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JUVENTAS CUBESAT IN SUPPORT OF HERA MISSION TO DIDYMOS ASTEROID SYSTEM: MECHANICAL AND THERMAL DESIGN VALIDATION

Abstract

Following on from the successful impact of DART into the Dimorphos asteroid in 2022, in support of the planatary defence mission, ESA will be launching the HERA mission to the Didymos binary asteroid system. Onboard Hera there are two CubeSats: Miliani and Juventas.

Juventas has the main objectives of determining the structure and surface properties of the Dimorphos asteroid, as well as calculating the gravitational field of the asteroid. This is investigated with the two instruments: GRASS a gravimeter and JuRa, a Low-Frequency Radar. The findings from Juventas will allow us to understand better how mitigating asteroid collisions with Earth can be done by impact.

This paper will describe the integration and test campaign of the Structural Thermal Interface Model (STIM) of Juventas, primarily focusing on validating the Mechanical and Thermal design.

Albeit a simplified model, the STIM was designed to have structural, thermal, and electrical interfaces which were representative of the flight model, and so it was used to validate much of the system design. The structural elements of the STIM went through vibration and shock test campaigns in the integrated system configuration, providing the ideal opportunity for test results before the proto-flight model. This test campaign allowed for the assessment of primary structure, secondary structures, and mechanisms.

The STIM was subjected to a Thermal cycling test (TCT) and Thermal Balance Test (TBT) campaign in which the temperature ranges of the sub-components were analysed in the operational and non-operational worst-case environments, this corresponded to when Juventas is stowed in HERA. The satellite was cycling to a range of +50DegC and -15DegC and the design of the satellite was validated for the temperature range of the sub-components. A cold start was performed at -15DegC to ensure that the satellite could start in the coldest environment and to investigate if onboard heaters were sufficient to heat the battery onboard. The TBT campaign was done at two plateaux: a hot TBT was performed at 10DegC to investigate the dissipations of the spacecraft and a cold TBT was performed -10DegC to investigate the heaters and insulating spacers on the propulsion tank.

The STIM campaign will support the validation of the flight model that is due to be launched with HERA in 2024. The ongoing work is being led by GomSpace Luxembourg and supported by GomSpace

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