
THE REGULATORY PROBLEM OF MEGA- CONSTELLATIONS: CAN NATIONAL LICENSING CONTROL THE CUMULATIVE EFFECTS OF THOUSANDS OF SATELLITES?

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ABSTRACT

Low Earth orbit is filling up faster than the rules that govern it. Satellite constellations are licensed by national regulators one application at a time, yet the risks of collision, debris, radio interference and sky brightness come from all systems added together. This paper asks whether national licensing, as it now works, can control those cumulative effects. Using 2026 regulatory orders, public notices, policy briefs and journal analysis, it finds that licensing tests each applicant but never tests the orbit. The paper proposes four changes that licensors can adopt under their existing powers: licences expressed as shares of a shell-level risk budget, tranches released only after audit, a cumulative impact statement for very large filings, and a shell ledger tied to regulatory equivalence.

Keywords: Satellite Constellations; Space Jurisprudence; National Licensing; US federal Communications Commission.

Introduction

For most of the space age, orbit felt like open sea: wide, empty and free for the taking. That picture is out of date. Low Earth orbit is now a working road, and traffic is rising faster than the rules. Starlink alone had about 9,600 satellites in orbit by 31 March 2026.¹ One analysis counted roughly 14,000 satellites of all kinds in orbit in February, with 1.23 million more planned.² The general problem is simple. Every satellite adds a small risk of collision, debris, radio interference and bright streaks across telescope images. One satellite changes little, but thousands together change a great deal. Under the Outer Space Treaty, a state answers for the space activities of its own companies, so the job of control has landed on national licensing bodies such as the US Federal Communications Commission (FCC).³

The narrower problem is where this paper looks. A licence goes to one applicant, for one system, at one moment. The harm, however, comes from the sum of all systems. So the research question is this: can national licensing, as it works today, control the cumulative effects of thousands of satellites? Many writers agree that cumulative control is missing. Few say what a licensing body could do tomorrow, with powers it already holds. This paper tries to fill that gap.

How Licensing Works, and Where It Stops

Take the FCC, the most important licensor. On 9 January 2026 its Space Bureau authorised 7,500 more Gen2 Starlink satellites, taking the approved total to 15,000, and allowed deployment in very low shells, down to 340 km.⁴ A month later, on 5 February, the FCC approved Logos Space's 3,960-satellite system after a technical review of interference and debris risk.⁵ The FCC grants in tranches, which is sensible. But every tranche is judged on the

¹ *Satellite Mega-Constellations 2026: Starlink, Kuiper, OneWeb, Guowang & Qianfan Compared*, SpaceOdysseyHub (2026), <https://spaceodysseyhub.com/articles/satellite-mega-constellations-explained> (last visited Oct. 5, 2026).

² Gregory Radisic & Samantha Lawler, *Too Many Satellites? Earth's Orbit Is on Track for a Catastrophe—but We Can Stop It*, Conversation (Feb. 17, 2026), <https://theconversation.com/un-million-de-satellites-la-nouvelle-reece-vers-lorbite-inquiete-scientifiques-et-juristes-276768>.

³ *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies* art. VI, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter *Outer Space Treaty*].

⁴ *Space Exploration Holdings, LLC, Request for Modification of Authorization for the SpaceX Gen2 NGSO Satellite System*, Order & Authorization, DA 26-36, ¶¶ 6, 12 (Fed. Comm'n's Comm'n Space Bureau Jan. 9, 2026), <https://docs.fcc.gov/public/attachments/DA-26-36A1.pdf>.

⁵ *FCC Authorizes Logos Space to Deploy 3,960-Satellite Mega-Constellation for Enterprise Connectivity*, SatNews (Feb. 5, 2026), <https://satnews.com/2026/02/05/fcc-authorizes-logos-space-to-deploy-3960-satellite->

applicant's own file. One 2026 analysis notes that approval rests almost entirely on the limited technical information that manufacturers give to regulators.⁶ The regulator mostly asks whether this company's system is safe. It rarely asks whether the orbit will still be safe once this system joins the others.

The international layer does not fill the hole. A 2026 governance review in ScienceDirect points out that registration confers no operational priority, imposes no capacity limits, and need not be updated when orbits change.⁷ The same review describes a collective-action failure: each operator pushes collision risk onto all other orbit users, and no institution counts the total. It also records that the US system has no domestic cap on constellation size.⁸ So national licensing is good at one question and blind to another. "Is this applicant safe?" is a question about a company. "Is this shell still safe after this company arrives?" is a question about a place. Today's licences answer only the first.

When the Sum Outgrows the Parts

The largest filing puts this to the test. On 30 January 2026, SpaceX applied for up to one million satellites for space-based data processing. The FCC Space Bureau accepted the application for filing and opened it for comment on 4 February.⁹ The design uses shells about 50 km thick between 500 km and 2,000 km.¹⁰

A July 2026 policy brief from Cambridge Judge Business School counts over 1.7 million satellites now proposed across FCC filings, mostly this application and a proposal for 50,000 sunlight-reflecting mirror satellites. By March, those two filings had drawn about 3,300 public comments between them.¹¹ Comments are useful, but they are not modelling. The brief also points to recent astronomy research, including an ESO study, that centres on a cumulative

mega-constellation-for-enterprise-connectivity/.

⁶ Radisic & Lawler, *supra* note 2.

⁷ Yunping Liu, *Governance of Large-Scale LEO Satellite Constellations: Challenges, Comparative Analysis, and Policy Recommendations*, J. Space Safety Eng'g (2026) (published online July 3, 2026), <https://doi.org/10.1016/j.jsse.2026.06.005>.

⁸ *Id.*

⁹ Fed. Comm'n's Comm'n, Space Bureau, *Space Bureau Accepts for Filing SpaceX's Application for Orbital Data Centers*, Public Notice, DA 26-113, at 1 (Feb. 4, 2026), <https://docs.fcc.gov/public/attachments/DA-26-113A1.pdf>.

¹⁰ *SpaceX Files FCC Application for Million-Satellite Orbital Data Center*, SatNews (Jan. 31, 2026), <https://satnews.com/2026/01/31/spacex-files-fcc-application-for-million-satellite-orbital-data-center/>.

¹¹ Arjuna Sathiaselalan, *Crowded Orbits, Fading Skies: A Policy Framework for Satellite Mega-Constellations*, Cambridge Judge Bus. Sch., Space Econ. Initiative, at 13 (July 2026), <https://www.jbs.cam.ac.uk/wp-content/uploads/2026/07/cigb-space-paper-crowded-orbits-fading-skies.pdf>.

population of around 100,000 satellites.¹² A single application is now ten times that figure. Most importantly, the brief concludes that no international body has binding authority over optical brightness or the cumulative debris footprint of large constellations.¹³

Europe has taken a different road. The Council's compromise text of the EU Space Act sets numeric tiers, with extra duties from 10 satellites and a stricter layer from 100, and turns trackability into a continuing duty to supply data.¹⁴ That is real progress. Yet the duties still attach to each operator's own conduct, not to a shared limit on the shell. And the original proposal would apply only from 1 January 2030.¹⁵ At today's launch rate, that is a long wait. The pattern is clear. Both systems regulate behaviour well. Neither regulates the total. A licence tells an operator what it must do, but nothing tells the regulator when a shell is full.

Recommendations: A Shell Ledger for Licensors

The following four changes need no new treaty. Each uses powers that licensing bodies already hold.

License shares of a risk budget, not satellite counts :-

A licence for "15,000 satellites" says almost nothing about risk. Instead, the regulator should set, for each 25–50 km shell, a yearly ceiling on expected collision-linked fragments and brightness impact. Each licence then states the operator's share of that ceiling. Operators with low failure rates and fast deorbiting would earn a larger share per satellite, so safety would become a way to win room. SpaceX's own filing already thinks in shells. The regulator should think the same way.

Release tranches only after an audit :-

The FCC already grants in stages, so the machinery exists. The next stage should open only

¹² Sathiaselam, supra note 11, at 1–2.

¹³ Sathiaselam, supra note 11, at 2, 9.

¹⁴ Gernot Fritz & Amina Kovacevic, *Sustainability in Orbit—Part I: How the Council Compromise Turns the EU Space Act's Debris and Traffic Rules into Real Operator Duties*, E+H Rechtsanwälte GmbH (July 20, 2026), <https://www.eh.at/en/sustainability-in-orbit-part-1-how-the-council-compromise-turns-the-eu-space-acts-debris-and-traffic-rules-into-real-operator-duties/>.

¹⁵ Proposal for a Regulation of the European Parliament and of the Council on the Safety, Resilience and Sustainability of Space Activities in the Union, COM (2025) 335 final, art. 119 (June 25, 2025), <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52025PC0335>; Jacob Hafey & Álvaro Ovejero, *Access Alert: European Commission Releases Proposal for the EU Space Act*, Access Partnership (June 26, 2025), <https://accesspartnership.com/opinion/access-alert-the-eu-space-act/>.

when an independent audit of the last one shows three things: how many satellites failed and drifted uncontrolled, how many avoidance manoeuvres each satellite made, and whether tracking data were shared on time. A tranche then becomes a reward for measured performance, not a calendar date.

Require a cumulative impact statement above 10,000 satellites :-

Large public works must show their combined effect on the environment before approval. Mega-constellations should face the same test. The applicant would model its system together with every authorised and pending system in the same shells. Independent experts would review it. This also gives the comment process something solid to examine. It follows the Cambridge brief's call for a cumulative, cross-operator approach at the FCC.

Use regulatory equivalence as the lever for a shared ledger :-

The EU Space Act proposal lets the Commission waive some requirements for non-EU operators if their home regime is sufficiently equivalent. That proposal dates from 2025, but the idea is useful here. A licensor's regime should count as "equivalent" only if it publishes its shell allocations to a common ledger and checks that ledger before it grants a new share. No treaty is required. Market access is the incentive, and a licensor that stays out of the ledger would risk losing access to the European market.

Conclusion

National licensing can control a single operator, but it cannot, in its present form, control the sum of many. The 2026 record shows regulators approving thousands of satellites at a time while no body counts the total in each shell. A million-satellite filing has made the gap impossible to ignore. Shell-level risk budgets, audited tranches, cumulative impact statements and a ledger tied to regulatory equivalence offer a practical way forward. Whether licensors act before the next large filing is decided will shape the orbit for decades. The test will come when the first shell reaches its limit, and the rules need to be ready before that day arrives.