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NEROS: A CONCEPT DEMONSTRATION FOR ON-ORBIT SERVICING CAPABILITIES IN NEAR EARTH REGION

Abstract

In the last few years, the idea that an on-orbit-servicing platform can bring benefits in several aspects has become more and more widespread. Indeed, in the current historical period the concept of economic and environmental sustainability has become crucial in almost all areas. In the space field, actions are being taken to prevent debris formation. Several spacecraft, whose components are still fully functional, could extend their operational lifetime with a larger availability of fuel. In this context, an infrastructure capable of performing refueling could allow space customers to receive profitable returns on their initial mission investment, by enlarging the operational activities on still functional satellites. In this framework, the Near Earth Region Orbit Servicer (NEROS) concept, assessed by a three months feasibility study at Politecnico di Milano, proposes a demo mission aiming at assessing the capability of a future on-orbit-servicer. In particular, the goal is to test a demonstrative infrastructure to approach and serve cooperative and uncooperative targets. For this purpose, the mission architecture embeds a main spacecraft (NEROS) and a self-released cooperative object (ROSE), which is detached from NEROS right after the detumbling. Namely, the mission timeline entails a sequence of three operations: refueling of ROSE, close approach with pose estimation of a first uncooperative debris and fly around with 3D reconstruction of a second uncooperative debris. The refueling is performed via berthing by means of a robotic arm. The feasibility of the maneuver is assessed, addressing the most critical operations and the system limitations. In addition to the refueling of a cooperative object, the GNC and propulsion system are to be tested during proximity operations with uncooperative targets. The targets are selected among the mapped existing debris and differ in terms of shape, orbit and dimensions. By assessing the feasibility of these operations,

the NEROS mission intends to collect useful data to design a future refueling platform, therefore taking a step forward in space debris reduction. NEROS demonstrator is intended to pioneer a future configuration which envisions a large orbiting tank and a smaller agile servicer, capable of hopping between orbits at different altitudes, fulfilling the needs of potential clients.