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PRISMA IRIDES: CLOSE RANGE OPTICAL INSPECTION OF THE NON-COOPERATIVE SATELLITE PICARD

Abstract

PRISMA has since its launch in 2010 successfully demonstrated two-spacecraft formation flying with cm-accuracy and autonomous rendezvous from 30 km down to 2 m using GPS, Vision Based and Radio Frequency sensors. Now the mission is in its final phase where an experiment named IRIDES (Iterative Reduction of Inspection Distance with Embedded Safety) is being implemented.

The primary goal of IRIDES is to perform rendezvous with and inspection of the non-operational and non-cooperative French satellite Picard. The experiment was initiated in May 2013 and the first phases, formation breakup and transfer start towards Picard, have been completed through a series of optimized delta-V manoeuvers.

The PRISMA Main spacecraft is since then in a transfer orbit towards Picard and the rendezvous phase is planned to be completed in August 2014, where the transfer is stopped and orbit alignment with Picard will be performed. This phase will demonstrate relative navigation based on GPS, TLE and the optical relative navigation sensors.

The last phase, to perform several fly-by inspections of Picard with decreasing relative minimum distance, is planned to take place between September and November 2014 and will demonstrate non-cooperative proximity operations while capturing long series of images with the on-board digital video system. The inspection strategy constitutes a series of inherently collision free drift maneuvers through the cross-track/radial plane of Picard, and a successively reduction of the closest relative distance. The images captured during the inspection will be used to estimate the pose and rate of the tumbling Picard spacecraft. This part will demonstrate ground-in-the-loop relative navigation and maneuvering based on GPS and the far and close range optical relative navigation sensors.

This paper will present the both ESA funded study and the in-orbit experiment results, including the optimized drift orbit acquisition, orbit alignment and safe rendezvous orbit acquisition with Picard. It will also present the close range optical navigation and maneuvering during the inspection and give a description of the object characterization strategies planned as an additional activity after the experiment.