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Space Debris Removal Concepts (6)

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THE COBRA IRIDES EXPERIMENT

Abstract

The COBRA IRIDES is a proposed experiment to modify the attitude motion of a non-cooperative satellite by means of the interaction between the thruster exhaust gases and the target satellite. Previously the COBRA concept was studied as an active debris removal system which relies on contactless technology to modify the state of a space debris object. Currently a proof-of-concept demonstration is proposed in the form of an experiment to be performed with the Mango and the Picard satellites. The COBRA concept was proposed as a solution to one of the challenges issued by ESA within the framework of the SysNova competition, and subsequently won this competition. The original goal of COBRA was to modify the motion of a space debris object by means of chemical propulsion plume impingement. Two effects were studied, namely the modification of the orbital parameters of the target object for the purpose of deorbiting it and modification of the attitude of the target for the purpose of control. The efficiency of the first effect is debatable in the frame of active debris removal missions, but the second effect was found to be extremely useful in this frame. Active debris removal missions will benefit from contactless methods to perform de-tumbling or attitude rate reduction of the target object before attempting the capture itself. The COBRA IRIDES experiment is to be performed after the completion of the IRIDES experiment, the goal of which is to perform close rendezvous with a non-cooperative satellite (Picard). After the IRIDES experiment ends, Mango will be in close proximity of Picard. The objective of the COBRA experiment is to use plume impingement of Mango's thrusters on the surface of Picard to induce torque on the Picard satellite and impart a new rotational state. The rotational state before and after the thruster firing will be determined by means of observations with Mango's on-board camera. The study will address, amongst others, the relative trajectories to be used, the thrusting strategy, the expected effect of the plume on the

motion of Picard, the operational aspects of the experiments, including ground interaction and ground contacts, and the image processing and navigation required to perform the experiment and determine the effect of the plume impingement. The paper will present the results of the study and the current status of the COBRA IRIDES experiment.