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AVOIDING THE KESSLER SYNDROME: PERSPECTIVE ON IMPLEMENTATION OF TAX MEASURES ON PAYLOAD LAUNCHES INTO LOW EARTH ORBIT AND SUSTAINABLE DEVELOPMENT OF LEO

Abstract

The Kessler Syndrome is a situation in which the density of objects in Low Earth Orbit (LEO) is numerous enough that collisions between objects could cause a cascade in which each collision generates space debris that increases the likelihood of further collisions, resulting in a possibility to render any future launches to LEO most difficult or even impossible. In 2024 over 20,000 cataloged objects and more than 130 million accumulated space debris orbit Earth in LEO. Number of objects launched to LEO is steadily increasing, with over 2000 objects launched in 2023 and over million scheduled to launch in the future that are to operate in more than 300 mega constellations. A realistic perspective, with recent developments of SpaceX launch capabilities. In a cost per kilogram of payload basis, a single use Super Heavy Starship can lower the current cost of launches to LEO nearly ten times, to about EUR 150 per kilogram. Reusable Super Heavy Starship will bring the cost down to EUR 10-20 per kilogram. Unregulated usage of these capabilities will diminish all movements towards mitigation of space debris or sustainable use of Outer Space, LEO in particular. The paper will analyze how implementation of additional tax measures on launches to LEO or more practical, predetermined taxation per kilogram of payload placed in LEO would provide a feasible method to reduce number of satellites in LEO, in particular unnecessary large number of satellites formed in mega constellations directed to achieve only commercial goals. Accordingly, a possibility of provision of tax reliefs on operations with established scientific goals will be considered. The paper will outline states that might benefit from newly introduced tax and its format, rendering optimal scenarios of parties which should be a final recipient of revenues from implemented tax measures. Implementation of universal global rate of the tax in question reflecting on recent developments towards introduction of BEPS will also be examined. Finally, the paper will analyze how introduced tax measures would contribute to sustainable usage and development of LEO, particularly outlining a role of national space agencies and international cooperation.