29th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Small Satellite Missions Global Technical Session (9-GTS.5)

Author: Mr. Panatchai Bunniti
Geo-Informatics and Space Technology Development Agency (GISTDA), Thailand, panatchai@gistda.or.th

Mr. Sutee Chusri
Geo-Informatics and Space Technology Development Agency (Public Organization), Thailand, sutee.c@gistda.or.th
Mr. Adam Loring
Surrey Satellite Technology Ltd (SSTL), United Kingdom, a.loring@sstl.co.uk

BUILDING AND LAUNCHING THAI 1ST-MADE COTS FLIGHT EXPERIMENTAL PAYLOAD ONBOARD THEOS-2 SMALLSAT

Abstract

The know-how transfer and training (KHTT) programme for Thailand Earth Observation Satellite-2 (THEOS-2 SmallSat) was established in 2019 between Geo-Informatics and Space Technology Development Agency (GISTDA) and Surrey Satellite Technology Ltd (SSTL). As part of the training, the unique hands-on opportunity was given to the GISTDA engineering team to design, develop, build, test, and launch an experimental module as the tertiary payload of the THEOS-2 SmallSat, which is scheduled to launch in early 2023.

Initially the high-level objectives were defined, these are: to understand the process required to take a concept from blank sheet to launch, including the steps to ensure the payload survives the extreme environment during its launch and in orbit, and to utilize the module as a heritage platform to train the next generation Thai engineers. To limit changes required on the existing SSTL platform design, various constraints were placed on the design of the third payload, such as: no-moving parts, maximum power consumption, data interfaces, sizing and weight, as well as a cost limit. The module architecture was designed to use low-cost COTS equipment. A Raspberry Pi (RPI) is used as an On-board Computer (OBC), with flight software developed by the Thai engineering team, Inertia Measurement Unit (IMU), sun sensor (SS) and Global Navigation Satellite System (GNSS) receiver as attitude and orbit control (AOCS) sensors, and two cameras as optical instruments, one to capture the Earth's surface and a second as an inspection camera to capture the satellite structure. The functionality of all units were tested and verified at the unit to module level following a qualification test campaign, of vibration and thermal cycling; before delivering the flight module to AIT for further functional testing at the spacecraft level.

The obtained results of the module throughout the testing phases compiled with the requirements. This indicated that the module launch readiness and an acceptable survivability is achieved with confidence, and also proved that the low-cost COTS can be used in flight model with some restriction and the associated risks leading to module failure can be mitigated by carefully following the best practices in flight hardware preparation. Using the knowledge and lessons learnt from developing the third payload, GISTDA initiates the training for the next generation of Thai space engineers, and plans to extend the programme by introducing the actuators for the proto-flight model of a CubeSAT using the third payload as a heritage.