

Are GEOs meeting LEOs?

Small satellites, large constellations and space debris: *in dubio pro LEO?*

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Emerging risks and opportunities in the space sector

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SIRIUS, Toulouse



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- **Prime example:** OneWeb & Airbus Defence and Space's joint venture
- **Transforming industry:** new possibilities for new space actors of all types
- **A new paradigm in space activities:** a 'step change' in the number of space objects
- **Inter-Agency Debris Coordination Committee**
 - 'Statement on Large Constellations of Satellites in Low Earth Orbit' (February 2016)
 - "... the potential for such systems to have an important influence on the evolution of the space debris environment and consequent impact on the population of man-made satellites orbiting the Earth"
- International **legal protection** for the **space environment**?
 - Technological evolution is outpacing legal frameworks
 - Legal lacunae!
 - → Long-term sustainability of space activities at risk?



- **International Public Law**
 - (Mainly) States, International Organizations: subjects of international law
- **The problem?**
 - Large potential for debris creation
 - At sufficient altitudes debris will be 'eternal'
- **Space Debris Mitigation Guidelines?**
 - IADC: quantitative guidelines
 - COPUOS: qualitative guidelines
 - Legally non-binding → voluntary implementation
 - Costly and burdensome ← → economic rationale?
- **Studies on impact of constellations on debris population**
 - E.g., B. Bastida Virgili *et al.*, "Risk to space sustainability from large constellations of satellites", *Acta Astronautica* 2016, Vol. 126.
 - E.g., J. Radtke *et al.*, "Interactions of the space debris environment with mega constellations – using the example of the OneWeb constellation", *Acta Astronautica* 2017, Vol. 131.
 - Beginning: main impact on constellation itself
- **Post-mission disposal (PMD)**
 - Period: 25 years, 5 years, ... ?
 - Affects fuel margins and platform lifetimes



- **Post-mission disposal**
 - **Compliance** rate?
 - E.g., V. Morand *et al.*, “Mitigation rules compliance in low Earth orbit”, *Journal of Space Safety Engineering* 2014
 - → LEO: approximately **20%**
 - **Sustainable level**: near-perfect compliance rate required!
- **Technological improvements** necessary
 - Actors with less sophisticated capabilities?
- **Mitigation Guidelines**
 - Non-enforceable...
 - No ‘obligation to mitigate’
- **Flags or harbors of convenience?**
 - Lenient or **absent** regulation
 - E.g., no domestic regulation on mitigation measures
 - Entice industry to settle
 - Risk of global **distortion of competition and marketplace**



- **Indirect** enforcement of Guidelines?
 - ‘Standards of reasonable conduct’
 - Objectively assess **negligent** behavior?
- 1972 **Convention on International Liability for Damage Caused by Space Objects (LIAB)**
 - Lex specialis
 - Lex generalis: Art. 7 Outer Space Treaty
- **Fault-based liability** for damage occurring in outer space
 - Art. 3 & 4 LIAB
- **LIAB: limited value for environmental protection**
 - Art. 1(a) LIAB: ‘damage’?
 - Damage needs to be ‘international’
 - Waivers of liability *inter partes*?
 - Compensation?
 - → Assessed *ex post facto* → *fait accompli*
 - → Impossible to restore *status quo ante*
- **No protection for the space environment *per se*?!**





Comments, questions, insights, discussions, ...

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