Unofficial Notes:

New America / International Center for Law & Economics (ICLE): The LEO Satellite Policy Symposium

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SUMMIT RIDGE GROUP

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***NOTICE**: These notes were taken live at The LEO Satellite Policy Symposium event in Washington, D.C., on November 13, 2025. They are a good-faith representation of our impressions of the events and what was said by participants. However, we cannot guarantee the accuracy of any specific comment. These notes are not endorsed by New America, the International Center for Law & Economics, or participants in any way. This document is not a recommendation to buy or sell any security. Please consult with appropriate professional advisors before making significant business decisions. Comments and corrections are welcome.*

49 West 38th Street, 12th Fl New York, NY 10018 ■ +1 212.433.4800 ■ info@SummitRidgeGroup.com

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EXECUTIVE SUMMARY

The New America / ICLE's LEO Satellite Policy Symposium examined how rapidly expanding Low-Earth Orbit (LEO) constellations are transforming U.S. space governance, spectrum policy, broadband strategy, and global competition. The discussions outlined the clear evolution that LEO has evolved from an experimental concept to a central component of the global communications infrastructure, driven by mass deployment, falling launch costs, new direct-to-device capabilities, and accelerating geopolitical competition with China. Participants agreed that U.S. policy is lagging behind technological reality, and that faster regulatory modernization is essential for national competitiveness, broadband equity, and orbital sustainability.

Key Takeaways.

1. **D2D and LEO Satellites are the Most Popular Topics of Discussion in the Satellite Industry Now.**

The symposium highlighted that the LEO sector has undergone a significant scale-up over the past decade. The total number of satellites in orbit has increased more than fivefold, driven heavily by large constellations such as Starlink, with additional systems (Kuiper, OneWeb, Telesat Lightspeed, IRIS,[1] and Guowang) in deployment or planning. Launch volumes have risen sharply, launch costs have fallen, and LEO system capacity is now measured in hundreds of terabits per second versus a few terabits across the entire GEO fleet. Latency in the 20–30 ms range enables LEO to support real-time applications that were historically reserved for terrestrial networks.

2. **FCC Policy Is Pivoting to Throughput and Process, Not Just Orbit and Spectrum Allocation.**

The policy framework presented focuses on removing four categories of regulatory inefficiency: technical limits (especially legacy EPFD rules), artificial spectrum scarcity, economic misallocation and anti-commons problems, and bureaucratic bottlenecks in licensing. Legacy EPFD limits established in the 1990s may be overly restrictive in light of modern coordination capabilities, which limit LEO power levels and thereby compromise broadband quality. Parallel proceedings aim to expand satellite allocations (over 20 GHz of new spectrum under consideration) and require basic ephemeris data-sharing to support collision avoidance. On licensing, the shift from a bespoke, case-by-case Part 25 framework to a standardized,[2] "presumed acceptable" Part 100 "assembly line" is intended to create predictable,[3] time-bounded decisions rather than multi-year uncertainty. [**AM Comment**: This is consistent with recent comments from other FCC officials advocating more streamlined FCC processes.]

3. **Spectrum Strategy Is Moving Beyond a Pure "Mobile-First" Paradigm.**

The spectrum panel highlighted a structural change in how satellite is treated in domestic allocations. Additional downlink and uplink capacity for LEO in Ku/Ka and higher bands is deemed

[1] IRIS² is European Union's "Infrastructure for Resilience, Interconnectivity and Security by Satellite" program, a multi-orbit sovereign communications initiative designed to provide secure government connectivity and support commercial broadband services across Europe and Africa.

[2] FCC Part 25 is the section of the Federal Communications Commission's (FCC) rules that governs satellite communications. It covers licensing, technical standards, and operations for both ground-based earth stations and space stations (satellites) that transmit energy, communications, or signals. This includes both geostationary and non-geostationary satellite systems.

[3] FCC Part 100 is a proposed new set of rules to modernize the FCC licensing process for space and earth stations, which would replace the current Part 25 regulations.

necessary to support user links, feeder links, and high-growth segments, such as aviation and maritime connectivity. Several candidate bands (e.g., upper 12 GHz and 42 GHz) were originally on a terrestrial path but are now under consideration for satellite or shared use, reflecting under-deployment in mobile and growing LEO demand. Millimeter-wave bands, where mobile deployments have lagged, are strong candidates for coordinated gateway and fixed wireless sharing using database-based coordination, given clear angular separation between "up" beams (gateways) and horizontal beams (FWA).

4. **LEO's Role in the Digital Divide Is Real but Bounded by Capacity, Cost, and Program Design.**

Participants framed LEO as one component in a broadband "toolkit," not a universal solution. LEO is particularly compelling for very rural, geographically challenging, or thinly populated regions, as well as for mobility use cases where terrestrial buildout is impractical. At the same time, LEO constellations do not have infinite capacity, can become constrained in dense areas, and have clear-sky and equipment requirements at the user premises. The symposium's digital divide workstream, therefore, focused on where and how to incorporate LEO into programs like BEAD, including: appropriate reporting and performance metrics (uptake and capacity), support for CPE and installation, and ensuring LEO eligibility in future deployment and affordability mechanisms, while recognizing that affordability remains a primary barrier to adoption. [**AM Comment:** The key is "use where appropriate." Treating LEO as an all-purpose fix for BEAD gaps would be a misread of both capacity and economics.]

5. **LEO Competition Is Shaped Primarily by Structural Barriers and Industrial Policy, Not Yet Firm Conduct.**

The competitive analysis emphasized that LEO markets are still in a formation phase. Structural entry barriers are high: constellations were described as requiring investments like "a minimum of 10 billion" to build viable global broadband systems, along with industrial capacity to produce thousands of satellites and secure reliable launch. Additionally, there are artificial barriers: only governments can file systems with the ITU, and filings must be global in scope to ensure continuous coverage. Vertical integration, encompassing design, manufacturing, and launch under one umbrella, currently manifests as faster iteration and cost control, rather than as foreclosure, particularly given that dominant launch providers are still launching competitor constellations. Although market launch prices are higher than launch costs, vertically integrated companies benefit from substantial cost advantages. For example, a SpaceX Falcon 9 launch is priced at roughly $60 million on the market, while its estimated actual launch cost to SpaceX is closer to $20 million. In parallel, state-backed systems in Europe and China are proceeding on political rather than purely commercial logics, further complicating any standard antitrust frame.

6. **Demand-Side Substitution, D2D, and Global South Use Cases Will Reframe How LEO Is Evaluated.**

Finally, the competition panel noted that most policies are still overweight in terms of supply (in terms of the number of constellations, satellites, and capacity) and underweight in terms of demand-side substitution: when users actually perceive LEO as a substitute for fiber, fixed wireless, or GEO, and when they do not. Direct-to-device services blur boundaries between satellite and terrestrial mobile, with hybrid models using MSS spectrum, terrestrial partners, or standalone holdings. In the Global South, LEO may first manifest as enterprise backhaul, anchor-institution connectivity, or shared access points rather than one terminal per household.

11:00 AM - 11:05 AM | WELCOME - OPENING REMARKS

SPEAKER: Michael Calabrese, Director - Wireless Future; Senior Advisor, Technology and Democracy, New America.

- Underscored the urgent policy need emerging from the rapid expansion of LEO constellations.
    - Governments and private companies are poised to deploy tens of thousands of new satellites, dramatically increasing orbital activity.
- LEO policy working group focused on three fundamental pillars of the LEO satellite policy challenge.
    - Spectrum access and coexistence enable far greater capacity while ensuring effective interference mitigation.
    - Market competitiveness fosters a dynamic LEO ecosystem characterized by healthy competition.
    - The digital divide is addressed by enabling satellite systems to expand connectivity through modernized subsidies and support programs.

11:05 AM - 11:35 AM | REMARKS FROM JAY SCHWARZ, CHIEF, FCC SPACE BUREAU

- 71% of contributors to the LEO working group report[4] were individuals he knew from the broadband and telecom sector, not space, which he views as a powerful indicator of the migration of traditional telecom talent into the space sector.
- **Historical Analogy: Lessons from the Berlin Airlift.**
    - To frame the FCC's current moment, Schwarz recounted the 1948-49 Berlin Airlift.
    - Initially, Allied forces delivered only 20% of the 5,000 tons of cargo required daily.
    - General William Tunner's operational reforms included one-way corridors, straight-in approaches, switching to C-54 aircraft, and eliminating crew delays, resulting in five times the throughput.
    - Emphasized that mundane procedural improvements, not revolutionary technology, unlocked that leap.
    - Minor efficiency gains in a complex system can dramatically increase national capacity.
- **"The Space Industrial Revolution" and the Space Hockey Stick.**
    - Schwarz argued that the U.S. is living through a space industrial revolution, marked by a vertical spike in launches from 2016 to 2018 ("the space hockey stick").
- **Rapid Innovations.**
    - Standardized satellite manufacturing.
    - New materials.
    - Novel space-based services (including emerging work on orbital data centers).

[4] Michael Calabrese, et. al, *Low Earth Orbit Satellites: Policies to Promote Spectrum Sharing, Foster Competition, and Close Digital Divides,* New America – Open Technology Institute (October 30, 2025), https://www.newamerica.org/oti/wireless-future-project/reports/leo-satellites/.

    - A massive increase in FCC licensing requests mirrors the launch growth.
    - Falling launch costs are analogous to the steam-power productivity leap of the 1800s.
    - This surge, he argued, represents a demarcation point between “old space” and the new commercial era.
- **Geopolitical Context: Space Race 2.0.**
    - Described a strategic contest between China (CCP) and the United States to dominate orbital infrastructure.
    - China is advancing.
        - LEO systems are designed for an authoritarian-controlled global internet.
        - Space warfare capabilities.
        - The U.S. must increase throughput, innovation, and deployment speed to maintain leadership.
    - “This isn’t a race against ourselves; this is Space Race 2.0.”
- **The FCC’s Guiding Philosophy: Remove Inefficiencies, Accelerate Innovation.**
    - Economist’s lens: inefficiencies → deadweight loss → lost innovations, deployments, and rural broadband upgrades.
    - Because the space industry is still in its initial stages of growth, accelerating innovation now compounds benefits for decades to come. [**AM Comment:** Accelerated innovations by reducing bureaucratic inefficiency - it is a common refrain among recent FCC officials; it will be great if the FCC can pull it off.]
- **FCC Role: Remove Inefficiencies in Four Categories**
    - **Bucket 1: Technical Inefficiencies.**
        - EPFD Limits (1990s-era GSO Protection Rules).
            - Non-GSO constellations face restrictive power limits to protect GSO systems.
            - Current EPFD limits may be overly conservative, resulting in reduced throughput for LEO broadband.
            - U.S. operators believe that, with modern coordination techniques, they can offer fiber-like LEO broadband (greater than 1 Gbps).
        - **Policy Significance.**
            - Lifting constraints could transform rural broadband competition.
            - The FCC opened a rulemaking in April to reevaluate EPFD limits, an issue addressed in the LEO Working Group report.
    - **Bucket 2: Scarcity Inefficiencies.**
        - In satellites, physical inputs are spectrum and orbital real estate.
        - **Regarding Spectrum Scarcity.**
            - The FCC has begun a proceeding to allocate more than 20,000 MHz across four bands to expand capacity for space services.
            - Objective: remove artificial scarcity and ensure room for U.S. operators to scale.

- The U.S. must avoid artificially underestimating LEO's carrying capacity.
- FCC is proposing ephemeris data-sharing requirements akin to "turn signals for satellites" to reduce collision risk and allow greater density in orbit.
- This is the opposite of "red-flag laws," which he used as a metaphor for over-regulation designed to suppress modern technology.

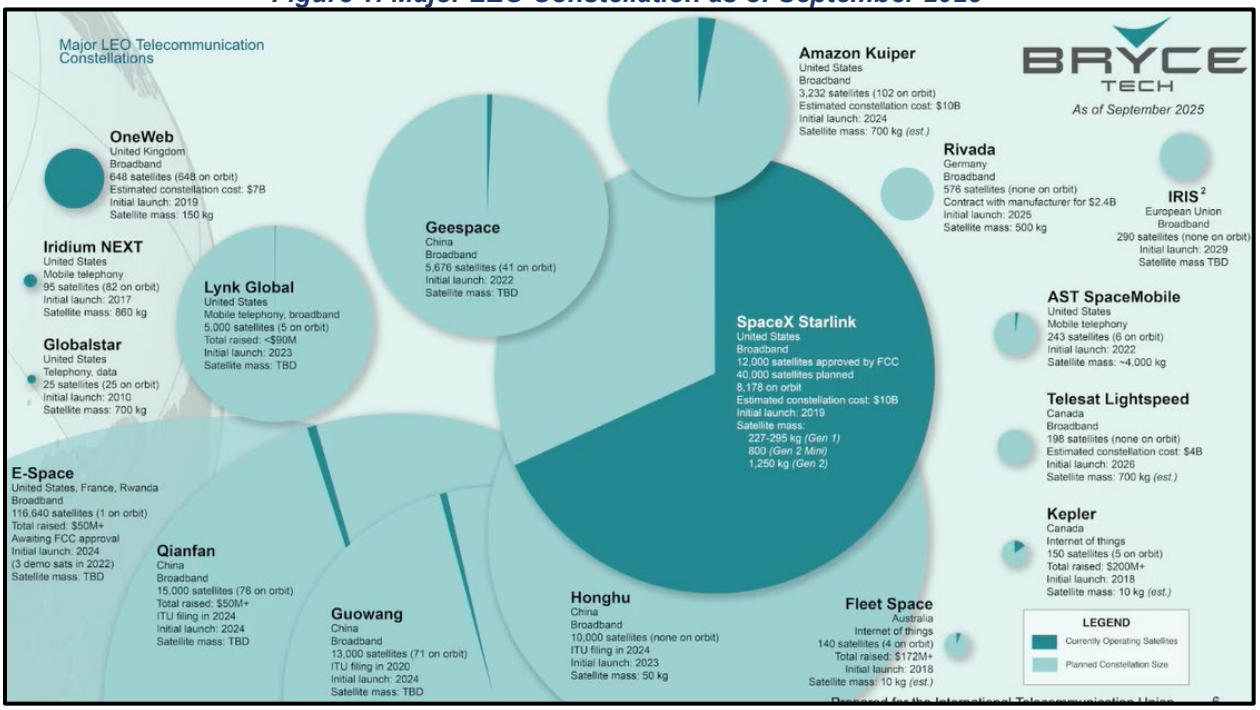
- **Bucket 3: Economic Inefficiencies Resulting From the Regulatory Framework.**
  - Schwarz identified the following two structural risks:
    - Misallocation.
      - Regulations may assign control of spectrum/orbital resources to entities that are not best positioned to deploy, thereby limiting U.S. competitiveness.
      - To win Space Race 2.0, we want to make sure we are pro-possibilities.
    - Anti-Commons Problem.
      - Fragmented rights and overlapping coordination requirements can lead to under-use of spectrum/orbit (too many veto points).
    - The report's discussion of strengthening secondary markets (p. 28) was highlighted as a potential solution.
- **Bucket 4: Bureaucratic Inefficiencies (Most Urgent).**
  - We are focusing on bureaucratic inefficiencies at the space bureau.
  - Satellite licensing (Part 25) is a slow, complex, and unpredictable process that can take anywhere from 1 to 4 years.
  - Application review is "bespoke," requiring staff to decode inconsistent submissions.
  - Every delay is "a ticket" preventing a company from innovating or deploying.
  - FCC's Licensing Modernization Agenda.
    - Replace Part 25 with a new Part 100.
    - Create a presumed acceptable framework.
      - If a request fits clearly within the rules → fast-track approval.
      - Only deviations require deeper review.
    - Introducing a licensing assembly line:
      - Standardized application formats.
      - Automated routing.
      - Rule-aligned triage.
      - Shot clocks to enforce accountability.

  - Emphasized that these reforms are about process, not changing substantive standards.
  - The Space Bureau will continue focusing on throughput, efficiency, and predictability, recognizing the urgency of both economic opportunity and geopolitical competition.
- **Q&A.**
  - **Question:** What happens when autocratic governments try to block or jam satellite signals, similar to historical interference with services like Radio Free Europe and Radio Free Asia, and what would happen if such actions created collateral interference for other countries?
    - **Schwarz:**
      - There is an established international framework for addressing harmful interference.
      - Enforcement mechanisms fall largely outside the FCC's jurisdiction, being handled by other parts of the U.S. government.
  - **Question:** Why would countries not simply adopt Chinese space-based communications systems, especially given their existing reliance on PRC telecom vendors, particularly on the ground?
    - **Schwarz:**
      - They shouldn't do it.
      - The U.S. is making the case that a country should not adopt a CCP system when it has already adopted a CCP-aligned terrestrial communications infrastructure.
      - The U.S. is currently ahead in LEO deployment, and the U.S. position to partners is that they should choose open, democratic, non-CCP-controlled systems for space communications.

11:35 AM - 11:45 AM | LEOS 101 WITH PATRICIA COOPER – PRESIDENT, CONSTELLATION ADVISORY LLC

- **LEO Constellations have Accelerated Rapidly over the Past Decade.**
  - 2015: ~2,000 satellites total across all orbits.
  - Today:
    - >10,000 from Starlink alone.
    - >5× global increase.
  - ITU filings:
    - 1.7M NGSO satellites.
    - Rwanda filing alone = 300,000.[5]
- **Additional Systems.**
  - Amazon Kuiper, OneWeb, Telesat Lightspeed, EU IRIS², China Guowang.
  - See Figure 1 below.

Figure 1: Major LEO Constellation as of September 2025



Source: Bryce Tech[6]

- **LEO Technical Basics.**
  - Orbit.
    - <2,000 km.

[5] Peter B. De Selding, *Rwanda Space Agency: Our 300,000 Satellite ITU Filing 'Made Noise for All the Good Reasons, Compares Well with SpaceX*, Space Intel Report (January 13, 2023), https://www.spaceintelreport.com/rwanda-space-agency-our-300000-satellite-itu-filing-made-noise-for-all-the-good-reasons-compares-well-with-spacex/.

[6] Carissa Christensen, *The Rise of SmallSat and Satellite Constellations – Growth and Drivers,* BryceTech (January 2025), https://www.itu.int/space-connect/wp-content/uploads/sites/66/2025/01/ITU-Space-Connect-E1-Carissa-Christensen-Presentation.pdf.

        - Most systems are located at altitudes of 500–1,200 km.
    - Orbital Period.
        - ~90 minutes → requires large constellations.
    - Size/lifetime.
        - ~500–700 kg.
        - 5 to 10-year lifespan vs. GEO at 15–20 years.
    - GEO at 35,786 km fixed relative to Earth.
- **Industrial Implications.**
    - High replenishment → need constant manufacturing + high launch cadence.
    - Launch costs have decreased by 75% compared to a decade ago. [**AM Comment:** SpaceX internal cost has fallen even faster.]
    - 2025 YTD: ~270 global launches vs. 85 in 2015.
    - Driven by reusable rockets (Falcon 9, etc.).
    - More satellite manufacturers shift to in-house production.
- **Demand Drivers for LEO Communications.**
    - Global coverage; works for remote, mountainous, maritime, aviation, and polar regions.
    - Latency: 20–30 ms (LEO) vs. 250–600 ms (GEO).
- **Constellation Capacity.**
    - Starlink: ~450 Tbps. [**AM Comment**: Grok says ~615 Tbps. In any case, it is a lot and increasing fast.]
    - Kuiper: ~117 Tbps.
    - Global GEO fleet: ~2.7 Tbps.
    - Terminals now cost in the low hundreds of dollars (10 times cheaper than legacy GEO terminals).
- **Use Cases.**
    - Consumer broadband (Starlink, Kuiper).
    - Enterprise, aviation, maritime, and government.
    - Direct-to-device (D2D) mobile broadband proposals are expanding rapidly.
    - Constellations can evolve service offerings (residential → enterprise → mobility → military → D2D → on-orbit compute).
- **Constraints and Risks.**
    - Limited capacity for dense urban markets.
    - Spectrum constraints: bands originally allocated for GEO or terrestrial.
    - Space safety/orbital debris risks.
    - High capex, manufacturing, operational, and regulatory complexity.
    - Historically, every previous LEO constellation wave has seen bankruptcies; several current-generation projects have already failed.
- **Market Context.**
    - Global satellite industry (2024): ~$293B.
    - Share of global telecom (~$1.1T): ~20%.
- **Broadband Subs.**
    - Starlink ~8M subs across 150 countries.

- All GEO broadband historically <1M subs.
- Global broadband subs ~1.5B.
- Satellite broadband has a small share but is critical for the “last 1%.”

- **Digital Divide Economics.**
  - Cost to close the U.S. divide terrestrially:
    - Approximately $240 billion for the U.S.
    - ~$2.3T globally.
  - LEO constellations can cover areas where terrestrial economics fail.
  - Spectrum access, licensing modernization, competition oversight, and orbital safety frameworks are essential.

PANEL I (11:45 - 12:30 PM): SPECTRUM

MODERATOR: Michael Calabrese, Director, Wireless Future; Senior Advisor, Technology and Democracy

PANELISTS:

- Armand Musey, President and Founder, Summit Ridge Group, LLC.
- Jeff Carlisle, Managing Member, Lerman Senter PLLC.
- Joe Kane, Director, Broadband and Spectrum Policy, Information Technology & Innovation Foundation.

SESSION:

Armand Musey, President and Founder, Summit Ridge Group, LLC [AM Comment: That's me!]

- **Spectrum Needs.**
  - More satellite spectrum is likely needed, but the report emphasized two qualifications:
    - "We really don't know how many constellations up there and ultimately how many users there will be." It is challenging to quantify what the spectrum needs will look like in 5–10 years.
    - FCC action alone is not enough. Constellations are global systems; operators need global harmonization to monetize users worldwide and justify the deployment of global fleets.
- **Specific Bands (Ku/Ka and Higher).**
  - SpaceX utilizes Ku-band and is capacity-constrained, particularly on the uplink.
  - Other systems like Kuiper use Ka-band and may have better availability initially.
  - Next-generation constellations will look to higher frequencies, including 42 GHz and above.
  - This follows the satellite industry's long-term trend, a "slow march" to higher frequencies, similar to the trend in terrestrial mobile.
- **Raising LEO Power Levels (EPFD Reconsideration).**
  - Increasing LEO power might not interfere with GEOs, but it could make it harder to add additional LEO constellations, potentially creating anticompetitive effects for future LEO entrants.
  - It is essential to consider this possibility in the rulemaking process.
- **SpaceX Purchasing ~40 MHz of 2 GHz MSS spectrum (EchoStar).**
  - This is "much money," but it depends on what rights SpaceX actually acquired.
  - 40 MHz of U.S. MSS spectrum is co-primary for terrestrial use, so part of it could be used for terrestrial purposes, which has a higher value.
  - EchoStar also holds rights in Europe through the complementary ground component; those rights are set to expire in 2027.

- Many believed renewal was unlikely with Echostar, but it appears that SpaceX is confident it can secure renewal.
- SpaceX also has rights in Australia and claims to have "perfected the rights globally."
- If SpaceX actually obtains global rights, especially with terrestrial flexibility, the purchase could be a very good deal.

- **Additional Point.:**
  - Historically, terrestrial mobile spectrum has been valued higher than satellite spectrum, but "the market is changing," and satellite spectrum appears to be more valuable today.
  - This is also the first time SpaceX has paid for spectrum, suggesting they may have additional plans that are not yet publicly visible. [**AM Comment**: It is unlikely Starlink can achieve a cost to compete with terrestrial wireless due to limited spectrum and large spot beam sizes. Even if it could, a lack of indoor coverage would be problematic.]
- **Gateway Sitting and Millimeter-Wave Sharing.**
  - Millimeter-wave spectrum purchased by mobile operators (24 GHz and above) is not being deployed as originally expected.
  - These bands are realistically suited for the following:
    - Fixed wireless access.
    - Satellite gateways (which are also fixed).
  - Sharing between the two should be "really simple" because:
    - Satellite earth stations beam straight up,
    - Fixed wireless beams are horizontal (nearly orthogonal),
  - Coordination should be far easier than other share regimes that already work.
- **Spectrum access to smaller players (auction participation):**
  - Smaller license areas (e.g., county-sized licenses in CBRS) allowed new entrants, utilities, and small companies to participate.
  - Large carriers prefer very large license sizes, as they can afford them; small carriers, on the other hand, prefer small license sizes.
  - For satellite, nationwide licenses are generally required; county-sized satellite licenses are not practical.
- **Upper C-band / possible satellite-terrestrial sharing:**
  - Sharing may be possible at the top of the band (near the guard band protecting aircraft altimeters), where satellite transmissions would cause less interference.
  - However, co-channel sharing in the same geographic location at the same time is challenging with current technology.

Jeff Carlisle, Managing Member, Lerman Senter PLLC

- **Spectrum Expansion (12 GHz, 42 GHz, Millimeter Wave)**

  - Demand exists for:
    - User links, Feeder links, and Gateways ("You don't have a satellite broadband network without many gateways.")
    - Aviation and maritime connectivity require more spectrum; current satellite Wi-Fi "works to an extent," but it could be "a lot better."
  - Adjacent spectrum is efficient because it aligns with existing satellite operations.
- **Shift From Terrestrial to Satellite Allocations**
  - The FCC's move signals a needed shift after ~15 years of prioritizing mobile carriers.
  - Mobile operators should "focus on improving service quality today… make use of the spectrum you've got."
  - Policymakers should examine how specific bands integrate terrestrial and space-based uses, rather than assuming an "everything goes to mobile" model.
- **Raising LEO Power Levels / EPFD Reform**
  - The issue is not LEO vs. GEO, but whether the current regime remains viable.
  - GEO power limits are based on assumptions from the 1960s to the 1980s.
- **Interference Standards.**
  - Interference standards should be objective, measurable, tied to actual harmful interference, and not arbitrary ("You cannot just say 'it's that number because we like that number").
  - Precedents: Hush-A-Phone, Carterfone, Part 68.[7]
  - GEO emergency services require protection, but significant flexibility exists for a more modern framework.
- **Gateway Siting in Millimeter Wave Bands**
  - Coordination databases are effective (example: CBRS, which supports hundreds of fixed wireless operators).
  - Implementation had obstacles, but it is successful.
  - LEO gateway siting "cries out for" next-generation coordination systems and active management.
- **Upper C-Band Sharing.**
  - Sharing may be possible at the top of the band (near altimeter guard bands).
  - But sharing across the entire mobile portion involves different and more complex issues.

[7] Part 68, FCC (updated May 3, 2019), https://www.fcc.gov/part-68.

Joe Kane, Director, Broadband and Spectrum Policy, Information Technology & Innovation Foundation

- **Spectrum.**
  - Supports the introduction of more spectrum into the marketplace for all commercial uses, not just satellite.
  - Higher bands are compatible with light licensing and high-density use.
- **Repurposing Mobile-Targeted Bands.**
  - Spectrum policy should prioritize productivity over incumbent protection.
    - "Optimal interference is not zero."
    - Optimal interference is always about maximizing utility.
    - Small increases in interference risk to GEO can be justified if LEO gains are large.
- **Updating EPFD Rules.**
  - GEO-driven rules were created for a world where GEO "was the space economy."
  - They never envisioned thousands of LEO satellites.
  - Updating rules makes sense given current realities.
- **Direct-to-Device (EchoStar–SpaceX Deal).**
  - Example of breaking down old "satellite vs. terrestrial" silos.
  - The industry is moving toward global ubiquitous connectivity for companies.
  - FCC's Supplemental Coverage from Space (SCS) proceeding (23-65) is consistent with this shift.
- **Gateway Siting / Millimeter Wave.**
  - Revisiting mmWave rules is justified, given the low deployment.
  - But the FCC should avoid "pulling the rug out" from auction winners; primary rights must be respected.
  - Sharing is possible with appropriate protections.
- **Auction Access for Smaller Players.**
  - Auctions are open to everyone; the highest bid reflects the value of the plan.
  - Secondary markets could allow small entrants to acquire slices of larger licenses.
  - Smaller license sizes (like county-size CBRS) help new entrants.

Audience Q&A

- **Question**: How can policy and auction design broaden access to spectrum for innovators and smaller players who are currently constrained by license costs, auction structure, or infrastructure requirements?
  - **Armand Musey:**
    - The most effective way to expand participation is to auction smaller license areas, which lowers upfront capital requirements.
    - The CBRS auction demonstrated this: county-sized licenses attracted "new faces," including utilities and small/private operators.

- This approach primarily applies to terrestrial mobile.
    - For satellite systems, especially those requiring LEO constellations with multi-billion-dollar investments, the barrier to entry is structurally far higher, limiting accessibility.
- Flexible-use auctions involving satellite operators further complicate matters: satellite players typically require nationwide footprints, making small license areas impractical.

- **Joe Kane:**
    - Auctions are technically "open to everyone," but the highest bidder wins because they signal the highest expected value from the spectrum.
    - Better secondary markets would help innovators carve out subsections of licenses from larger holders, which are useful when a small operator has a targeted, high-value use case.
    - However, auction design is inherently shaped by a recurring debate about the following:
        - Small carriers advocate for small license areas.
        - Large carriers advocate for large, nationwide licenses that only major bidders can afford.

- **Question:** With the upcoming upper C-band auction, is it feasible to include a secondary mobile-satellite allocation either within the guard band or through a supplemental coverage-from-space framework?
    - **Joe Kane**:
        - Feasibility depends heavily on guard-band size.
        - Satellite operations at the top end of the band may present lower interference risks for aviation altimeters, potentially allowing a satellite segment adjacent to the protected band to operate without interference.
        - The utility depends on how much bandwidth is ultimately carved out.
    - **Armand Musey:**
        - A satellite-only segment at the top of the band could be workable.
        - However, co-sharing the same frequencies at the same time and location with mobile terrestrial users is extremely difficult with current technology.
    - **Jeff Carlisle:**
        - There are two distinct scenarios, which must not be conflated:
            - The mobile-satellite and fixed-satellite shared segment in the unauctioned top portion of the upper C-band is made

available because part of the band must remain unused to protect aircraft altimeters in the adjacent band.
    - Supplemental Coverage from Space (SCS) overlaying the entire terrestrial 5G portion of the auctioned band.
- The first scenario (satellite use in the guard-band-adjacent remainder) is technically plausible.
- The second scenario (satellite and terrestrial co-channel use throughout the entire band) involves significant interference, rights, and policy complexities, and has far broader implications for auction design.

PANEL II (12:45 - 1:30 PM): DIGITAL DIVIDE

MODERATOR: Jessica Dine, Policy Analyst, Open Technology Institute and Wireless Future, New America

PANELISTS:

- Mignon Clyburn, Principal, MLC Strategies, LLC, and Former Commissioner, Federal Communications Commission
- Nicol Turner-Lee, Director, Center for Technology Innovation, Brookings
- Greg Guice, Chief Policy Officer, Vernonburg Group

SESSION:

Jessica Dine, Policy Analyst, Wireless Future & Open Technology Institute.

- **Digital Divide Subcommittee Objective.**
  - Determine how and where LEO satellite broadband fits into the broader U.S. connectivity toolkit.
  - Choosing LEO over other broadband technologies involves trade-offs that must be understood and evaluated.
- **LEO Context.**
  - Residential LEO is a nascent field with one active provider and another emerging.
  - Despite this, the U.S. is relying heavily on LEO through the BEAD program. [**AM Comment**: LEO is roughly five percent of the overall BEAD program, with each state varying in allocation.[8]]
  - Inclusion of LEO in broadband deployment policy is new and untested.
- **LEO Limitations.**
  - LEO cannot scale indefinitely; it has natural capacity limits.
  - Population density limits.
  - Geographic constraints: users require a clear view of the sky.
  - Spectrum access uncertainties.
  - Reporting and verification challenges arise because LEO lacks traditional buildout milestones.

[8] SpaceX is awarded over $600 million, and Amazon LEO is awarded over $230 million as part of BEAD program. Ian Doescher, *Updated, Comprehensive List: BEAD Benefit of the Bargain Provisional Awards,* Telecompetitor (October 21, 2025), https://www.telecompetitor.com/updated-comprehensive-list-bead-benefit-of-the-bargain-provisional-awards/.

- **Short-Term Recommendations.**
  - Streamline BEAD and other deployment programs to incorporate LEO providers.
  - Standardize reporting requirements (e.g., projected uptake, current and planned capacity).
  - Deployment programs should subsidize consumer premises equipment (CPE) and installation (analogous to terrestrial last-mile support).
- **Long-Term Recommendations:**
  - Use LEO where appropriate, not universally.
  - FCC should evaluate LEO's potential in other sectors such as direct-to-device (D2D) and backhaul.
  - Affordability support must match actual LEO costs (e.g., a $10 billion subsidy is insufficient).
  - A new mapping process is needed that accurately reflects satellite coverage.

Mignon Clyburn, Principal, MLC Strategies, LLC, and Former Commissioner, Federal Communications Commission.

- **USF Funding Problem.**
  - Immediate need to fix the Universal Service Fund; otherwise, efforts could yield only "short-term gains."
  - Without USF reform, digital divide initiatives risk failure ("like opening and closing the government").
- **Define the Regulatory Objective Before Technology.**
  - Identify the actual problem being solved:
    - Broadband coverage.
    - Resiliency/redundancy.
    - Competition and affordability.
    - Underserved markets.
    - Technologies (LEO, fiber, fixed wireless) are means, not ends.
- **Tiered Technology-Readiness Framework.**
  - Emerging technologies (including LEO) should pass through the following:
    - Phase validation.
    - Pilot and performance evaluation.
    - Scalability and sustainability analysis.
    - Consumer protections.
    - Continuity safeguards.
- **Outcomes-Based Standards.**
  - Avoid locking programs into a single technology. [**AM Comment**: Of the few technologies, Fiber and FWA are so different that none can be repurposed for the other.]

  - Use performance standards (e.g., minimum speeds, affordability thresholds) to guide decision-making.
- **Assess Externalities and Dependencies.**
  - Consider unique system characteristics and non-market impacts.
- **Market Structure and Resilience.**
  - Consider concentration risk.
  - Promote interoperability and open access to avoid vendor lock-in. [**AM Comment**: Not sure how to avoid vendor lock-in, due to proprietary standards.]
  - Consider national security and data sovereignty.
- **Adaptive, Data-Driven Oversight:**
  - Establish feedback loops to adjust programs as technologies evolve and change.
- **Equity and Public Value.**
  - Ask who benefits first and who is left out.
  - Focus on equity, workforce development, local installation, and community resilience.

Nicol Turner-Lee, Director, Center for Technology Innovation, Brookings.

- **Why Digital Divide Analysis Matters.**
  - Digital disparities persist across demographic and geographic groups.
  - 30 years of shifting political priorities have not solved the structural divide.
- **Historical Context.**
  - Digital divide efforts date back to the Clinton/Gore era.
  - Different administrations prioritize different technologies (mobile, 5G, fiber).
  - LEO is the latest part of this "swinging pendulum."
- **Field Observations.**
  - Rural communities commonly use satellite dishes, primarily for television, rather than broadband.
  - Affordability remains a major barrier.
  - Topography, line of sight, and space debris present challenges.
- **Opportunities for LEO.**
  - LEO could serve extremely rural regions ("more cows than people").
  - Avoids costly terrestrial construction.
  - Should be part of a broad toolkit, not a one-size-fits-all solution.
- **Adoption and Affordability Issues:**
  - After ACP expired, 23 million households lost connectivity.
  - Adoption depends on the following:
    - Income.
    - Use case.
    - Technology fit.
    - Deployment programs must consider demand-side realities.

- No single technology solves all problems.
- LEO must be contextualized among broader structural challenges.

Greg Guice, Chief Policy Officer, Vernonburg Group.

- **BEAD Program Design.**
  - BEAD was intentionally designed as a fiber-first program.
  - LEO was grafted onto a structure not built for a satellite, creating inefficiencies.
  - LEO providers often must file redundant or mismatched forms.
- **Right-Sizing Solutions.**
  - Fiber is the "gold standard," but it cannot reach every location.
  - Regulators must do the following:
    - "Meet consumers where they are."
    - Use tiered subsidies where appropriate.
    - Allow technology substitution when fiber is impractical.
- **Technical Considerations.**
  - Upgradability of technology pathways.
  - Reliability and resiliency (e.g., ability to activate service quickly after disasters).
  - Need for rigorous reporting to verify that providers deliver promised speeds and performance.
- **Adoption-Based Reimbursement.**
  - Adoption-based compensation may be the fairest approach for LEO.
  - LEO has no physical buildout to subsidize.
  - **Avoids overcompensating for investments LEO would make anyway.**
  - Historical USF examples show that granting identical support across quite different technologies creates distortions. [**AM Comment**: This is a complex issue. LEO investments and future upgrades can only be justified with additional revenue. Who knows what investments SpaceX would make with $1 billion less or $1 billion more?]

Audience Q&A.

- **Question:** Should subsidies go directly to users instead of technologies?
  - **Mignon Clyburn:**
    - User-directed support fits tech neutrality.
    - "Equal eligibility should not mean identical program design."
    - It must be ensured that all technologies demonstrate both performance and sustainability.
  - **Greg Guice:**
    - User subsidies alone may not address deployment risk.
    - Providers need upfront support for infrastructure.
    - User-only subsidies may distort incentives if deployment remains financially unviable.

- **Nicole Turner Lee:**
  - Users need consumer education to understand LEO as a form of broadband.
  - We need to strike a balance between consumer agency and sustainable network expansion. [**AM Comment**: Much generalization with few specifics; however, in all fairness, this is a huge topic.]

PANEL III (12:45 - 1:30 PM): COMPETITION

MODERATOR: Kristian Stout, Director of Innovation Policy, International Center for Law & Economics

PANELISTS:

- Patricia Cooper, President, Constellation Advisory LLC.
- Ruth Pritchard-Kelly, Expert, Satellite Regulatory Policy.
- Scott Wallsten, President and Senior Fellow, Technology Policy Institute.

SESSION: [**AM Comment:** I disagree with the panelist's general thesis that new entrants are reasonably viable in the LEO broadband market.]

Kristian Stout, Director of Innovation Policy, International Center for Law & Economics.

- The chapter "Competition in LEO Satellite Markets" in the working group report aims to capture a moment in time in a rapidly evolving industry.[9]
- **Analytical Lenses Used in the Chapter.**
  - **Market structure:** what the industry looks like today.
  - **Entry**: how easy or difficult it is to build a constellation.
  - **Product differentiation:** how services may diverge across providers.
  - **Conduct**: future competitive behaviors regulators might watch for.
- Today's market is best described as a competitive market, not within it.
- It is too early to raise competition concerns; infrastructure is still being deployed.
- Geopolitical dynamics complicate competitive analysis; LEO systems in China and Europe are often national strategic assets rather than purely commercial ventures.
- **LEO is a Highly Dynamic Market.**
  - 2014: ~1,000–2,000 satellites in orbit.
  - 2024: ~10,000 satellites.
  - Many more filings and systems are underway.
- Regulatory caution is needed because industrial policy will intermix with market forces.
- **Barriers to Entry.**
  - High capital intensity.
  - Launch capacity limits. [**AM Comment**: Also, the adverse pricing to those not vertically integrated with reusable launch vehicles.]
  - Specialized workforce constraints.
  - Slow and outdated regulatory frameworks.
  - Improved regulatory clarity increases investor confidence and reduces artificial barriers.
  - Terrestrial markets often support 2 to 4 viable competitors; LEO may converge similarly.

[9] Michael Calabrese et. al, *Low Earth Orbit Satellites: Policies to Promote Spectrum Sharing, Foster Competition, and Close Digital Divides,* New America – Open Technology Institute (October 30, 2025), https://www.newamerica.org/oti/wireless-future-project/reports/leo-satellites/.

Scott Wallsten, President & Senior Fellow, Technology Policy Institute.

- **"Corporate Graveyard Turned Commercial Frontier" is an Apt Phrase for LEO.**
  - Earlier attempts at LEO failed due to the immaturity of the technology.
  - Decades from before the 1960s through the early space age, space was a stable, cozy ecosystem:
  - The same institutions, with the same geographically based technologies, are experiencing little institutional or regulatory change.
- **"Corporate Graveyard Turned Commercial Frontier" vs. Recent Developments.**
  - Elon Musk "yanked the technology into the present."
  - However, regulation did not evolve in tandem with technological breakthroughs.
  - Regulation remains effectively stuck in a 1960s framework.
- **Institutional Incumbency: Major Barrier to Regulatory Modernization.**
  - GEO operators dislike LEO systems. [**AM Comment**: Or do they dislike competition?]
  - Some national governments resist LEO for strategic reasons.
  - The ITU itself is an incumbent actor that "doesn't like LEOs." [**AM Comment**: ITU is global, and LEOs are only working in any country.]
  - People who participate in ITU processes enjoy the status quo of global meetings and bureaucracy.
- **Public Choice Problem.**
  - New policy ideas, especially market-based reforms, are shot down immediately.
  - Participants say: "Impossible, too hard to coordinate internationally."
  - This resistance mirrors how Ronald Coase's spectrum auction proposals were dismissed in the 1950s.
  - Auctions were once considered "impossible" until they revolutionized spectrum policy.
  - Not claiming reforms are easy, but that "impossible" means incumbents do not want to change.
- **Natural vs. Artificial Barriers to LEO Entry.**
  - Natural barriers include the following:
    - High capital intensity.
    - Launch capacity constraints.
    - Specialized workforce requirements.
    - Physics of orbital architecture.
    - [**AM Comment**: Also, need for vertical integration & need to deploy and market almost globally from day 1.]
  - Artificial barriers include the following:
    - Regulatory inertia.
    - Outdated ITU and national processes.
    - Country-level resistance to new technologies.
- **Impact of Unclear or Slow-Moving Public Policy.**
  - Unclear or slow-moving public policy directly reduces investment.

  - Investors hesitate when regulatory frameworks don't clearly support market formation.
  - Cleaner policy signals attract more capital and reduce artificial barriers.
- **Foundational Question Raised by Global Competition.**
  - Why shouldn't American consumers buy broadband from a European LEO constellation?
  - Why not even from a Chinese constellation (excluding military users)?
  - LEO competition will increasingly be international, not just domestic.
- **Competition Analysis and an Overemphasis on Supply.**
  - Competition analysis traditionally focuses too much on supply.
  - Number of providers.
  - Technology type.
  - Latency or throughput.
  - Orbital configuration.
- **Regulators and Incorporation of Demand-Side Factors.**
  - Regulators must incorporate demand-side factors.
  - How do users substitute between technologies?
  - What are the cross-elasticities between LEO, GEO, FWA, and fiber?
  - For most individuals, LEO may be a full competitor to fiber.
  - For hospitals or critical facilities, LEO may not be a substitute at all.
  - Policymakers who do not understand substitution cannot analyze competition correctly.
- **Factors Considered in Future Competitive Landscape.**
  - A diversity of LEO systems with different architectures.
  - Providers from multiple countries (IRIS², Guowang). [**AM Comment**: Maybe China, but that will likely be off limits for western customers. It's unlikely IRIS² will be competitive in the longer term after spending $10.5 billion for 3.3 Tbps capacity by 2031,[10] whereas SpaceX alone added over 450 Tbps in 2024.[11]]
  - A need to reevaluate assumptions about national boundaries and broadband markets.
  - A dynamic, competitive environment where technology, policy, and geopolitics intersect.

Ruth Pritchard-Kelly, Expert, Satellite Regulatory Policy.

- **Fundamental Artificial Barrier in Space Law.**
  - Under the Outer Space Treaty, only governments are permitted to file satellite constellations with the ITU.
  - SpaceX could not simply "launch their own constellation," but instead needed a national administration to submit the paperwork. [**AM Comment**: Not really a

[10] Caleb Henry, *Why Europe's IRIS² constellation is in trouble,* Quilty Space (Jun 24, 2025), https://www.quiltyspace.com/post/why-europes-iris-constellation-is-in-trouble.
[11] Network Scalability, SpaceX, https://starlink.com/updates/network-update, (accessed November 25, 2025).

barrier, as lots of countries are interested in doing these filings. The Isle of Man has outsourced to a private company.]
    - Musk attempted to approach multiple countries to file for Starlink before the U.S. sponsored it. [**AM Comment**: U.S. is the most attractive sponsor as it comes with improved access to U.S. markets, so it is unclear why Musk would approach others first.]
- **Government-Filing Requirement.**
    - Major artificial barrier to entry.
    - Companies must persuade a government sponsor.
    - Firms cannot interface with ITU on their own.
    - Creates fixed gatekeeping that does not exist in comparable industries.
- **Physics of LEO Constellations.**
    - In low Earth orbit, one satellite quickly moves out of view.
    - To provide uninterrupted service, an operator needs:
        - Several satellites in a circle, multiple orbital planes, and an entire shell around the globe.
        - The architecture looks like "lines of longitude around a globe."
        - LEO is inherently global, more so than any other technology.
- **Global Geopolitical Reaction to LEO Filings.**
    - When the U.S. filed a global Starlink network at the ITU, other nations responded strategically.
    - China immediately objected, stating, "Our people can't use an American system," and pledged to build their own.
    - Europe, recalling dependence on GPS, insisted it would not rely on U.S. or Chinese LEO systems.
- **Africa and South America are the Key Battlegrounds.**
    - Nearly 100 countries in these regions are "open to everybody."
    - Major question: Who will serve Uganda? Who will serve Brazil?
    - These regions will determine the global market balance.
- **Cost Benchmarks.**
    - LEO constellations cost a minimum of $10 billion.
    - Starlink, OneWeb, and Kuiper fit this model.
    - Europe and China are not building for commercial returns. Their constellations are political projects, not profit-driven.
- LEO, unlike other markets, is shaped by industrial policy, national strategy, and geopolitical goals, and is fundamentally different from a typical commercial market.
- **Advantages of Vertical Integration.**
    - SpaceX/Starlink can design, manufacture, launch, and operate entirely in-house. [**AM Comment**: Also, xAI, robotics, and battery technology could help achieve vertical integration synergies. The level of Musk-related synergies keeps growing.]
    - This verticality gives flexibility unmatched by any other commercial operator.
    - Other satellite companies must negotiate for: manufacturing, launch, and operations.

  - Meanwhile, Starlink has undergone six design modifications (which take 6–7 months) and has been iterating constantly.
- **SpaceX's Approach to Testing.**
  - Traditional industry treats failed launches as catastrophes.
  - SpaceX treats them as "learning opportunities":
  - Launch → fail → revise → relaunch.
  - Always have more vehicles ready.
  - Only a nation-state can match Starlink's degree of vertical integration — and even then, perhaps not.
- **Geopolitical Fragility of Launch Access.**
  - Regime change can happen overnight.
  - If a major launch country changes policy, access can collapse instantly.
  - OneWeb's reliance on Russian Soyuz launches ended "overnight" due to geopolitical factors.
  - OneWeb was saved only through India and SpaceX launches. [**AM Comment**: Not sure if OneWeb was saved; it is unlikely to be commercially visible. European taxpayers would save money if it "died".]
- **Competition Classification.**
  - Spectrum is a global resource; satellites share spectrum internationally.
  - Unlike terrestrial operators, satellites do not get exclusive spectrum slices.
  - This leads to cross-border competition and interference dynamics that differ significantly from those in terrestrial markets.
- **Demand-Side.**
  - For most consumers, the underlying technology is not a concern, whether it is Wi-Fi, LEO, GEO, 4G, or 5G; they want connectivity.
  - Direct-to-device (D2D) is compelling because users want a single device that works everywhere, providing 4G-quality, if not 5G-quality, service.
- **Long-Term LEO Competition.**
  - Starlink's dominance stems from its being the first and most visible.
  - OneWeb's enterprise activities are largely invisible because they are not publicly reported. [**AM Comment:** OneWeb has disclosed several customers, including Gogo, Delta Airlines (via Hughes), Telecom Italia, Orange, Deutsche Telekom, KVH industries, U.S. Government, and many others.]
  - Upcoming competitors (like Amazon Kuiper) will change the competitive dynamics dramatically. [**AM Comment**: Maybe, but Kuiper has a way to go.]
- **Regulatory Fragmentation.**
  - Because the spectrum spans multiple borders, national approval becomes increasingly complex.
  - Satellite operators may choose to skip serving countries with unfavorable regulatory environments.
  - This may result in only one to two providers being able to navigate the entire global regulatory maze.

Patricia Cooper, President, Constellation Advisory LLC.

- Geopolitical reactions to global LEO filings agree that both technology and politics shape the market.
- China and Europe responded strongly to the U.S. Starlink filing because they do not want to be dependent on American systems. [**AM Comment:** Perhaps China, but Europe has been falling behind for many years and does not realistically have the capacity for a strong response.]
- Geopolitical reactions are driven by concerns over sovereignty, not market economics.
- Despite high barriers, many constellations continue to be proposed.
- Examples of new filings every month.
    - Italian military constellation
    - Muon constellation for wildfires
    - Violet MEO constellation
    - These are filed at the ITU through sovereign regulators. [**AM Comment:** There is always lots of filing and little launching.]
    - ITU records now show ~1.7 million NGSO satellites on paper.
- However stupid or antiquated those rules are, they are not the problem."
- The problem is building the systems, not filing them.
- **Bottleneck from Industrial Capacity Limits.**
    - Industrial capacity limits are the real bottleneck.
    - Manufacturing hundreds or thousands of satellites is extremely difficult.
    - Industry previously built ~40 reaction wheels per year; now it needs around 4,000 annually.
    - Satellite builders struggle to meet price, schedule, and volume requirements.
    - Finding "the right people" with correct technical expertise is a major obstacle.
- **Severe Barrier from Launch Capacity Constraints.**
    - Launch capacity constraints are another severe barrier.
    - Launch capability is "awaiting new capacity," but growth is slow.
    - Even with SpaceX dominating, new rockets face delays:
    - Dozens of proposed launch vehicles exist globally, but building a reliable rocket that does not explode is an extremely challenging task. [**AM Comment**: A few years ago, there were many more, but the number of them failed, as they could not match SpaceX, particularly its ride share program.]
    - A rocket with a large cartoon bag of money on top symbolizes the risk of launch costs.
    - Launch providers must maintain cadence, reliability, and investor confidence.
- **Time to Market Pressures for Constellation Developers.**
    - Need to hit ITU and FCC milestones ("deployment milestones").
    - We have to build quickly enough to serve the market before the applications change.
    - Most services evolve every 18 months, while satellite build cycles are 5 years.
- **Vertical Integration**.

  - The traditional industry mindset is generational (Gen 1, Gen 2), not iterative.
  - Legacy operators view failures as disasters; Starlink views them as opportunities for learning and improvement.
  - Iterative improvement is rarely possible when outsourcing satellite manufacturing.
  - SpaceX can address an issue, walk down to the production line, and easily tweak it, whereas traditional operators cannot, as they have to renegotiate contracts for every change.
  - Starlink's innovations are rewards for being on the frontier, not anticompetitive conduct. [**AM Comment**: Starlink's synergies are so massive that they create a barrier that may make entry unavailable for a new entrant.]
- **Amazon Kuiper.**
  - **Amazon Kuiper could follow a similar SpaceX-type model.**
  - Amazon is designing and building its own satellites.
  - Kuiper may not share SpaceX's "destructive innovation" style, but Amazon has a massive consumer infrastructure (e.g., Prime). [**AM Comment**: One can imagine, Kuiper (now Amazon LEO) could be offered with Amazon Prime.]
  - Amazon can bring in massive capital flows and reach customers directly.
- **Launch Market Reality.**
  - Launch data shows SpaceX serves all customers neutrally. No evidence SpaceX denies launch access to competitors.
  - **2024 launches:** SpaceX 134; China 48; Russia 17; others far behind. [**AM Comment**: SpaceX launched even more in 2025, 138 as of November 20, 2025.]
  - Competitors' heavy-lift rockets are delayed (Ariane 6, Blue Origin New Glenn, ULA Vulcan). [**AM Comment**: And other than New Glenn, they are not even reusable, thus unlikely to be a viable competitor of SpaceX.]
  - Most U.S. companies will not launch in China or Russia.
- **Competitive Dynamics by Application.**
  - In-flight broadband: Starlink's main competitor is GEO, not other LEO operators.
  - Precision agriculture: Starlink beat GEO competitors like Intelsat; other LEOs were not present.
  - Enterprise/government markets: OneWeb competes, but mostly through non-public deals. [**AM Comment:** Given its price per bit, Oneweb is not even remotely a competitor on unsubsidized commercial terms.]
  - Consumer broadband: Kuiper's entry will significantly reshape the market.
- **Warns that head-to-head competition is not yet visible because:**
  - OneWeb's enterprise deals are not publicly reported. [**AM Comment:** See lots of announced deals above.]
  - Starlink dominates press visibility, but not all markets.
- Consumers do not know or care if their connection is LEO, GEO, FWA, or Wi-Fi, as long as they want reliability.
- **Discusses spectrum and global competition:**
- Spectrum spills across borders; national boundaries do not confine satellite beams.
- Satellite operators must navigate dozens of regulatory regimes.

- Only operators capable of navigating over 100 national licensing systems will be able to compete globally.

Audience Q&A

- **Question**: SpaceX paid $17 billion for EchoStar's MSS spectrum (25×25 MHz) and another $2.6 billion for an additional 15 MHz. Do panelists think Musk has something disruptive in mind for this spectrum, and how might it impact mobile competition?
    - **Ruth Pritchard-Kelly:**
        - Musk will utilize the MSS spectrum however he sees fit, without regard for legacy ITU service allocations. SpaceX to rely on exclusive, not shared, spectrum access. [**AM Comment:** Starlink uses shared spectrum, but use of MSS spectrum may be exclusive.]
        - Traditional GEO MSS allocations (e.g., classic Inmarsat bands) are commercially obsolete. [**AM Comment:** Inmarsat still has decent business, but admittedly declining.]
        - If a LEO constellation can offer better service, it makes sense for it to use the spectrum.
        - "192 of 193 countries didn't think of this."
        - This will create a global entry barrier and regulatory challenge since existing filings and service definitions were never designed for LEO/D2D mobile use.
    - **Patricia Cooper:**
        - Long-standing issue in satellite regulation is that regulators struggle with when to abandon service allocations that no longer match market demand.
        - Musk's repurposing effort was "one of the most abrupt and unexpected ways" to force regulators to confront this misalignment.
        - Policymakers must now determine what constitutes "good utility" of MSS spectrum in a LEO era.
- **Question**: As LEO systems expand into the Global South, what should the policy priorities be: utility, ROI, accessibility, performance? Where does the center of gravity lie?
    - **Patricia Cooper:**
        - Highlights the ITU/UN goal of "meaningful connectivity," defined as:
        - 4G-quality service or better.
        - LEO enables oceans, skies, remote villages, and islands to receive the same high-quality, real-time video calls as those in New York or Hong Kong.
        - LEO could bring remote populations "forcefully into the global economy" if national governments allow it.
    - **Scott Wallsten:**
        - Utility and performance must come first, because without user value, there is no long-term ROI.
        - Global South is already adopting LEO: for example, OneWeb (Angola), and Starlink (~300,000 users in Argentina last year)

- Key unknowns are how individuals in remote regions will utilize connectivity differently once they have access to it.

End of Event.