

21st IAA SYMPOSIUM ON SPACE DEBRIS (A6)  
Impact-Induced Mission Effects and Risk Assessments (3)

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A STUDY ON THE HAZARDS OF SPACE DEBRIS FOR LUNAR MISSIONS: A REVIEW

**Abstract**

The growing amount of space debris in Low Earth Orbit (LEO) has become a serious hazard for space operations, particularly for lunar orbit missions. This research evaluates the risks posed by space debris to spacecraft destined for lunar orbit, with an emphasis on space debris impact assessments on spacecraft systems. The study begins by reviewing the characteristics of space debris and its sources, highlighting the risks they pose to spacecraft systems. The study also examines the types and densities of space debris in LEO, and their potential impact on spacecraft heading to lunar orbit. This paper aims to analyze the impacts of space debris on spacecraft surfaces and various other subsystems using the System Toolkit (STK) Software. Moreover, this study reviews the current state of knowledge regarding the impact of space debris on spacecraft, including the effects of high-velocity impacts and the potential damage to critical systems, such as propulsion, communication, and life support. In addition, it proposes ways to reduce the dangers of space debris to missions destined for lunar orbit. These options include the use of protective shielding materials, changes to spacecraft architecture, and the creation of space situational awareness capabilities to track and prevent probable collisions with space debris. The study aims to provide valuable insights into the risks of space debris to spacecraft bound for lunar orbit and offers potential solutions to mitigate these risks. This will result in a contribution towards the development of safer lunar as well as deep space missions for the future of human spaceflight.

Keywords: Low Earth Orbit, Lunar Orbit, Space Debris, Propulsion, Lunar Missions