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Author: Prof. Sabrina Corpino
Politecnico di Torino, Italy

Mr. Giorgio Ammirante
Politecnico di Torino, Italy
Mr. Guglielmo Daddi
Politecnico di Torino, Italy
Dr. Jeroen Van den Eynde
ESTEC, European Space Agency, The Netherlands
Mr. Stijn Lemmens
European Space Agency (ESA), Germany

INSPECTION OF ACTIVE SATELLITES WITH CUBESATS: THE SROC+ MISSION

Abstract

A feasibility study has been performed of a CubeSat mission (SROC+) with the objective of observing selected space objects and recording environment-induced changes on their surfaces. The SROC+ mission also aims to demonstrate the feasibility of inspecting multiple targets within a single mission. The main targets considered in the current study are the Copernicus satellites, but other targets of opportunity can be considered along the mission. Potential targets are the Sentinel-1A/B pair or the Sentinel-2A/B Sentinel-3A/B quartet. It is assumed that each target is controlled and cooperative. A minimum of two inspections is performed on each target during a two-year period, with a minimum time interval between successive observations of six months. The need to mitigate the potential increase of space debris has been considered, therefore the mission complies with space debris mitigation requirements. The SROC+ spacecraft is a 12U CubeSat able to perform close proximity manoeuvres to approach the targets in order to inspect their solar arrays to observe micrometeoroid and space debris impacts, with spatial resolution to detect features in the mm-to-cm range. To achieve this, the observation strategy used is the Walking Safety Ellipse, during which the relative distance between SROC+ and the target varies from a maximum of 250m to a minimum of 50m. This range and the duration of the inspections change according to the desired resolution. These challenges require SROC+ to have high-resolution imaging capabilities as well as good manoeuvring capabilities to ensure orbit changes, including phasing to move from one target to another, execution of precise proximity operations and the mission's end-of-life disposal. Several Concepts of Operations, observation strategies and mission architectures have been considered and assessed through a small feasibility study conducted under CCN2 to ESA contract no. 4000126281/18/NL/KML/ig.