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Assuring a Safe, Secure and Sustainable Environment for Space Activities (4)

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EXPLORING THE EFFECTIVENESS OF MANEUVERING GUIDELINES FOR SPACE TRAFFIC MANAGEMENT

Abstract

If the current estimate of proposed large constellations is realized, the near-Earth space environment will see more than 50,000 new satellites added to the catalog of resident space objects (RSOs) in the coming decade. This is an order of magnitude increase from the current population, and poses new policy challenges as global operators seek to leverage the benefits these new satellite systems provide while also ensuring a sustainable approach to collision avoidance. Various guidelines have been proposed to date to guide this effort, focusing primarily on right-of-way rules to guide how a collision avoidance maneuver should be performed, and how the maneuver burden should be shared between the two satellites involved. The real-world implementation of such guidelines may involve a number of additional external factors, ranging from geopolitical considerations to differing risk postures of the operators involved. This study seeks to explore these aspects by utilizing a high-fidelity simulation tool that has been developed over the past few years with the explicit purpose of evaluating the future space traffic environment. Using this tool, a full sensitivity study is performed that evaluates a likely set of future large constellations, and provides metrics on the impact that a select set of proposed maneuvering guidelines would have on operators given variations in compliance, conjunction notification windows, spacecraft capabilities, and other factors (owner-type, maneuverability, etc.). The results highlight general observations on the effectiveness of current and proposed maneuvering guidelines, as well as potential areas where additional guidelines still need to be developed. In addition to examining the impact of potential right-of-way rules, the simulation is also used to examine potential governance regimes for space traffic management. The relative impact of non-binding principles, unilateral regulation, and binding multilateral agreements are examined by varying compliance with the right of way rules within the simulation. This provides insight into the relative gains in safety (decrease in collision risk) that would likely result from more politically intense efforts to increase the number of countries implementing space traffic management rules.