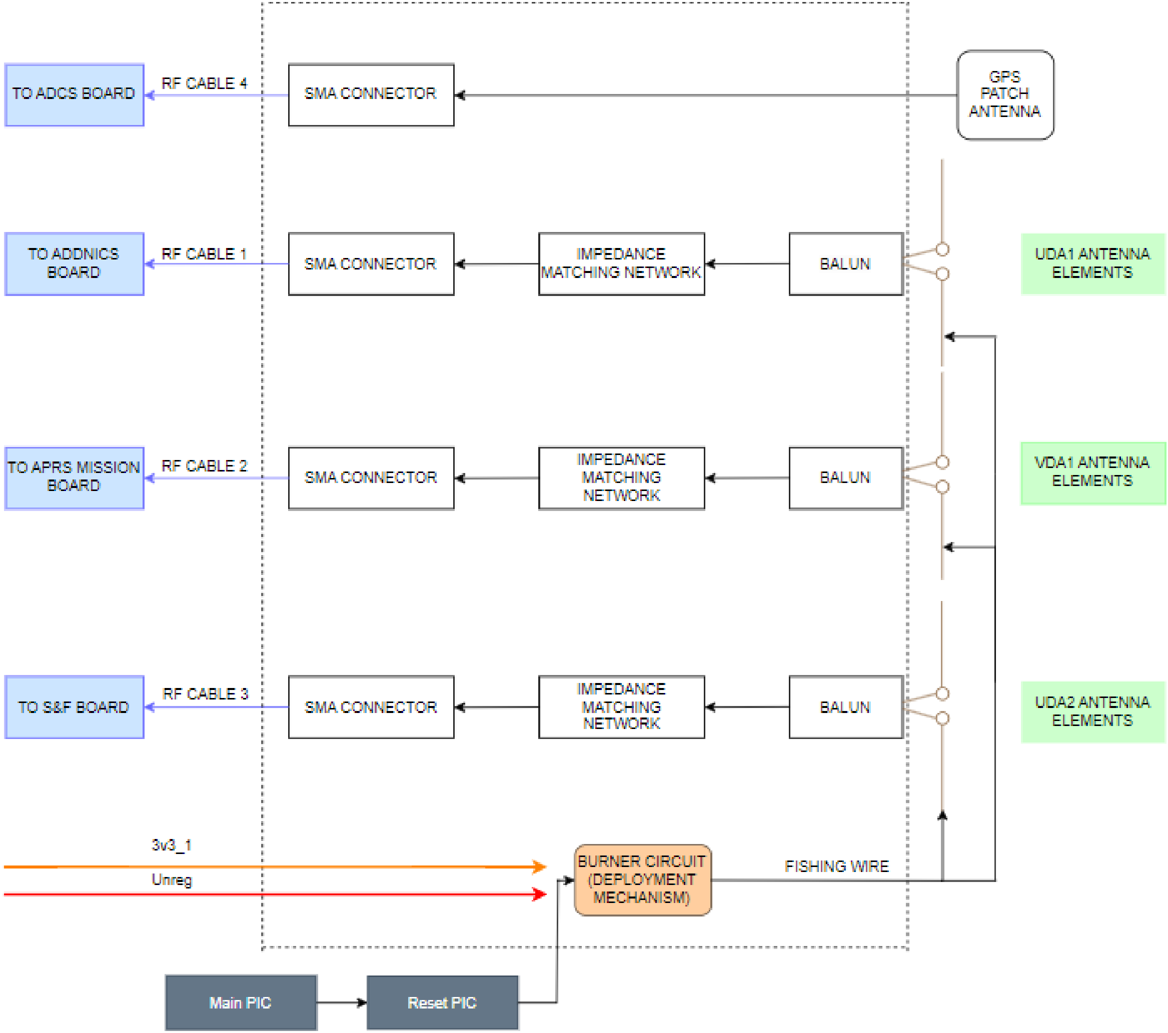
- Receive uplink command from Ground Station (GS) and send the received command to the On-Board-Computer (OBC)
- Receive the telemetry/housekeeping (TLM/HK) and mission data from OBC and transmit the data downlink to GS
- Transmit Continuous Wave (CW) beacon to GS



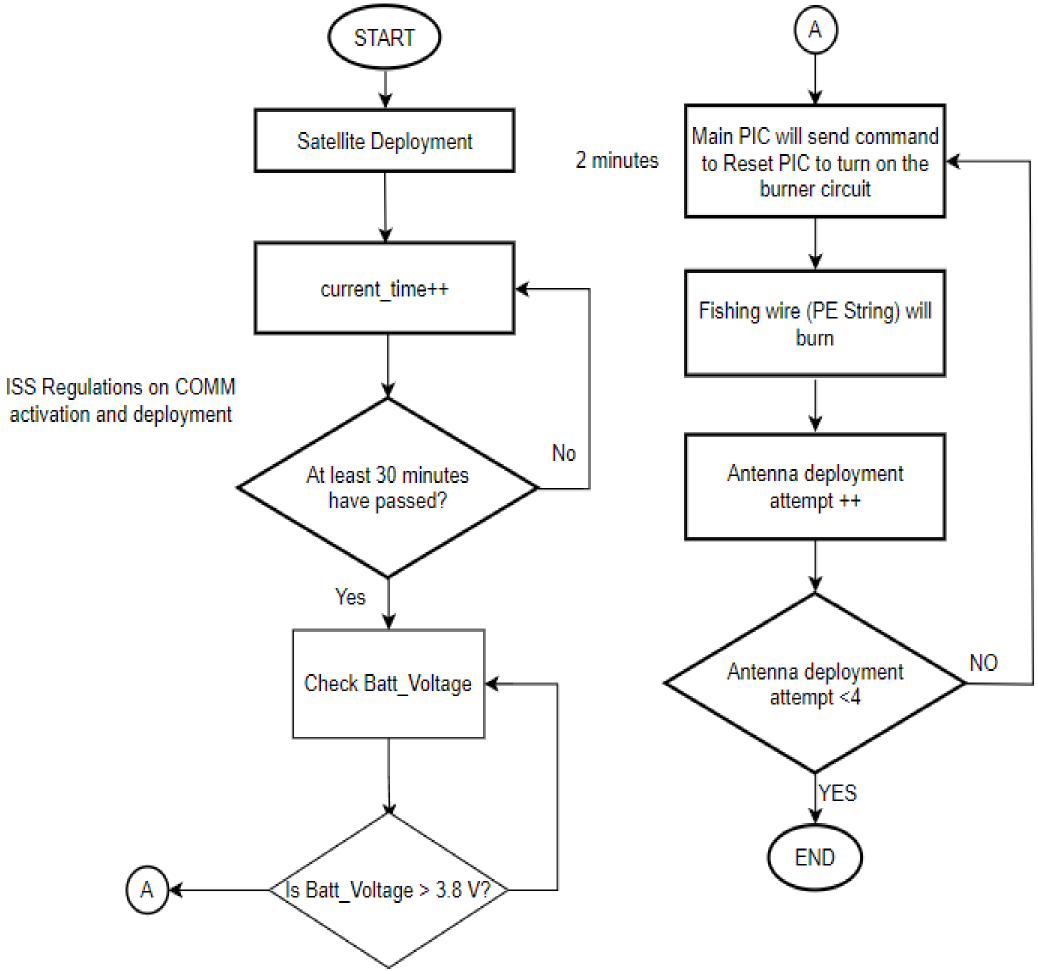
ANTENNA DESIGN AND DEPLOYMENT

Functions

- Must be able to transmit and receive RF signals to and from the ground station
- Must be able to transmit and receive RF signals to and from the Ground Sensor Terminals (GST) used in S&F mission and the handheld radios used in APRS-DP mission

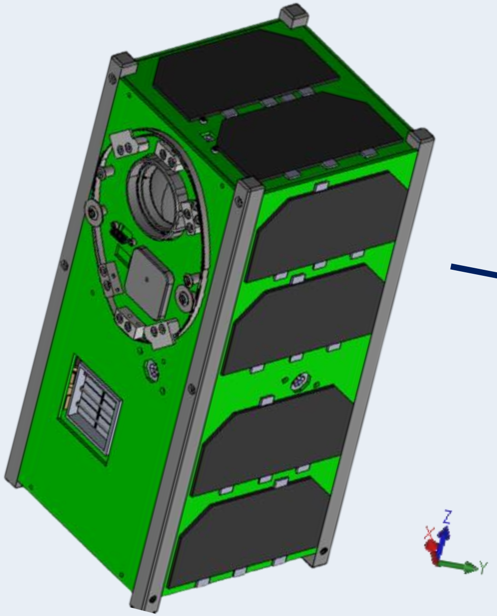


BLOCK DIAGRAM

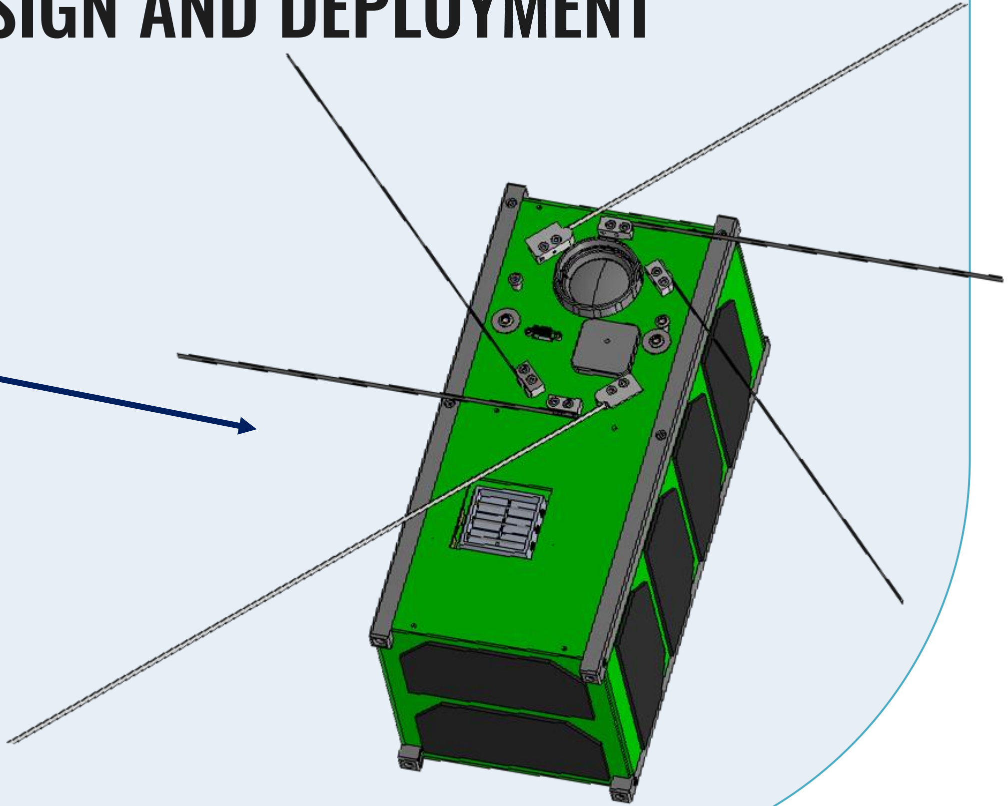


CONCEPT OF OPERATIONS

ANTENNA DESIGN AND DEPLOYMENT



Antenna Stowed

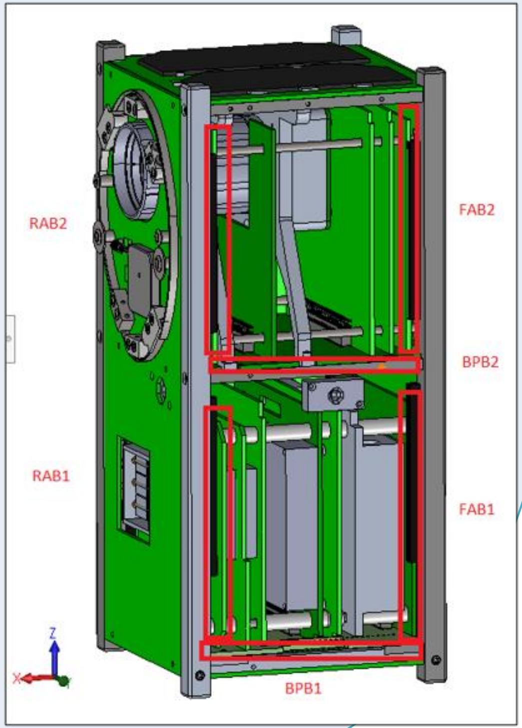


Antenna Deployed

Electrical iNterface and Access Boards for Linkage Ease (ENABLE) Subsystem

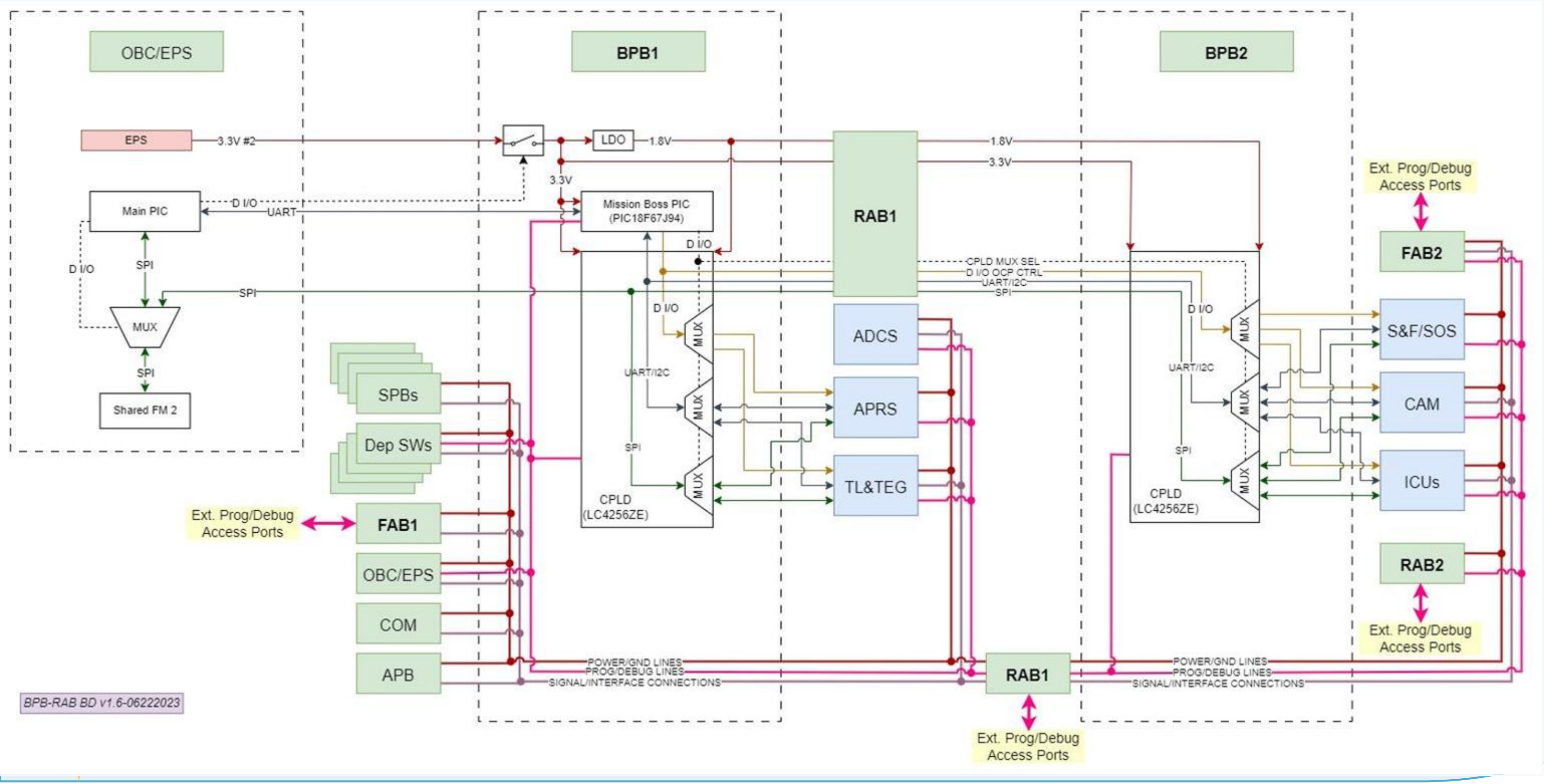
Functions

- Composed of the Backplane Boards (BPB) and Access Boards (RAB, FAB)
- Adds ease in satellite assembly and reduce harnesses and risks of workmanship errors associated to wire harness
- Allows means to access bus and mission boards for programming and debugging purposes



Boards of ENABLE Subsystem

Electrical iNterface and Access Boards for Linkage Ease (ENABLE) Subsystem



Mission Boss PIC functions:

- Turn mission boards on/off
- Communicate with mission boards
- Control CPLDs

CPLD functions:

- Change software-configurable routes

Thermal & Radiation Design, Analysis & Testing (THR)

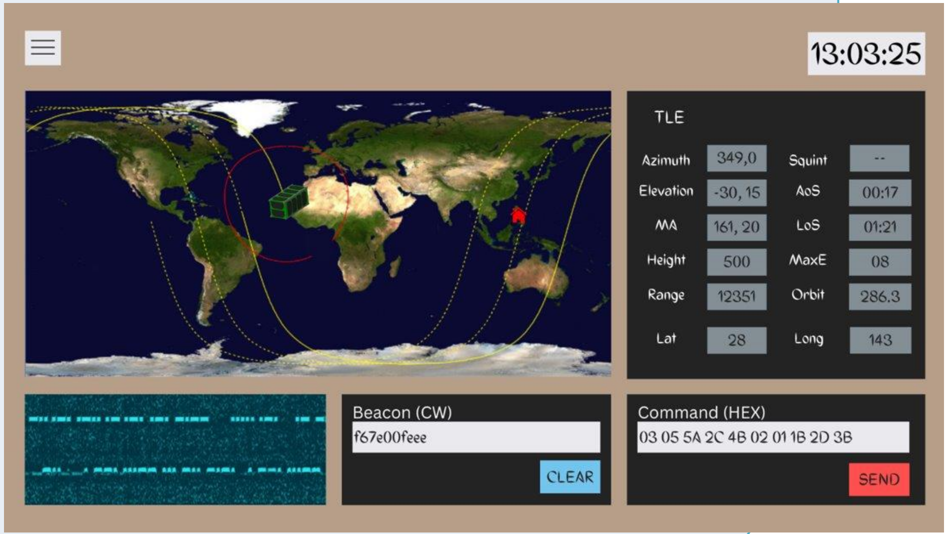
Functions

- Allows the Maya-7 CubeSat to withstand thermal conditions of space environment
- Accommodates thermal requirements and operating limits of the mission payloads

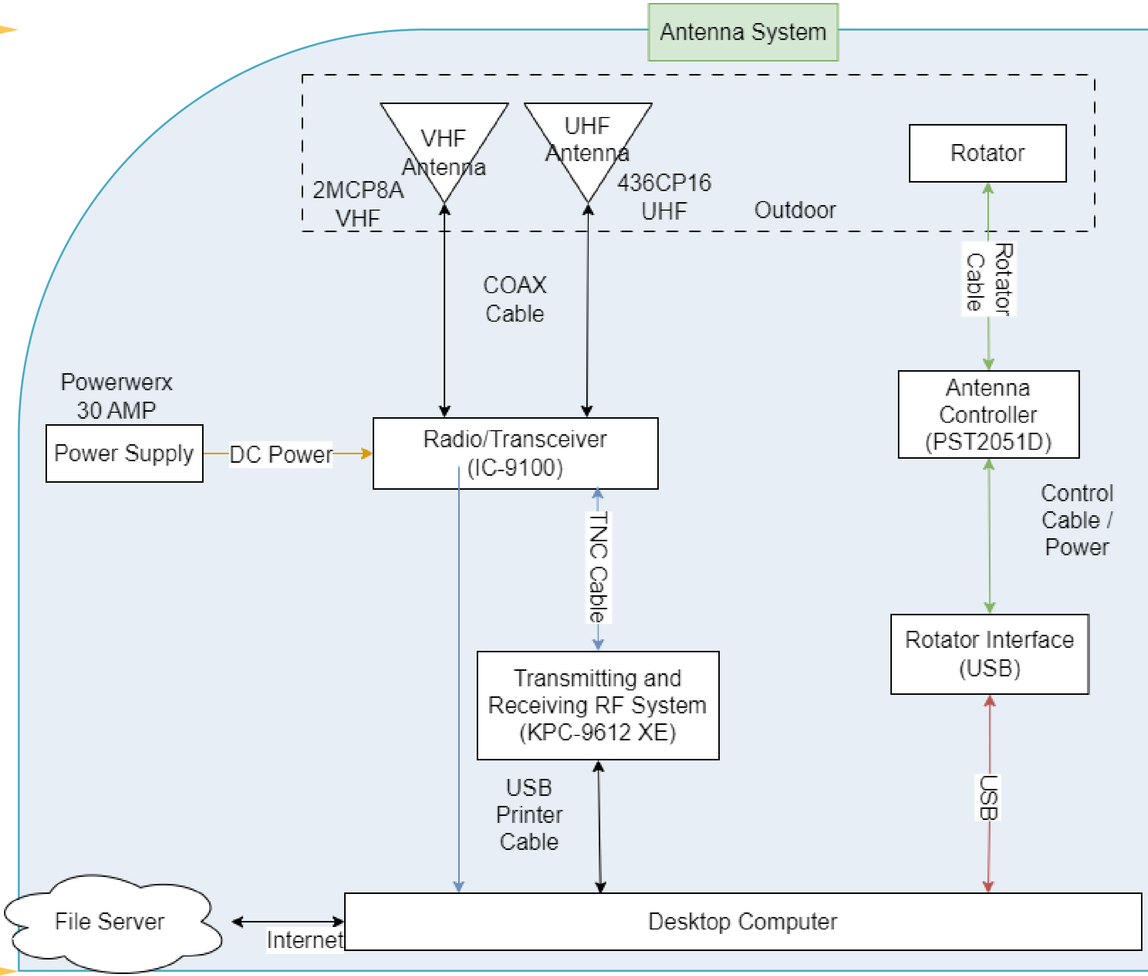
Ground Station (GS)

Functions

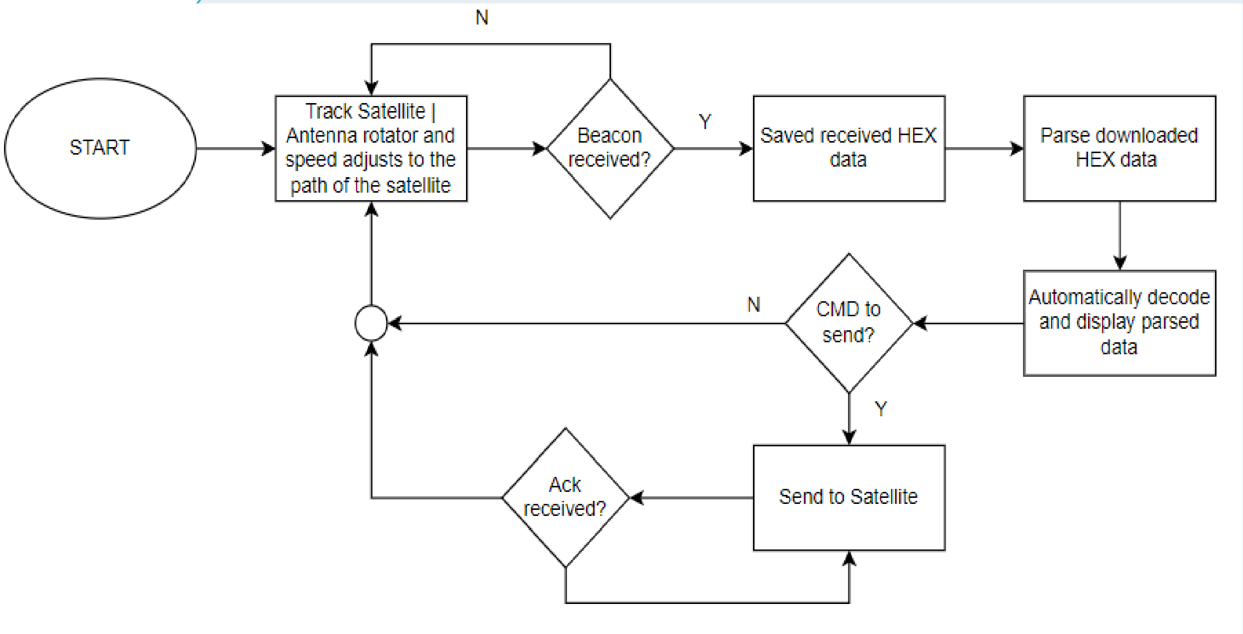
- Communicate with Maya-7
- Track and determine the position of the satellite
- Send command to Maya-7 and receive telemetry from the satellite
- Support communication of the S&F and APRS-DP missions

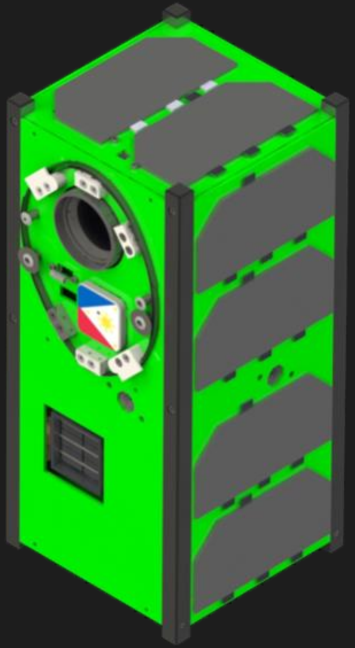


BLOCK DIAGRAM



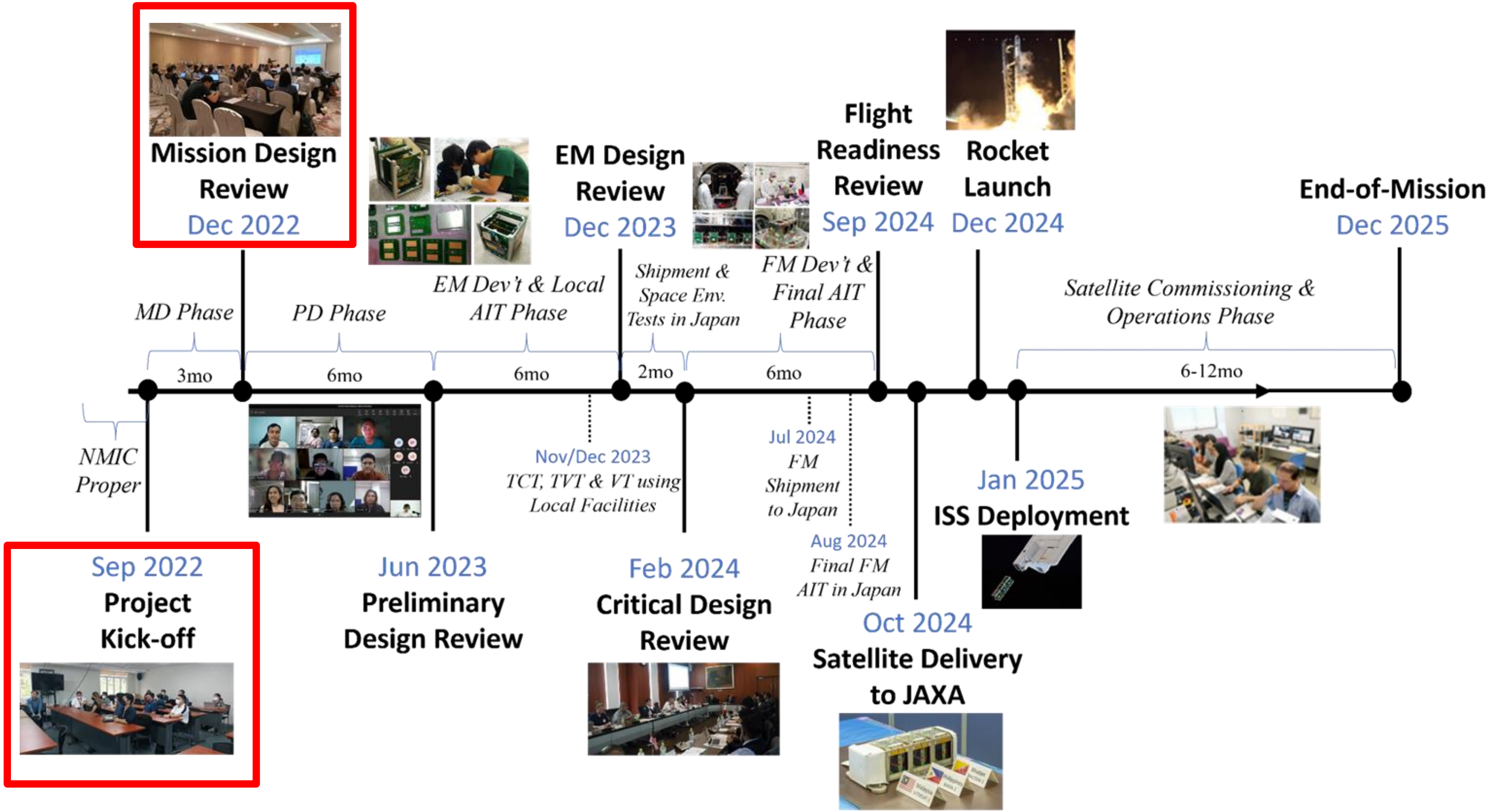
CONCEPT OF OPERATIONS





MILESTONES ACHIEVED

Ariel Nopre, Jr.



MD: Mission Design
PD: Preliminary Design & Prototype Development
EM: Engineering Model
FM: Flight Model

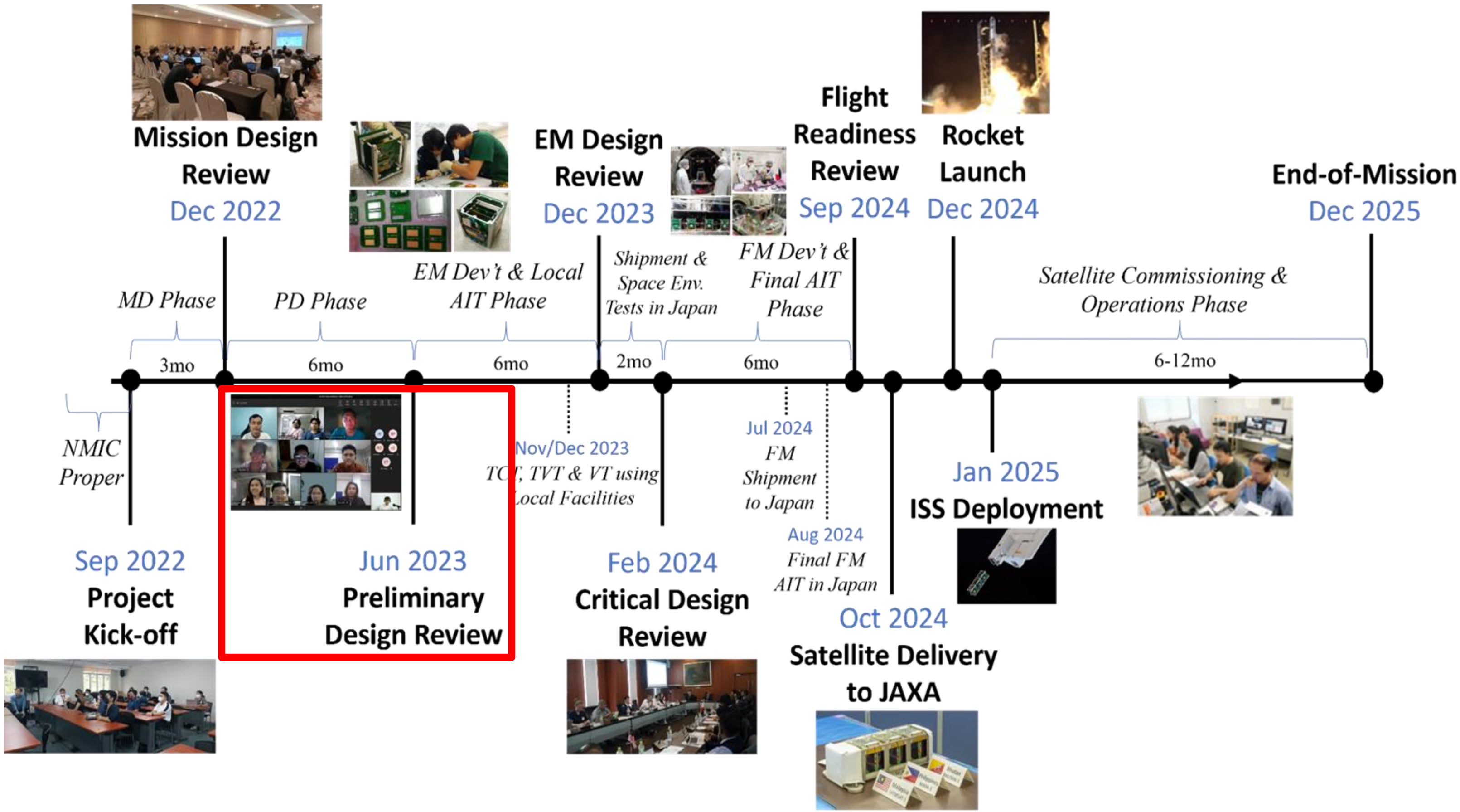
AIT: Assembly, Integration & Test
TCT: Thermal Cycle Test
TVT: Thermal Vacuum Test
VT: Vibration Test

MAYA-7 PROJECT TIMELINE

Mission Design Review

Maya-7 Mission Design Review held on 13 December 2022

- Examined the feasibility and desirability of the satellite missions
- Established the initial strategic plan of the project
- Outputs: Mission objectives, requirements allocation, initial technical specifications, success criteria, mission operation concept



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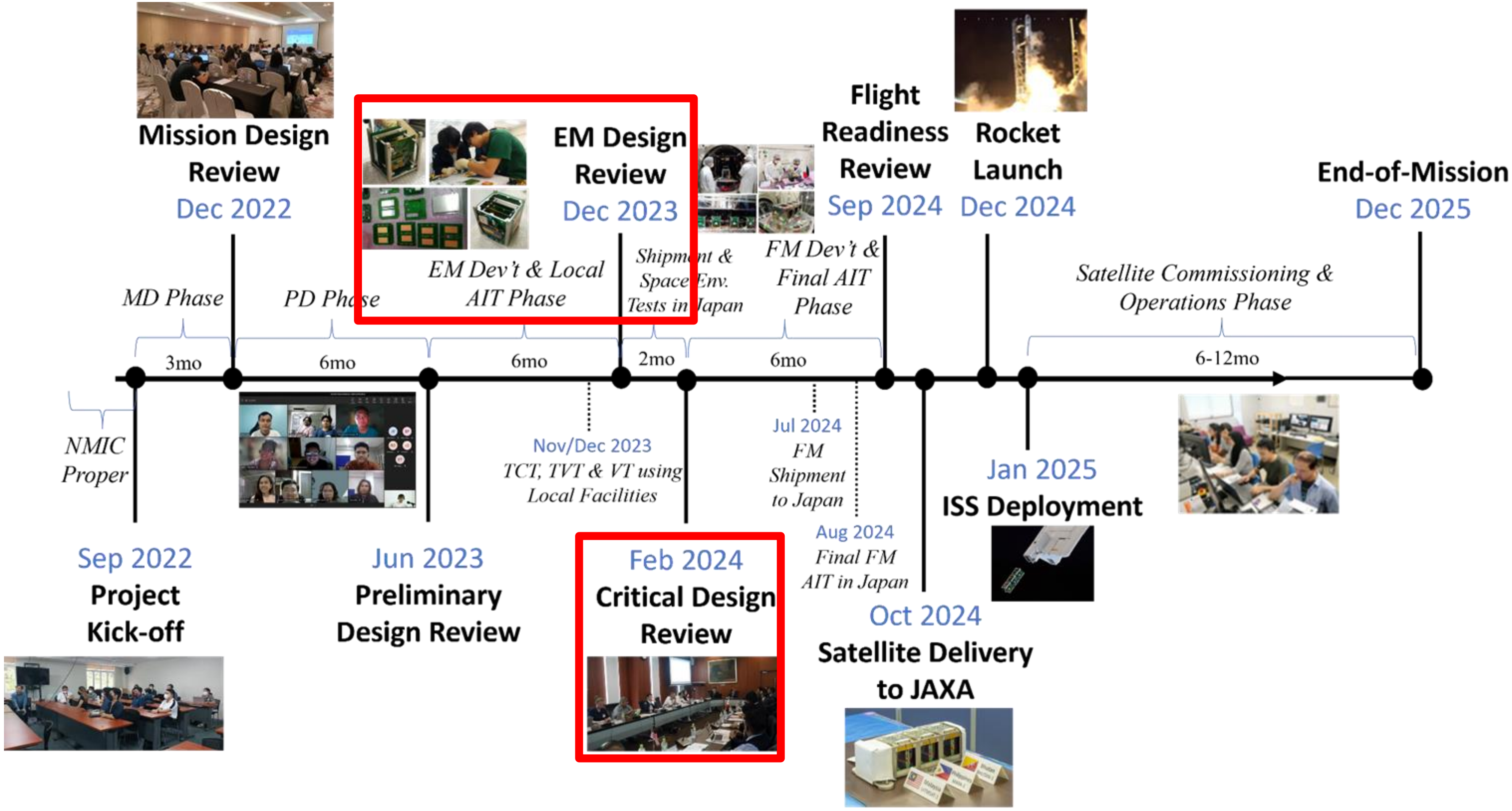
MAYA-7 PROJECT TIMELINE

Preliminary Design Review

Maya-7 Mission Design Review held on 23 and 29 June 2023

The Preliminary Design Review I (PDR I) examines the baseline implementation, integration, verification, and validation plans of the project. Preliminary design solutions are also scrutinized. Expected Output: Initial subsystem prototypes, initial integration, verification and validation, simulations and analyses

What's Next ???



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MAYA-7 PROJECT TIMELINE

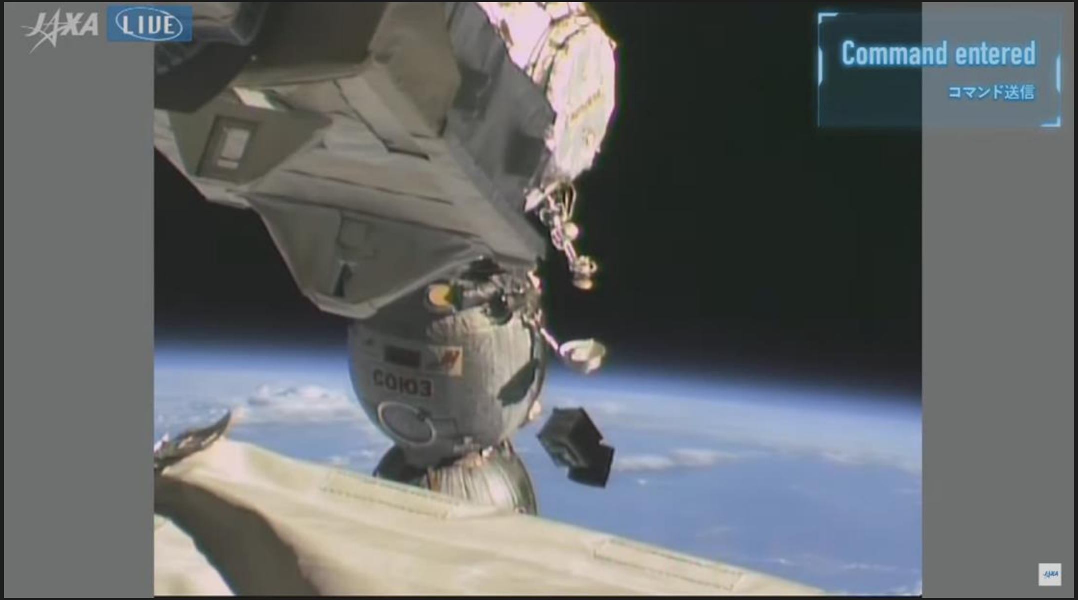
MAYA-5 & MAYA-6 OPERATIONS STATUS

John Abiel Villanueva

Maya 5 and Maya-6 Photo courtesy of Stamina4Space

Maya-5 and Maya-6

On July 19, 2023 satellites Maya-5 and Maya-6 were deployed from the ISS



https://www.youtube.com/watch?v=0kci4493p2Q

Operation Report

Satellite	CW Beacon	UHF Uplink	UHF Downlink	Remark
Maya-5	✓	X	X	Maya-5 beacon is not received regularly and ARSS has not received ACK from Maya-6
Maya-6	✓	✓	X	

Command Uplinks Sent:

- Check COMM Uplink (Paraguay GS received 1 ACK on September 1)
- Download HK Data (No ACK)
- Download HSSC (No ACK)

Ground Stations Tracking Maya-5 and Maya-6

- ARSS GS (Main)
- BIRDS GS Network
- Local Amateur Radio Community
- IARU Community
- SatNOGS

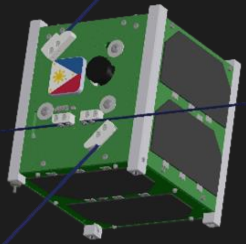
Orbit Status

Satellite	NORAD ID	International Code	Callsign	Altitude (km)
Maya-5	57419	1998-067VW	DX5MYA	388
Maya-6	57420	1998-067VX	DX6MYA	389

The latest beacons were received on:

- **Maya-5**:September 11,20203 - 10:38:28 (UTC)
- **Maya-6**: September 11, 2023 - 22:00:47 (UTC)

The GS setup was turned off and unplug because of thunderstorms in the area



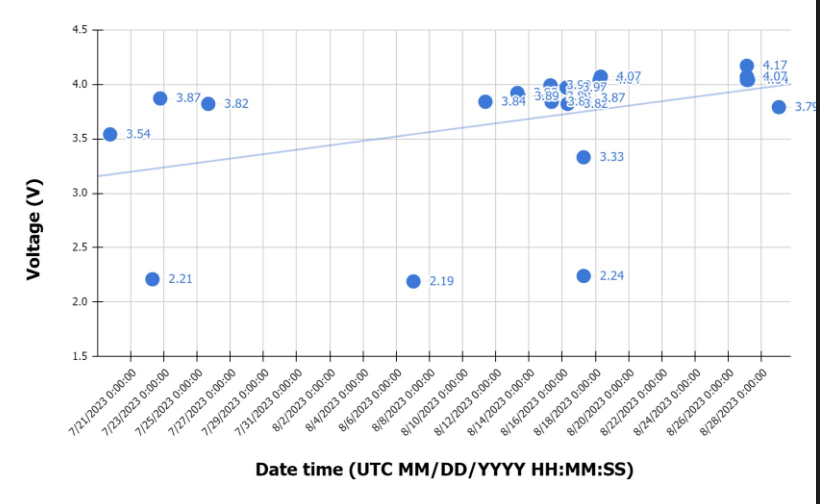
MAYA-5

Maya-5

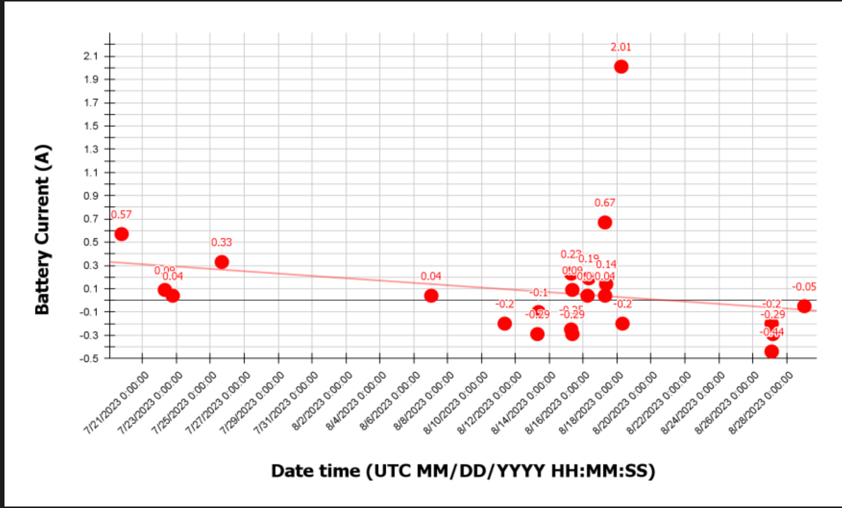
Problem Encountered	Remarks
Maya-5 **battery** falling under **critical levels**	On Maya-5's first few weeks **CW beacons indicate 2.2~3.9V** **Continuous monitoring** and **no uplink** commands were executed to allow the satellite to charge. As of late, we've been getting 3.8V~4.1V but fewer beacon receptions have been collected
Antenna deployment status turning ON and OFF	First beacon indicated Deployed Antenna but most beacons show a **Not deployed flag** has been received
Main kill switch has been **raised 4 times**	Cause has not been identified yet but flag switches OFF in the succeeding beacon(s)
CW beacons are not regularly received	Satellite is **suspected** to be going into **safe Mode** and is suspected to not **generate enough power**. Decoded beacons indicate that **all solar cells are functional** and **little to no beacons** have been received **during eclipse**. Probably caused by the battery deteriorating
Reserved Missions that were indicated to have been performed **but have not been confirmed**	APRS, HNT, D-TR

Maya-5 Battery Levels

Voltage-Time Graph



Current-Time Graph



Daylight Beacons :56
Eclipse Beacons : 15
Last beacon during eclipse: 8/17

The few CW beacons are suspected to be caused by Maya-5 entering into safe-mode especially during eclipse.

Future plan: After stabilizing above 3.9V, uplinks are to be scheduled

Maya-5 Solar Cells

Date time Format (UTC)	Solar Cell				
	X	-X	Y	Z	-Z
7/22/2023 7:38:00	-	-	*	-	*
7/22/2023 18:49:00	-	-	-	-	*
7/25/2023 16:18:00	-	-	-	-	-
7/19/2023 18:24:16	-	-	-	-	-
8/7/2023 0:53:27	-	-	*	-	-
8/11/2023 8:54:24	*	-	-	*	-
8/13/2023 7:08:20	*	-	*	*	-
8/13/2023 8:48:43	-	-	*	-	-
8/15/2023 6:58:24	*	-	-	*	-
8/15/2023 7:02:28	-	*	-	-	-
8/15/2023 8:35:19	*	*	-	*	-
8/15/2023 8:37:24	*	-	*	*	-
8/16/2023 6:10:02	-	-	-	*	-
8/16/2023 7:48:13	-	*	-	-	-

Date time Format (UTC)	Solar Cell				
	X	-X	Y	Z	-Z
8/17/2023 6:50:54	-	*	-	*	-
8/17/2023 6:59:18	*	-	*	-	-
8/17/2023 8:30:28	*	-	-	-	-
8/18/2023 5:59:08	-	-	*	*	-
8/18/2023 7:40:03	-	*	*	-	-
8/27/2023 2:53:25	*	*	*	*	-
8/27/2023 2:52:24	*	*	-	*	*
8/27/2023 4:32:34	-	*	*	-	*
8/27/2023 2:48:36	-	-	*	*	-
8/29/2023 1:09:56	-	*	-	-	-

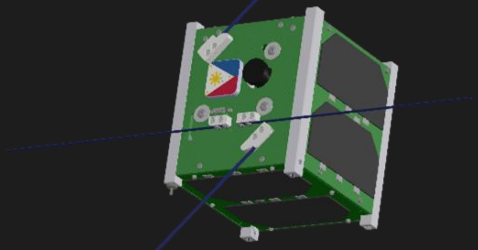
Solar Cell Damage: Rejected

Suspected: Battery performance is weak
Probable cause: Deterioration

Maya-5 Mission Status

Date Time (UTC)	Auto Mission				Reservation	Uplink Success	Execute Mission							
	HSSC	CAM	MBP	ADCS			ADCS	APRS	HNT	SF-W	NTU	TMCR	PSC	D-TR
7/19/2023 18:28:00.	ON	OFF	OFF	OFF	No	ON	-	-	-	-	-	-	-	-
7/23/2023 13:32:00	ON	OFF	OFF	OFF	No	ON	-	-	-	-	-	-	-	-
7/19/2023 16:49:10	ON	OFF	OFF	OFF	No	ON	-	-	-	-	-	-	-	-
7/19/2023 18:28:22	ON	OFF	OFF	OFF	No	ON	-	-	-	-	-	-	-	-
8/5/2023 2:29:21	ON	ON	OFF	OFF	No	No	-	-	-	-	-	-	-	-
8/7/2023 0:51:14	ON	ON	OFF	OFF	No	No	-	-	-	-	-	-	-	-
8/8/2023 23:10:33	ON	ON	OFF	OFF	No	No	-	-	-	-	-	-	-	-
8/9/2023 23:49:18	ON	ON	OFF	OFF	No	No	-	-	-	-	-	-	-	-
8/9/2023 23:52:56	ON	ON	OFF	OFF	No	No	-	-	-	-	-	-	-	-
8/9/2023 23:55:09	ON	OFF	ON	OFF	YES	YES	-	*	*	-	-	-	-	*
8/11/2023 10:28:36	ON	ON	OFF	OFF	No	No	-	-	-	-	-	-	-	-
8/11/2023 10:30:45	ON	ON	OFF	OFF	No	No	-	-	-	-	-	-	-	-
8/12/2023 8:01:00	ON	ON	OFF	OFF	No	No	-	-	-	-	-	-	-	-
8/12/2023 8:03:00	ON	ON	OFF	OFF	No	No	-	-	-	-	-	-	-	-

Executed Missions: To be verified



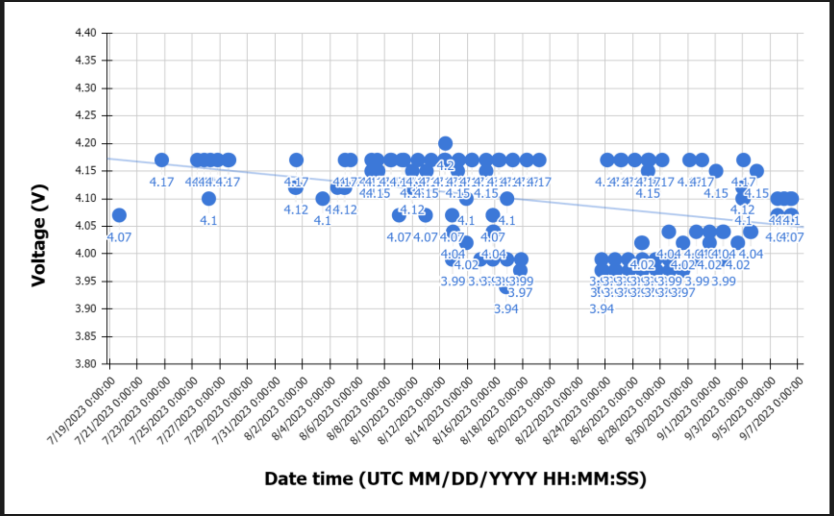
MAYA-6

Maya-6

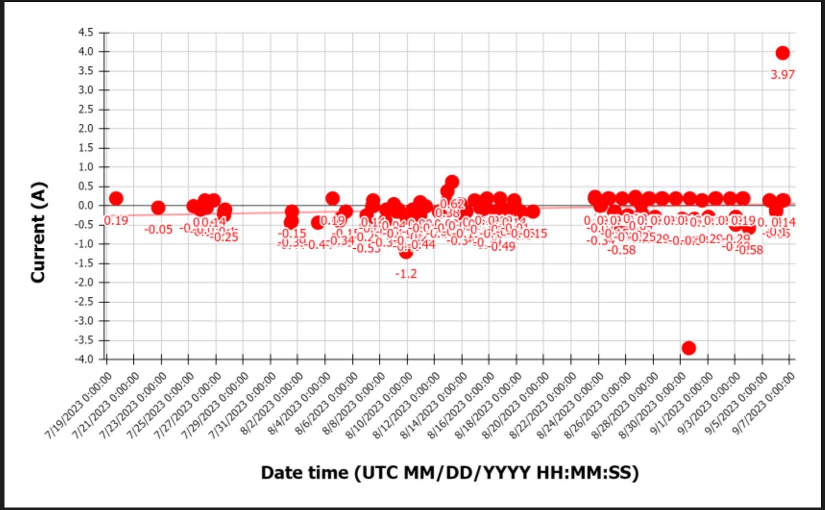
Problem Encountered	Remarks
Maya-6 **voltage** has a stable > 3.9 V reading but has been **slowly decreasing**	Solar Panel indicates that **problems** on the **Y-panel** might be happening
Antenna deployment flag has only been raised twice and is **consistently sent as Not Deployed**	CW Beacon reception is consistent but no ACK has been received by ARSS GS
Main **kill switch** has been **raised 13** times	Cause has not been identified yet but flag switches OFF in the succeeding beacon(s)
Reserved Missions that were indicated to have been performed but **have not been confirmed**	ADCS, APRS, HNT, D-TR, PSC, NTU, TMCR
ARSS GS Uplink no ACK	Beacon reception even at 1 degree elevation, Confirmed TNC can send and received ACK, Attempted to measure Channel Power between Maya-6 and ARSS GS (no data received) even at 70deg, No ACK even at 87 deg

Maya-6 Battery Levels

Voltage-Time Graph



Current-Time Graph



Consistent reception of beacons. As the trendline suggests, Maya-6 voltage is noticeably decreasing

Suspected: Power Generation problems

Maya-6 Solar Cells

Date time Format (UTC)	Solar Cell				
	X	-X	Y	Z	-Z
9/2/2023 23:47:58	*	-	-	*	-
9/2/2023 23:49:58	-	*	-	-	*
9/3/2023 1:26:53	-	-	-	*	-
9/3/2023 1:28:58	-	*	-	-	*
9/3/2023 13:08:28	-	-	-	-	-
9/3/2023 14:38:56	-	-	-	-	-
9/3/2023 14:40:59	-	-	-	-	-
9/4/2023 0:32:14	-	*	-	-	*
9/5/2023 12:49:30	-	-	-	-	-
9/5/2023 12:55:46	-	-	-	-	-
9/6/2023 0:15:25	-	-	-	*	-
9/6/2023 0:19:35	-	*	-	-	-

Y Solar Panel was last observed to generate power on 8/15/23 and the other only instance was recorded on 7/27/23

Date time Format (UTC)	Solar Cell				
	X	-X	Y	Z	-Z
8/15/2023 8:36:26	-	*	*	-	-
8/15/2023 8:38:27	-	-	-	*	-
8/15/2023 20:16:44	-	-	-	-	-
8/15/2023 20:20:57	-	*	-	-	*
8/15/2023 20:23:03	-	*	-	-	*
8/15/2023 20:23:03	-	*	-	-	*
8/15/2023 21:59:37	-	*	-	-	*
8/16/2023 6:07:28	-	*	-	-	-
8/16/2023 6:11:40	-	*	-	-	-
8/16/2023 7:47:53	-	*	-	-	*

Solar Cell Damage: Possible

Maya-6 Mission Status

Date Time (UTC)	Auto Mission				Reservation	Uplink Success	Execute Mission							
	HSSC	CAM	MBP	ADCS			ADCS	APRS	HNT	SF-W	NTU	TMCR	PSC	D-TR
7/25/2023 15:54:00	OFF	ON	ON	OFF	No	No	-	-	*	-	*	-	-	-
7/25/2023 16:19:00	ON	OFF	OFF	OFF	No	YES	-	-	-	-	-	-	-	-
7/21/2023 13:25:00	ON	OFF	OFF	OFF	No	YES	-	-	-	-	-	-	-	-
7/19/2023 18:24:42	ON	OFF	OFF	OFF	No	YES	-	-	-	-	-	-	-	-
7/19/2023 18:28:50	ON	OFF	OFF	OFF	No	YES	-	-	-	-	-	-	-	-
8/4/2023 11:41:23	OFF	ON	ON	OFF	No	No	-	-	-	-	-	*	-	-
8/8/2023 11:26:35	ON	ON	OFF	OFF	No	No	-	-	-	-	-	-	-	-
8/8/2023 11:28:43	ON	ON	OFF	OFF	No	No	-	-	-	-	-	-	-	-
8/8/2023 11:30:51	ON	OFF	ON	ON	Yes	No	-	-	-	-	*	-	-	-
8/14/2023 21:11:12	ON	ON	OFF	OFF	No	No	-	-	-	-	-	-	-	-
8/14/2023 21:13:19	OFF	OFF	ON	OFF	No	No	*	-	-	-	*	*	*	-
8/14/2023 22:47:42	ON	ON	OFF	OFF	No	No	-	-	-	-	-	-	-	-

Executed Missions: To be verified

ARSS GS Setup, Tests and Challenges

ARSS Setup

Old Antenna (2MCP8A and 436CP16)

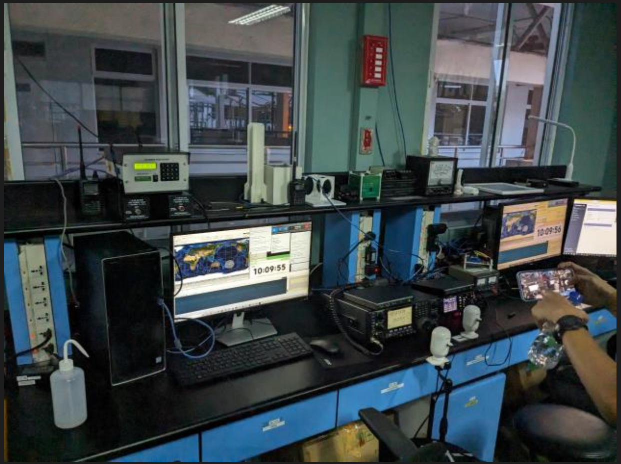
A. TNC (KPC 9612XE)
B. Yaesu FT991 Radio
C. Yaesu G-5500

New Antenna (436CP42UG)

A. TNC
B. ICOM IC-9100 Radio
C. Prosistel Combo rotator Box

Wrong GS Setting

A. ARSS Ground Station Hardware
   A. Radios
      A. Maya-5, Maya-6, RS-44 and FO-29 beacons can be heard
   B. TNC
      A. Can transmit and receive with Maya-3 EM



Hardware Problems: Rejected

Wrong GS Setting

B. Kyutech Amateur Satellite Operation by UHF

A. Maya-5 and Maya-6 CW Beacons are collected

B. Paraguay GS has received 1 ACK using the same software and settings

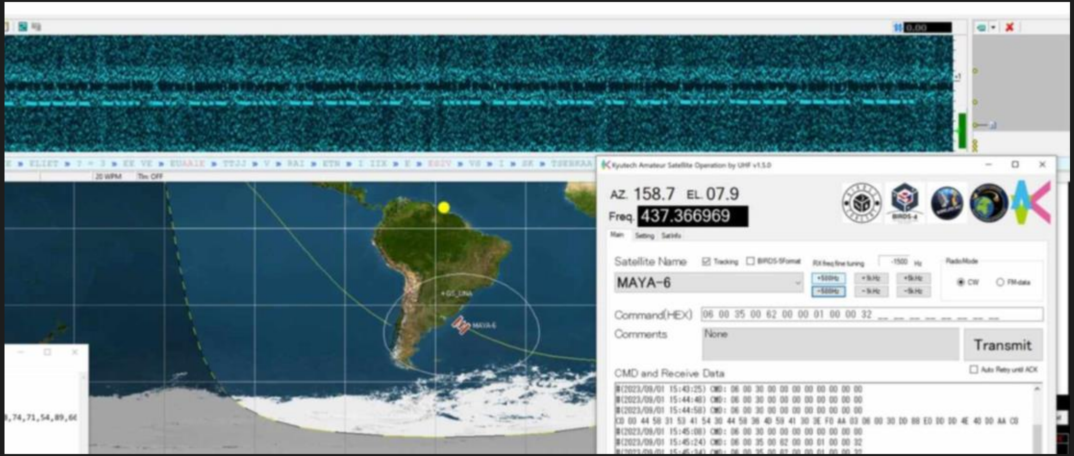


Photo Courtesy of Paraguay GS

Wrong Software Setup: Rejected

Rotator Box PIC Replacement

Problem: The rotator stopped communicating with the PC and could not be operated manually

Solution: Replaced rotator box PIC and replaced USB to UART (Serial TTL) Converter

Status: Fixed

Coax Cable and Connector Repairs

Problem: No beacon was being received for a couple of days

Solution: Replaced coax cables and antenna junction box adapters

Status: Fixed

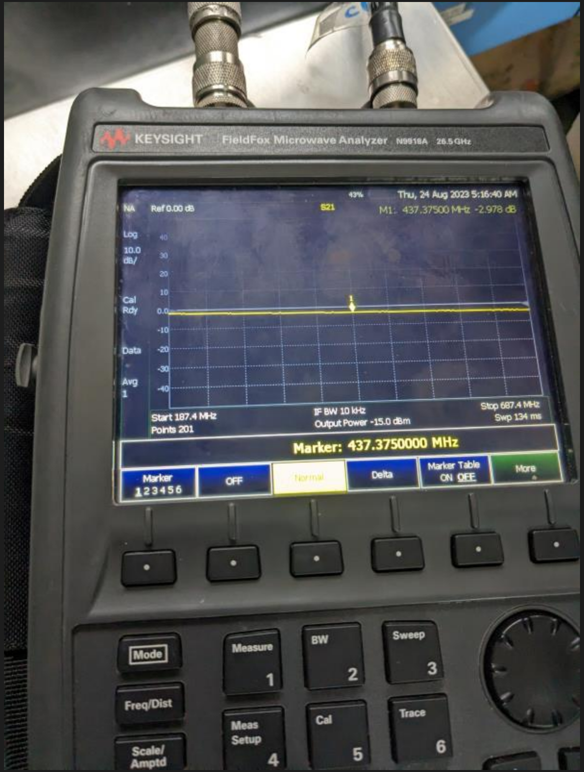
Insertion Loss and

During each Repair, the cables insertion loss and the antennas reflection loss is measured

Antenna	S11	S21
Old Antenna	-11.18 dB	-1.107 dB
New Antenna	-19.82 dB	-2.978 dB*

Currently, both antenna setups and are operable and can receive Maya-5 and Maya-6 beacons

Status: Fixed



Future Plans

Long Range Test (LRT)

- Another LRT to improve pointing accuracy as well as compare the new path loss of the repaired antennas to the expected values

- Bit-error checks to determine which areas are causing the anomalous flags
- Time domain reflectometry* to locate cable interruptions

Maraming salamat po!

(Thank you!)

Do you have any questions?

access-nanosat-team@eee.upd.edu.ph

Connect with us!

Maya-7 Cube Satellite