Project MARITES:

Multipurpose APRS in Nanosatellite for Risk Reduction in Times of Emergency Situations

for IoT Constellation Mission Program in UNISEC-GLOBAL

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Project Technical Assistant IV
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ADU STARLAB

Space Technologies & Applications Research Laboratory

STAR Lab shall be a laboratory specifically designed to support space engineering education with research and activities focusing on skill development, technology familiarization, and the pursuit of innovative solutions through space and space technology.

Ground Receiving Station Operations

Space & Systems Engineering

Geoscience & Remote Sensing

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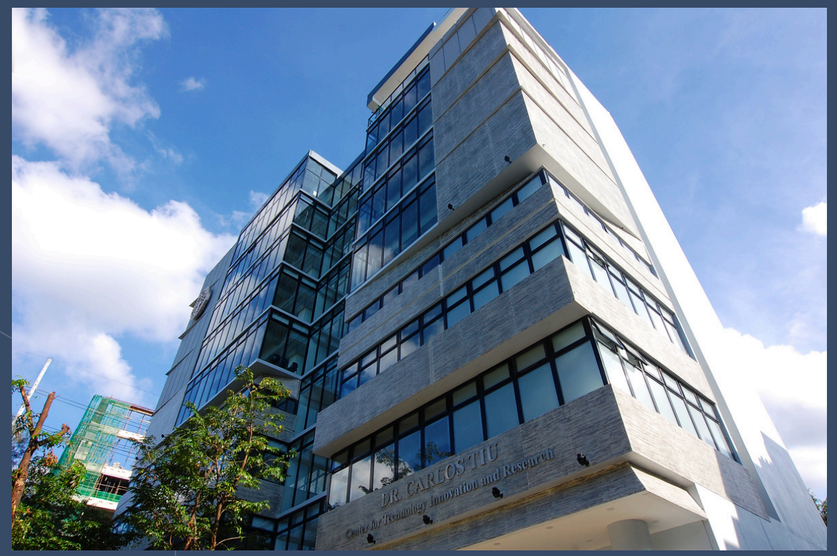
DR. CARLOS TIU
Center for Technology Innovation and Research


STAR
LABORATORY
Space Technologies & Applications Research Laboratory


acer

ADU STARLAB

Laboratory Capabilities

- Create structured research programs for the doctoral, master's, and undergraduate students that are included in its research groups.
- Give mentorship and assistance in the undertaking of research, theses, and dissertations.
- Provide capacity building to internal and external stakeholders.
- Make services available to students, faculty, researchers, incubatees, and partners of Adamson University.
- Initiate industry or government-funded research.

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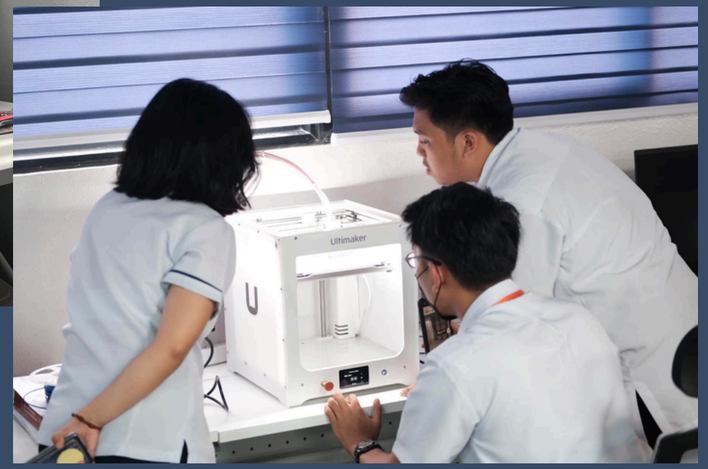
Laboratory Facilities & Equipment

- Ground Receiving Station
- Satellite Tracking and Control Software
- Licensed & Open-Source GIS Softwares
  - ArcGIS Pro
  - QGIS
- Hepta-Sat Training Kits
- Reflector Telescope

- 3D-Printing Service
- Hosted-Programming Service
- Google Colab Subscription
- GPU Server for AI projects
- Computer Terminals for Research



RATIONALE

The Philippines is **highly susceptible** to natural calamities.

Data coverage may **not be enough**, especially when cell towers, power grids, or other ground-based infrastructure are destroyed.

MARITES

Multi-purpose APRS for Risk-Reduction In Times of Emergency Situations

Use an alternative communication system that is **not ground-dependent** & **can cover a wider area**

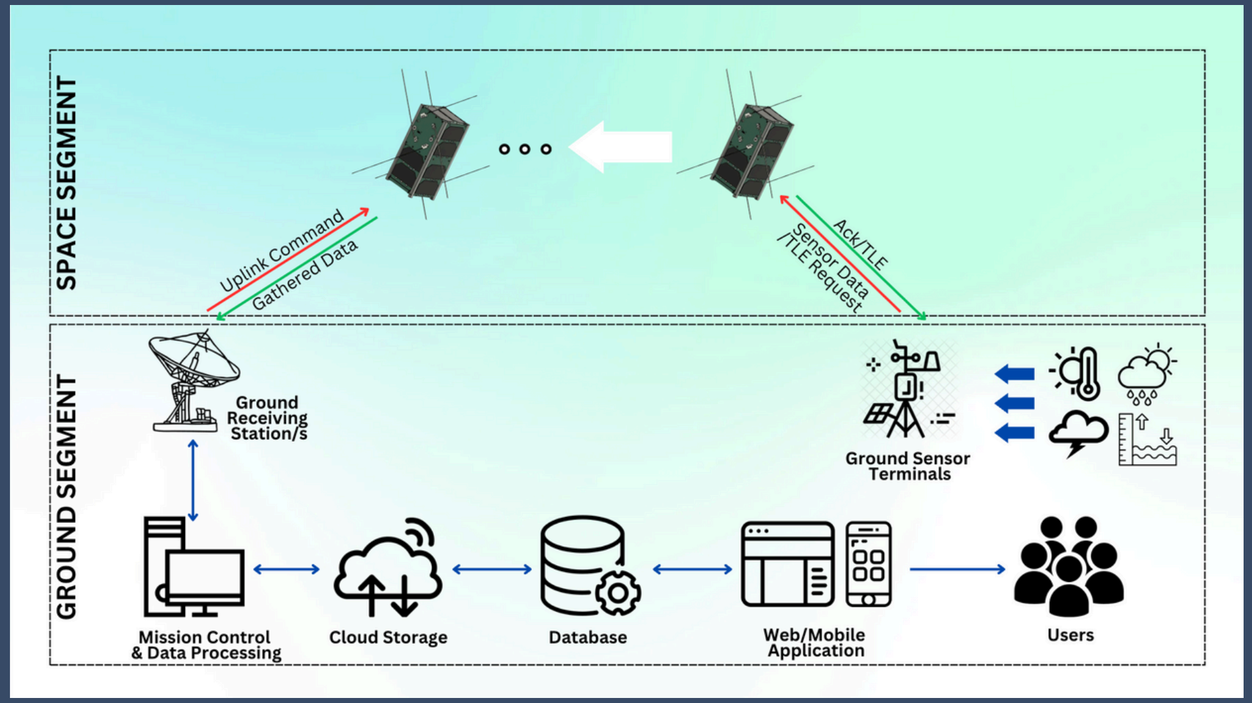
Project MARITES proposes an alternative communication system utilizing satellite technology, specifically APRS, to address this need.

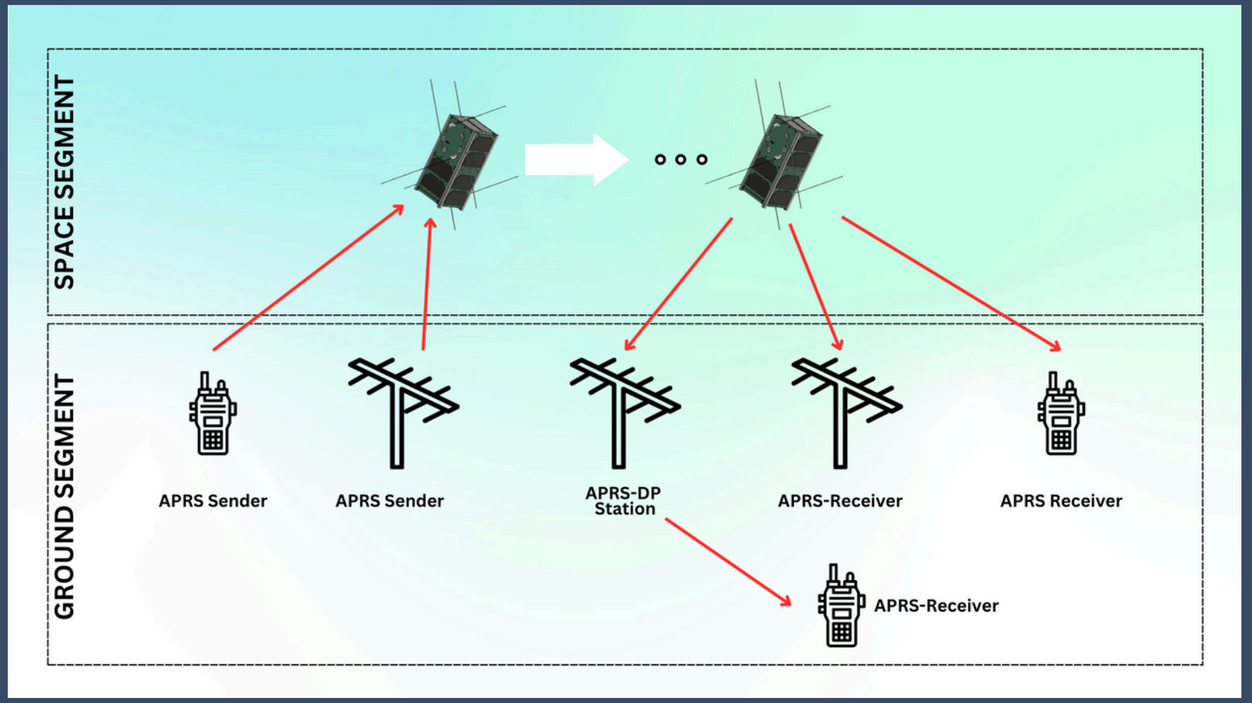
MISSION OVERVIEW

Section 1

MISSION OVERVIEW

Concept of Operation





Store & Forward

Digital Repeater

Store and Forward: The payload collects sensor data from GSTs during satellite passes, storing them in onboard memory. Upon uplink command, data is downloaded to a BIRDS ground station, transferred online, processed, and distributed.

Digipeater: Enables real-time APRS packet relays between amateur radios within the satellite footprint. A ham radio operator transmits a packet to the satellite, which instantly retransmits it for others to receive.

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Multi-purpose APRS for Risk-Reduction In Times of Emergency Situations

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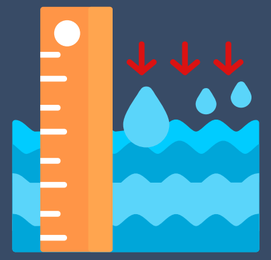
Flood Monitoring

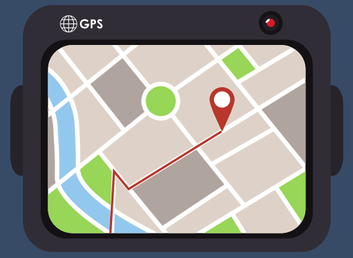


Water Level

for flood detection and prediction.

Rain Intensity

to assess potential flooding.

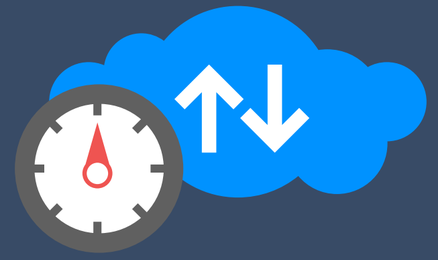


GPS

to track sensor locations and flood-prone areas.

Soil Moisture

for landslide and flood risk assessment.



Barometric Pressure

for detecting weather pattern changes.

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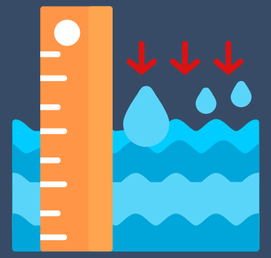
What kind of sensor data should be sent to satellites?

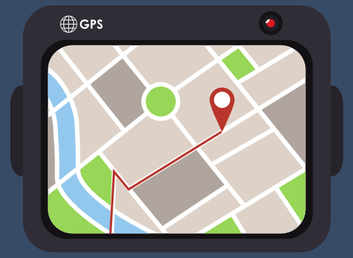
MISSION OVERVIEW

Flood Monitoring



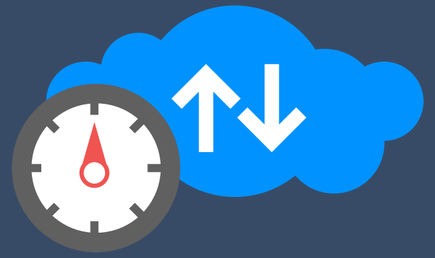
Water Level Sensors

Rain Gauges

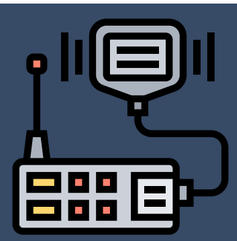


GPS Modules

Soil Moisture Sensors



Barometric Pressure Sensor



APRS Transceivers

for long-range wireless data transmission.

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What kind of sensor is to be used for your IoT mission?

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Target Users

Local Government Units

Disaster Response Teams

National Disaster Risk Reduction and Management Council

Government Agencies for Diisaster / Weather

Community Residents

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Who will use the data?

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Objectives

Improve early flood warnings through near real-time water level and rainfall monitoring.

Enhance flood risk assessment by deploying sensors in high-risk areas.

Support evacuation planning by providing near real-time flood depth and flow data.

Optimize disaster response and recovery through accurate flood mapping.

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For what objectives?

MISSION OVERVIEW

Contributions

Reduces loss of lives and property by improving early warning systems.

Empowers communities with real-time flood alerts for faster evacuation.

Improves disaster preparedness for local governments and agencies.

Supports national flood resilience policies through scientific data analysis.

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Contribution to the Society

REQUIREMENTS FOR THE IOT SYSTEM

Section 2

SYSTEM REQUIREMENTS

Requirements	Details
Data Transmission Frequency	Every 30 min to 2 hrs (risk-based). Immediate if water rises suddenly (e.g., flash floods).
Data Size per Transmission	50- 255 bytes. Standard packet (~70 bytes) transmits in 446 ms. Full packet (255 bytes) takes 1.7 sec.
Allowed Delay	10 min to 2 hrs (routine). Immediate for critical alerts. Up to 8 hrs in worst-case scenarios.
Sensor Deployment (10km x 10km)	10-20 sensors for general monitoring. 50+ in flood-prone & critical areas.

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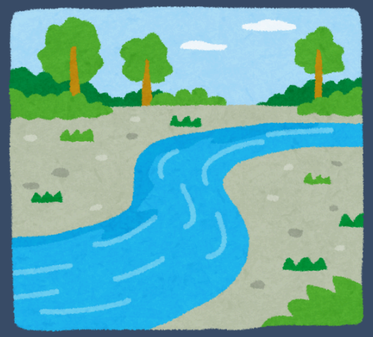
SYSTEM REQUIREMENTS

Priority Deployment Sites



Riverbanks & Major Waterways

for water level monitoring

Low-lying urban areas

for flood depth measurement.

Drainage systems and reservoir

for overflow detection

Landslide-prone regions

to assess combined flood and soil saturation risks.

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Priority Area

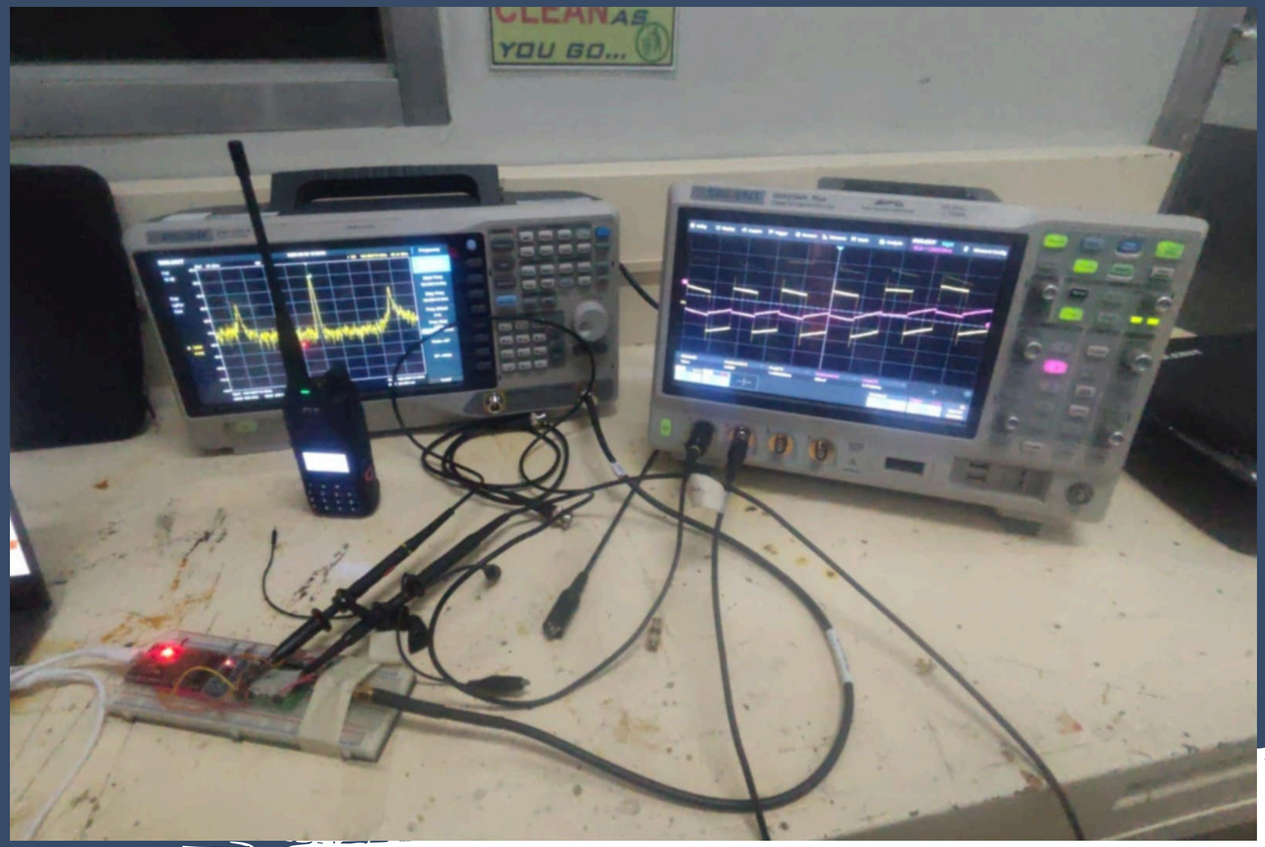
Project Progress

Updates about the Project

PROGRESS

APRS Implementation

- Developed breadboard model of APRS transceivers built using:
  - Microcontroller
    - RP2040
    - ESP32
  - Transceiver
    - BiM1H
    - DRA818V
    - SA818V
- Software TNC for APRS Implementation



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WAY FORWARD

- Implementation of AFSK signal processing and op-amp-based filtering for cleaner signal transmission.
- Finalize GST hardware and firmware for seamless data transmission.
- Conduct a power budget analysis for GST and APRS to optimize energy efficiency and ensure reliable operation.
- Conduct field tests to validate APRS transmission range and reliability.
- Enhance APRS signal processing to improve efficiency in real-world conditions.
- Strengthen partnerships with disaster agencies, LGUs, and amateur radio operators for system deployment.
- Prepare for integration into the IoT Constellation Mission under UNISEC-GLOBAL for broader implementation.

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Thank You!

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