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REVIEW OF STRATEGIES FOR CISLUNAR SPACE TRAFFIC MANAGEMENT

Abstract

The space industry is currently undergoing a renaissance, allowing for a revolution in access to orbit and high-quality data from space as we tread towards a satellite boom in lunar orbits. This decade will see humanity step foot on the Lunar surface once again through programs like Artemis, the Lunar Gateway, and numerous other government, private and academic projects. The moon will be a testing ground for our species, as we venture into the solar system. Over the coming years, the technology required to support lunar orbital and surface operations will see an increase in activity in the Cis-Lunar space. A forthcoming, highly commercialized lunar industry will rely on the infrastructure set up in the coming years. It is expected to see exponential growth in satellites with applications such as communication, navigation, observation, and even habitable stations adding onto the fleet of existing scientific satellites; spacecraft operators will need to prepare for increasingly challenging space traffic management scenarios. Traditional debris removal tactics utilized on Earth majorly involve deorbiting and burning up the defunct satellite in the atmosphere. However, the absence of a Lunar atmosphere inhibits this assured mode of satellite disposal. To avoid overcrowding the finite number of families of stable Lunar orbits, satellite operators must ensure a robust strategy for mission end-of-life scenarios. Additionally, the provision removal for defunct/non-cooperational satellites in Lunar orbit must be addressed. The objective of this paper is two-fold, firstly we provide a review of strategies for Cis-lunar Space Traffic Management (CSTM). This deals with the discussions regarding past and present lunar mission heritage, as well as the natural mechanisms affecting satellite lifetime in the cis-lunar space. The paper's secondary objective is to discuss various technologies and frameworks which will be used for end-of-life scenarios for lunar missions. This also consists of strategies that may be adapted for the removal of non-cooperative/defunct satellites in cislunar orbit. Ultimately, we aim to provide an understanding of the improvements required in the present framework for the creation of sustainable and safe operations in Lunar orbit.