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ISS CONTROLLED DEORBIT: CHALLENGES AND SOLUTIONS

Abstract

Currently the International Space Station Partner community agreed to extend ISS operations till at least 2024. Once the ISS operations are complete the ISS has to be safely deorbited in the safe unpopulated area which now is assumed to be South Pacific Ocean Uninhabited Area. The history of Human Space Exploration has many examples of space station deorbits. The most recent is the deorbit of the 130 metric ton Russian Mir Space Station in 2001. In 2011 NASA and Roscosmos have established a bilateral working group tasked to develop a comprehensive strategy for the safe deorbit of the largest man-made space object with the mass over 400 metric tons. Currently the primary source for performing the deorbit operations is considered to be a propulsion system of the Russian Progress Cargo vehicle, using Service Module Zvezda propulsion system for back up. Even though Progress vehicles are very reliable and currently used for conducting a majority of the ISS propulsive events, those vehicles do not have an optimal propulsive capability to support this complex task. This paper discusses nominal and contingency ISS deorbit scenarios and provides quantitative assessments of propellant requirements and debris foot print for each of the cases. The proposed approaches are also compared with the strategies previously used to deorbit large man made space objects