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Author: Mr. Emanuele Tomassi
Politecnico di Milano, Italy, emanuele.tomassi@mail.polimi.it

Mr. Davide Martire
Politecnico di Milano, Italy, davide.martire@mail.polimi.it
Ms. Elisa Garbagnati
Politecnico di Milano, Italy, elisa.garbagnati@mail.polimi.it
Mr. Guglielmo Gomiero
Politecnico di Milano, Italy, guglielmo.gomiero@mail.polimi.it
Mrs. Aurora Saracini
Politecnico di Milano, Italy, aurora.saracini@mail.polimi.it
Ms. Giulia Lombardo
Politecnico di Milano, Italy, giulia.lombardo@mail.polimi.it

THE ROLE OF ADVANCED SOFTWARE TOOLS IN ENSURING SPACE DEBRIS MITIGATION IN CUBESAT MISSIONS

Abstract

The number of man-made objects orbiting around Earth continuously increases over the years, therefore implementing debris prevention and reduction measures is now essential. During the design process of 6S, a 1U CubeSat mission led by a student association of Politecnico di Milano, some software tools were employed to address the debris risk assessment and guarantee compliance with international standards regarding space debris. Among them, ESA MASTER (Meteoroid and Space Debris Terrestrial Environment Reference), ESA DRAMA (Debris Risk Assessment and Mitigation Analysis), and NASA DAS (Debris Assessment Software) played a fundamental role in the analyses for the Space Debris Mitigation Plan.

The project highlighted the importance of using advanced tools to conduct comprehensive risk analyses and employ effective mitigation techniques while showing how debris-related studies participate in the MA (Mission Analysis) process. This paper will discuss practical experiences in the planning and verification of measures for the Space Debris Mitigation Plan, highlighting its importance in ensuring the proper development of missions. The challenges and the lessons learned from executing mitigation actions will also be addressed, providing valuable studies to improve future mitigation efforts.

The application of MASTER, DRAMA, and DAS underscored the need for innovative approaches to the space debris problem. while their integration into the MA studies gave the 6S team hands-on experience conducting extensive debris risk assessments. The practical knowledge shared in this research will serve as a useful resource for future missions, stressing the significance of developing and executing effective measures to reduce the risks posed by orbiting objects to spacecrafts and suggesting best practices and approaches to the existing tools.

In conclusion, the mitigation aspect of Space Debris Management is critical to ensure the safety and success of space missions, and a more coherent and integrated use of advanced tools can facilitate the analyses of the MA subsystem and the process of verifying compliance with existing regulations.