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Author: Mr. Mehdi Scoubeau
GomSpace Aps, Luxembourg

Dr. Stefaan Van wal
GomSpace Aps, Luxembourg
Mr. Camiel Plevier
GomSpace Aps, Luxembourg
Mr. Etienne Le Bras
GomSpace Aps, Luxembourg

JUVENTAS CUBESAT IN SUPPORT OF HERA MISSION TO DIDYMOS ASTEROID SYSTEM: GENERAL UPDATE

Abstract

The European Space Agency's planetary defence mission "Hera" will launch to the binary asteroid system "Didymos" in 2024, to investigate the results from NASA's DART impact into the secondary body, "Dimorphos." The Hera spacecraft is expected to arrive at Didymos at the end of 2026. Once in vicinity of the asteroid, and after an early characterization phase, two CubeSats, Juventas and Milani, will be deployed to contribute to the asteroid research and mitigation assessment objectives of the Hera mission.

After 2.2 years of mostly passive cruise within Hera, the close proximity operations will start at deployment with two weeks of commissioning upon release from Hera. Then Juventas will be inserted into a first Self-Stabilized Terminator Orbit (SSTO) at 3.3 km from Didymos. After 30 days, a transfer to a closer SSTO at 2.0 km is performed for another 30 days of payload operations. Finally, at the end of around 70 days of operations, Juventas will attempt to land on the surface of Dimorphos and plan on operating there for one or two period(s) of Dimorphos around Didymos.

This mission architecture creates a new paradigm for CubeSats, requiring high levels of mission autonomy while operating in the challenging, deep-space environment of a binary asteroid. Juventas will use its main payload "JuRa" to conduct monostatic low-frequency radar observations of an asteroid and will utilize the inter-satellite link to Hera to perform radio science experiments, augmenting Hera's characterization of the asteroid gravity field. Once the radar science and radio science observation objectives have been met, Juventas will perform an attempted landing on the surface of Dimorphos to measure its surface properties from accelerometer measurements obtained during bouncing. Once on the surface, Juventas will measure Dimorphos' dynamical properties with its "GRASS" gravimeter instrument.

The 6U-XL CubeSat platform has a consolidated design optimized to operate its payloads in the Didymos environment with a semi-autonomous concept of operations, while keeping strict mass, power, and data budgets. This paper will present an update on the current status of the Juventas mission. The project has finalized phase B in 2020 and is going forward with the phase C/D beginning in 2021 with the goal of reaching successful CDR end of 2021.