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Large satellite constellations

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The European Space Agency

- Intergovernmental organisation with 22 Member States.
- responsibility in nearly all areas of space activity.
- +80 satellites designed, tested and operated, 6 types of launcher.
- worldwide cooperation, about 400 agreements.





Mega-constellations

- Future large satellite infrastructures in Low Earth Orbit (LEO) for telecommunication purposes.
- Saturation of GSO, complexity and cost to reach and service GSO, limited coverage, high latency time (700 ms vs. 30 ms).
- Concepts for hundreds up to thousands of satellites developed by commercial operators.





Requirements for LEO constellations

- Mass manufacturing of satellites with low per unit cost.
- Frequent and flexible multi-payload launches.
- Population of several orbital planes.
- Automation in orbit operations, in particular for CAM.
- Overall high satellite reliability incl. EOL.



Aspects of international law

- Space freedoms: orbit access and reliability.
- Collision avoidance in orbit and during ascent / descent through denser orbital regions.
- Spectrum access and coordination -> ITU (WRC19).
- Joint launches: registration; liability; export control.
- Space debris mitigation: effects on the orbital environment.



Aspects of national regulation

- Efforts to review the regulatory framework for large, long-living orbital infrastructures.
- Compliance requires to know which regime applies for international joint ventures.
- Relationship between regulator and operator: find mutually beneficial and viable solutions.



Contractual and insurance aspects

- Contractual challenges: testing, delivery, launches etc.
- Launch services: flexibility in service agreements; different types of launchers.
- Long-term operations and post-mission services.
- Risk quantification for large infrastructures: move towards aggregated insurance policies (per constellation)?



Summary: large satellite infrastructures

- Important increase in launch and orbital traffic.
- Paradigm change in satellite production and testing.
- (semi-)automated in-orbit operations including CAM.
- Legal and regulatory questions to be tackled.



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THANK YOU

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