



# ESEP: An Experimental Onboard Computing System for Localized Capacity Building and Future Philippine Microsatellites

## ABSTRACT

The Experimental Science and Engineering Payload (ESEP) platform is a bus and payload system designed to host and perform the functions of the primary components of a satellite bus system. This engineering platform is intended to act as an experimental redundant bus and payload system to the primary Diwata-2 system. This will allow testing of experimental bus and payload modules which will then be the base platform for future small satellite developments in the Philippines. The bus segment consists of the satellite command and data handling, satellite attitude control and management, and the communications subsystem. Consequently, the mission segment performs both scientific mission instrument control and data management.

The platform follows the FLOWN "Fly Old with New" concept, designed to conform with the existing Diwata-2 modules and act as a redundant bus system for the planned Diwata-3 satellite. After establishing heritage, the flexibility of ESEP will allow it to be integrated with future small satellite architectures, addressing the constantly evolving developments in satellite technology.

## BACKGROUND AND MOTIVATION

In recent years, the Philippines has taken a more active role in Space Science and Technology Applications (SSTA), demonstrating the country's ability to utilize existing technology, as seen in the successful launch of the microsatellites Diwata-1 and Diwata-2. These achievements contributed to the establishment of the Philippine Space Agency (PhilSA) in 2019, which now leads all SSTA activities in the country. Building upon this momentum and through collaboration with various institutions, PhilSA aims to foster and enhance the local capacity for space technology development.

The development and completion of the ESEP platform plays a significant role in the local capacity-building efforts of PhilSA. The launch of the ESEP platform will be the first step to building a portfolio of modules and components with space heritage. In satellite development, heritage components are sought after due to their track record in previous missions, and these components are used wherever possible to minimize risks. Having a space heritage portfolio will thus give the emerging space technology industry in the Philippines an edge to flourish.

## EXPERIMENTAL SCIENCE AND ENGINEERING PAYLOAD (ESEP) PLATFORM

### PAYLOAD SEGMENT

#### USAP – Unit for Satellite Amateur Radio Payload

- 1 Receiver
- 2 Transmitter
- 3 Computing Unit

#### HUSSAI – Handling Unit of Satellite Scientific Apparatus and Instruments

- 4 Payload Data Handling Module

#### Camera Modules

- 5 MALIC-MaTA: Multi-Application Line Imaging Camera - Monochrome and Tri-linear Array
- 6 \*Panchromatic Camera  
\*backup camera payload

### BUS SEGMENT

#### GABAI – Guidance, Attitude, and Bearing Acquisition Instrument

- 7 GALAW: Guidance, Attitude, Location, and Actuation Work Module
- 8 SIPAT: Star Image for Precise Attitude Tracking
- 9 SINAG: Solar, Inertial, Navigation, And Geomagnetic Module

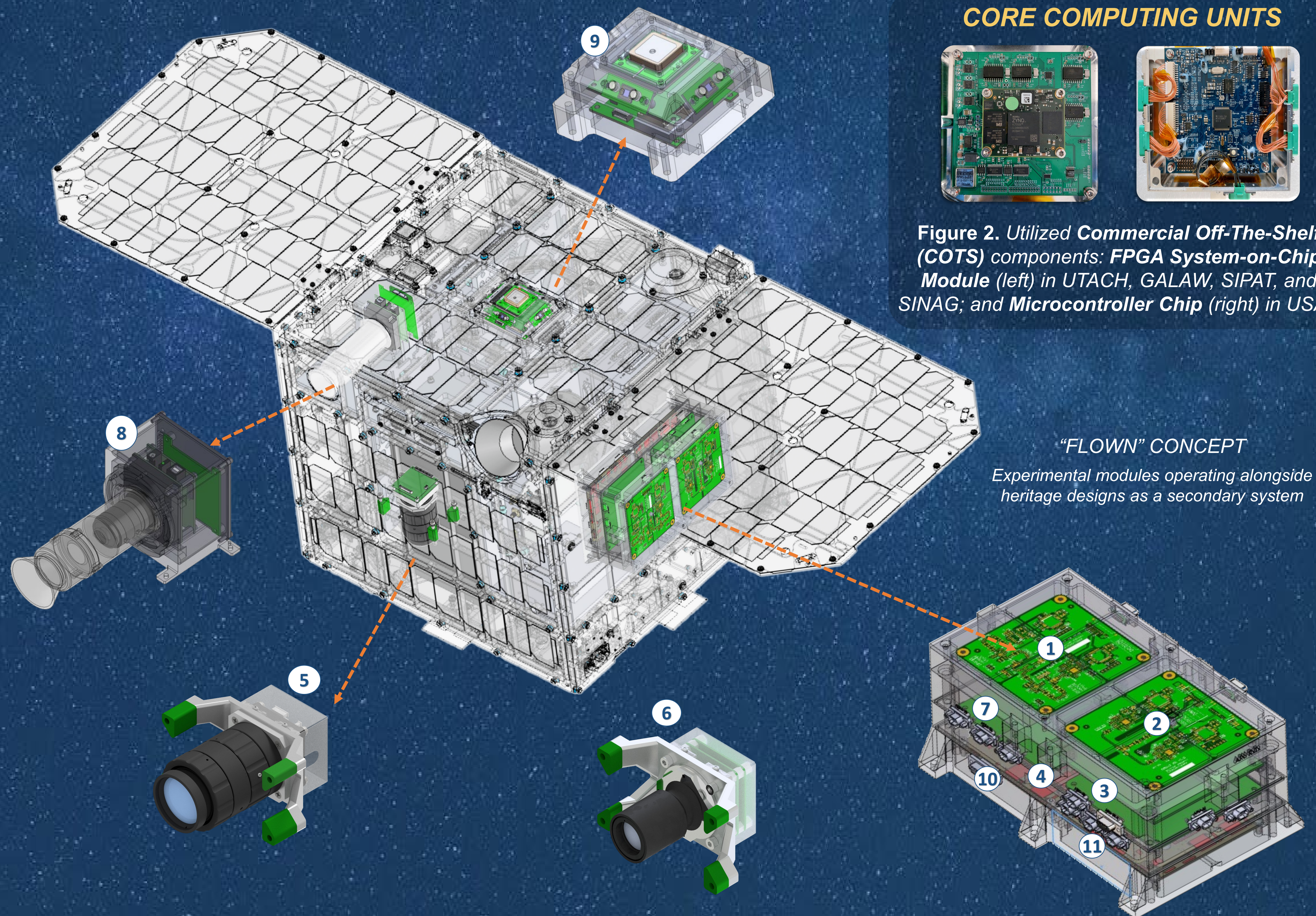
#### UTACH – Unit for Telemetry Acquisition and Command Handling

- 10 Main Computing Unit
- 11 Redundant Computing Unit

#### PUSO – Power Unit for Satellite Operations

\*\*Power Module

\*\*not shown in diagram



### CORE COMPUTING UNITS

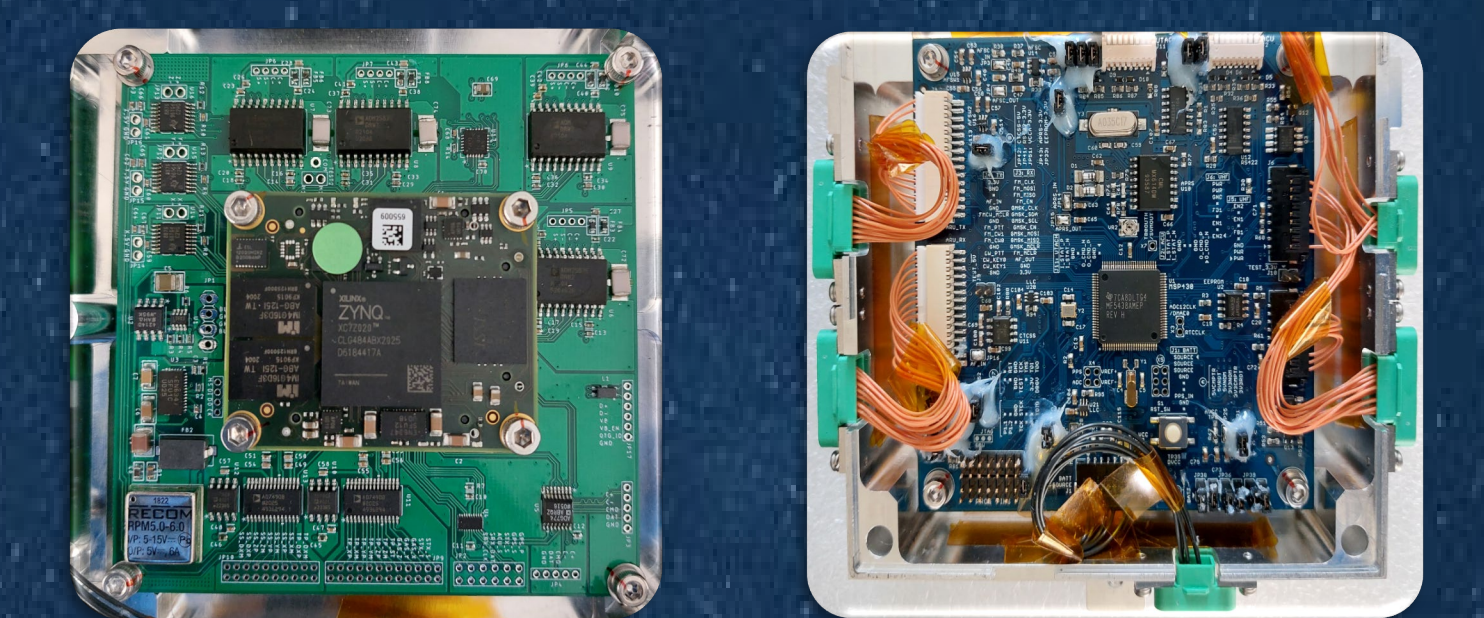


Figure 2. Utilized Commercial Off-The-Shelf (COTS) components: FPGA System-on-Chip Module (left) in UTACH, GALAW, SIPAT, and SINAG; and Microcontroller Chip (right) in USAP

### "FLOWN" CONCEPT

Experimental modules operating alongside heritage designs as a secondary system

Figure 1. Components of the ESEP Platform (Source: STAMINA4Space Program)

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## ACKNOWLEDGEMENTS

