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Author: Mr. Rainer Diaz de Cerio Goenaga
Aistech Space, Spain

Dr. Manuel Moreno-Ibáñez
Aistech Space, Spain
Mr. Josep Pino
Spain
Mrs. Monica Aragay Verdeny
Aistech Space, Spain

# CENTRALIZED VERSUS DISTRIBUTED FLIGHT SOFTWARE ARCHITECTURE OPERATIONAL DIFFERENCES ON TWO IDENTICAL NANOSATELLITES IN-ORBIT

**Abstract**

The first two 2U nanosatellites deployed by Aistech Space at the end of 2018 and beginning of 2019 implement design evolution features envisioned to upgrade the constellation operational performance. Except for a minor revision of the TTC subsystem, the hardware of both nanosatellites is the same. The software architecture, however, shows major re-designs.

Aistechsat-2 runs a centralized flight software. The on-board computer monitors the nanosatellite subsystems, collects all the housekeeping and science data, and distributes and controls the commanded actions sent from the ground operators. On the other hand, Aistechsat-3 implements a distributed flight software which allows the ground operators to access each subsystem individually, thus enabling the operators to reconfigure hardware/software functionalities and to command low level functions. In Aistechsat-3, the science data must be retrieved directly from each payload, but the housekeeping of each subsystem is still monitored and stored in the on-board computer.

The FDIR service is also adapted for each flight software architecture. The centralized software requires a higher control of the FDIR reports and actions from the on-board computer. Thus, constraining the individual FDIR activity running on each subsystem but allowing redundant FDIR capabilities. Opposite to this approach, the FDIR implemented in the distributed software of Aistechsat-3 shows higher local activity. Each subsystem runs their own FDIR, which reduces the design and operations complexity and the number of prevention mechanism.

Running different on-board flight software on the same spacecraft design allows a wider understanding on the spacecraft bus and software design capabilities, and promotes future re-design optimization activities. This paper describes how the implementation of two different software architectures affect LEOP, commissioning and daily operations. It will also be discussed the lessons learned after one year of successful nominal operations of both nanosatellites.

The experience operating both on-board architectures using commercially available subsystems illustrates the high versatility of nanosatellites to comply with different mission and operational scenarios, and is relevant input for the design decisions of nanosatellite integrators.