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SPEYE: A CUBESAT TECHNOLOGY DEMONSTRATION MISSION FOR ON-ORBIT INSPECTION AND FORMATION-FLYING

Abstract

Space Eye (SpEye) is a two-satellite technology demonstration mission aimed at validating crucial technologies and methodologies essential for advanced on-orbit inspection and formation-flying. This initiative holds significant relevance for the development of future operational nano-satellite capabilities and missions.

The primary objective of the SpEye mission is to showcase the safe and cost-effective on-orbit inspection and mapping of a designated target satellite using an agile, autonomously maneuverable 6U CubeSat nanosatellite deployed by the same target. Although the target satellite could be any resident space object, in the SpEye mission, it also serves as the deployer for the inspector satellite.

The key milestones of SpEye foresee the validation of several pivotal technologies, including:

• The free-flying nanosatellite (6U CubeSat) inspector with autonomous maneuvering capabilities for orbiting in close proximity and imaging the target and deployer satellite. • A versatile multispectral vision-based sensor system for autonomous navigation and inspection tasks. • A Guidance, Navigation, and Control (GNC) processing unit implementing novel guidance and control schemes, fusing Global Navigation Satellite System (GNSS), Electro-Optical, and Inertial Navigation System (INS) observations to ensure robust, precise, and reliable absolute and relative navigation. • The propulsion system for the 6U CubeSat, enabling precise formation-keeping and proximity operations.

These technologies will also be leveraged to demonstrate the autonomous formation flying of a 6U CubeSat alongside its deployer satellite, the autonomous rendezvous maneuvers between a 6U CubeSat and a resident space object and to validate several GNC algorithms.

The SpEye mission has been selected by the Italian Space Agency (ASI) in the framework of the call "Future CubeSat Missions", now part of the "Alcor" program. Led by TSD-Space, the mission comprises an all-Italian consortium, including D-Orbit, T4i Technology for Propulsion and Innovation, Planetek Italia, Politecnico di Milano, and Università degli Studi di Napoli Federico II.

This paper describes the mission and presents a preliminary design overview of the critical subsystems of the free-flying inspector 6U CubeSat.