SpaceX Redmond (Starlink): Constellation-Scale Propulsive Deorbit, Low Altitude & Demisability

Pillar: Constellation Scale | **Basis:** FCC Filings & NASA/ESA Context | **Primary Source:** SpaceX / FCC Space Bureau | **As Of:** As of Nov 2026 (ESA 2026: ~16,100 Active Payloads)

SpaceX's Redmond-engineered Starlink constellation operates primarily below 600 km, pairing onboard Hall-effect thrusters for active propulsive deorbit with low-altitude passive drag backup and demisable bus design to satisfy FCC 5-year and 1:10,000 limits at fleet scale.

Documented Instrument & Engineering Record

• Redmond engineering anchor: SpaceX's Redmond, WA facility designs and builds Starlink satellites, making Puget Sound a primary engineering center for mega-constellation orbital sustainability.

• Low-altitude safety net: As noted in NASA ODPO's Orbital Debris Quarterly News (ODQN, 2025–2026), Starlink operates primarily below 600 km—where residual atmospheric drag naturally clears defunct spacecraft well inside the 5-year FCC ceiling even if propulsion fails.

• Active propulsive deorbit: Nominal end-of-life satellites use onboard electric propulsion to lower perigee rapidly in months rather than waiting years for passive decay.

• Aggregate casualty scrutiny: At thousands of active satellites—part of ~16,100 functioning payloads worldwide per ESA's 2026 Space Environment Report (data through end of 2025)—regulators evaluate both per-satellite demisability and fleet-wide reentry risk.

Constellation-Scale Disposal Obligations vs. Single-Satellite Rules

Compliance Dimension	Single-Satellite Baseline	Mega-Constellation Multiplier
Deorbit Timeline	<= 5 years post-EOM	Months via propulsive descent; <5-yr passive backup
Reentry Casualty (Ec)	< 1:10,000 per event	Fleet-wide demisability or controlled reentry
Collision Avoidance	Manual / ad-hoc maneuvers	Autonomous onboard conjunction screening
Propulsion Reliability	Pass/fail single unit	Statistical failure-rate disclosure in FCC ODMP

Mission Designer, Compliance Lead & Founder Takeaways

• Operating below ~550–600 km provides a physical passive-decay backstop that higher-altitude constellations lack.

• Suppliers providing avionics, solar arrays, or structural brackets to constellation primes must meet strict material-demisability specs.

• Every constellation replenishment cycle increases launch cadence and reentry mass—driving regulatory focus on aggregate fleet reliability.

Cross-Cluster Links & Primary Sources

• **SpaceX Redmond Census Profile:** https://bcesg.org/spacex-redmond-washington-space-cluster-profile/

• **FCC 5-Year Disposal Rule Mechanics:** https://bcesg.org/wa-space-orbital-fcc-5-year-rule-mechanics/

• **Tracked Objects vs. Modeled Debris (2026):** https://bcesg.org/wa-space-orbital-esa-nasa-debris-counts-2026/

• **SpaceX Updates:** https://www.spacex.com/updates/

• **NASA ODPO: Orbital Debris Quarterly News:** https://orbitaldebris.jsc.nasa.gov/quarterly-news/

• **eCFR: 47 CFR § 25.283:** https://www.ecfr.gov/current/title-47/chapter-I/subchapter-B/part-25/subpart-D/section-25.283

Provenance Note: Global active payload count (~16,100) cited from ESA 2026 Space Environment Report (data through end of 2025); Starlink shell context from NASA ODQN (2025–2026).