

Policy tools for preventing, mitigating, and defending against orbital debris

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ABSTRACT

Earth's orbital environment is a common-pool resource which has been largely unregulated since the commencement of human space activity in the 20th century. Satellites – both operational and defunct – as well as expelled upper stage rocket bodies have congested orbital patterns and have increased the probability of asset conjunctures. Moreover, anti-satellite missile demonstrations from the United States, China, India, and Russia have added to the amount of debris circulating the planet. The need to minimize waste in space adds requirements to the governance of space and its uses that are evident in a range of types of policy tools, from laws and regulations and procurement requirements at the national level through international treaties and practices. This paper begins by providing a brief overview of the space waste issue and highlights events that have brought attention to the hazardous consequences of polluting the planet's orbital environment. Secondly, it examines existing literature and discourse on the state of orbital debris regulations and international practices, and provides the theoretical foundation explaining the role of regulation in protecting the orbital environment. Thirdly, this paper analyzes existing policy tools utilized by federal agencies and departments in the U.S. to address orbital waste. This paper is unique in that it divides such tools into three categories based on their ability to prevent the accumulation of debris in space, mitigate the effects of debris, and defend against waste in space, and then highlights how policies focused on prevention, mitigation, and defense perpetuate pillars of the U.S. Government Orbital Debris Mitigation Standard Practices. Additionally, this analysis examines international treaties, standards, and practices that promote sustainable activity in Earth's orbital environment to minimize the probability of asset collision. Finally, this paper discusses proposed policy changes in the U.S. outer space regulatory structure and evaluates contemporary discourse on proposed next steps for regulation of the planet's orbital environment and dialogue on the effectiveness of existing orbital debris-related laws, regulations, and international practices. This method of analysis provides a clear image of deficiencies in each policy realm. Much of the existing U.S. regulatory infrastructure focused on orbital debris can be categorized as preventing or mitigating debris issues through policy. Prevention policies exist as procurement requirements, technical standards for launch vehicle production and design, and requirements asset operators must comply with in order for their satellite to be cleared for launch. Policies that mitigate the ancillary effects of orbital debris focus on asset registration to improve U.S. space situational awareness, asset maneuver capabilities to minimize collisions in orbit, and on-orbit servicing. Existing orbital debris defense policies limit the amount of time an asset can remain in orbit and require asset operators to submit object retirement plans upon applying for launch licenses that explain what satellites are to do once their mission life has ended. This analysis exposes deficiencies in U.S. orbital debris policies focused on defending against space waste and highlights explanations for such weaknesses. Many strategies for defending against orbital debris through active debris removal and forced reentry have not yet proven to be economically or technologically feasible. International treaties and practices addressing orbital debris and human activity in the Earth's orbital environment discuss liability, asset registration, and offer non-binding recommendations to space faring nations on how to combat the issue of space waste. This paper contributes to existing research on policy tools used to address space debris by examining U.S. policies and international practices based on their ability to prevent, mitigate, and defend against orbital debris.