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Policy, Legal, Institutional and Economic Aspects of Space Debris Detection, Mitigation and Removal  
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MEGA CONSTELLATIONS – LIABILITY AND INSURANCE ISSUES

**Abstract**

“Space-as-a-service industry” tendency is becoming a reality, as demand for services – broadband and imagery-related services. Notably, mega constellations are making a new business case, due to a greater responsiveness to internet-based applications. However, these constellations will occupy an already densely populated orbital area. The number of operational satellites has increased to over 1800, and is projected to grow greatly in the coming decade. As of today, there are 1232 satellites in orbit in LEO. The amount of debris on-orbit increased as well, currently amounting over 19,000 pieces of debris, with the potential for further growth as space gets increasingly congested. They are sometimes uncontrolled, unobservable and some of them are non-maneuvrable. Alongside with mega constellations, this overpopulation raises risks of cascading collisions with existing orbital debris and with other satellites; and also it increases the cost of losing satellites capabilities. They will possibly be endangering the safety of other space missions, and also the sustainability of space activities in general. Overall, there is an upsurge unfolding in new uses of space assets: deployment of mega constellations, rendez-vous and proximity operations, active debris removal, in-orbit servicing (IoS), asteroid mining, among others. Such incremental usage generates potential for damage to other actors, and hence, increases liability for damage disputes over activities in orbit, should some sort of incident occur that requires a claim to be compensated. This juncture requires an international reflection and testing of the existing space liability regime and insurance. Are current rules – Liability Convention, Outer Space Treaty and insurance policies adapted to the requirements and risks portrayed by mega constellations? Insurers will be asked to provide cover by the satellite operators, for space insurance has been a key enabler of space industry due to their symbiotic relationship, ensuring coverage for any new risks being introduced. In this paper, we introduce a three-track approach to address these space-traffic conditions in LEO. The operators of proposed satellite mega-constellations could mitigate the risk of future collisions and damage production by repairing, rapidly de-orbiting their spacecraft at the end of service, refueling needed satellites, etc, a service which entails in orbit servicing, and which would afford new capabilities and resilience into the constellations. We propose mandated in-orbit liability insurance, as we argue it provides for a sound legal regime amenable for mitigating risk amidst mega-constellation impact, and to optimize performance.