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RENDEZVOUS AND PROXIMITY OPERATIONS USING DEPLOYABLE THRUSTER ARMS WITH ELECTRIC PROPULSION

Abstract

Astroscale is developing a viable cost-effective small satellite servicer called LEXI, a spacecraft for providing on-orbit services such as life extension to host satellites reaching their end-of-life. These new capabilities provide satellite operators leverage of postponing the need for a replacement satellite by extending the life of an operational satellite. The LEXI servicer spacecraft has within its capabilities a revolutionary mechanical thruster arms design with electric propulsion capable of providing high manoeuvrability for various phases of the LEXI mission. Electric propulsion thrusters, although highly efficient in their fuel consumption, provide lower thrust compared to traditional chemical thrusters, thus requiring longer duration for accomplishing the various mission phases. One of the most demanding phases in offering On Orbit Services (OOS) is to reach a host satellite is a safe and accurate manner. This phase is called Rendezvous and Proximity Operations (RPO). Traditionally the RPO phase is using Chemical Propulsion that requires sixteen of these small thrusters mounted on the edges of the servicer. The chemical propulsion is used only for this short phase, thus requiring the servicer to deploy two propulsion systems, electrical and chemical, making the design of the servicer complicated and expensive. In this paper, the reader will better understand the benefits of making use of only the Electric Propulsion system for all the LEXI phases including RPO. By entirely removing the chemical propulsion system, the LEXI becomes even more efficient and affordable as the electric propulsion is the only system used. The LEXI four deployable thruster arms allow for six degrees of freedom for performing all mission phases as well as momentum management. For the RPO phase, the Thruster Arms perform acceleration and deceleration with high precision, meeting the tight requirements for reaching proximity and docking conditions.