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Post Mission Disposal and Space Debris Removal (1) (5)

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THE IN-ORBIT TECHNOLOGIES DEMONSTRATIONS OF THE REMOVEDEBRIS MISSION

Abstract

The RemoveDebris mission has been the first successful in-orbit demonstration of technologies for the active removal of space debris; more specifically, a Lidar camera for the close range observation of space debris (Visual Based Navigation VBN experiment), two technologies for the capture of large space debris (a Net and a Harpoon), and finally a drag-sail that has been deployed at the end of the mission to accelerate de-orbiting. The craft (a main mini satellite of approximately 100kg mass that included two 2U cubesats which were later released as targets for the experiments) was resealed in orbit from the ISS the 20th of June 2018.

Launch and Early Operations Phase proceed as planned with contact made during the first pass over the SSTL groundstation in Guildford, UK. The spacecraft commissioning proceeded nominally, ultimately

de-tumbling the craft to reach a coarse Nadir pointing mode. Prime and redundant RF receivers, low rate transmitters and low level command link were then tested, followed by a series of AOCS manoeuvres to verify performance against that required for executing payload experiments. Supervision cameras and Lidar system were also tested and calibrated.

The first cubesat, released the 16th September 2018, deployed an inflatable structure in order to increase its size becoming more representative of real large space debris. The cubesat has then been captured by a net launched by mothercraft when it was approximately 6 meters away, with the whole operation filmed by the satellite supervision cameras.

The second cubesat, was released the 28th of October 2018, with a low speed ejection from the satellite platform and while drifting away has been observed using the Lidar system to test its hardware and algorithm capabilities.

The harpoon experiment was performed the 8th of February. The target (a small Honeycomb panel of construction analogous to that used in standard satellites structures) was deployed at the end of a boom and was hit in the centre by the harpoon, tethered to the mothercraft. On impact the end of the boom broke off, with the harpoon imbedded in target floating away, tethered to the modercraft, and eventually these wrapped themselves around the boom that was supporting the target.

The final experiment, the drag sail, is planned for early March to accelerate the deorbiting of the craft and its burning into the atmosphere. This paper briefly describes the challenges in the development of the mission and discusses the various in orbit operations.