Insight

Streamlining Satellite Licensing: A Space Modernization Odyssey

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Executive Summary

- Advances in satellite technology have made space-based broadband offered by low Earth orbit (LEO) "constellations"—clusters of hundreds or thousands of small satellites close to Earth such as SpaceX's Starlink and Amazon's Leo—available to more Americans, increasing connectivity options for consumers.
- Until recently, satellite licensing relied on a bespoke, or individualized, application and review process built for a world where space-based communications relied on fewer, larger geostationary Earth orbit (GEO) satellites; this process was not scalable to meet the demands and challenges presented by LEO constellations.
- The Federal Communications Commission (FCC) recently revamped its satellite licensing rules to shift away from the old, bespoke model toward a rules-based, scalable process; Congress is considering revising the FCC's regulatory authority over communications satellites through the proposed Satellite and Telecommunications (SAT) Streamlining Act, but the House and Senate must resolve differences in their respective versions before it can become law.

Introduction

Satellite technology and economics have radically changed in the past 10 years. For much of the twentieth century, geostationary Earth orbit (GEO) satellites the size of school buses dominated commercial space communications. They were made to spec and launched to an orbit precisely 22,236 miles above sea level over the equator. Relatively few GEO satellites were needed to serve basic communication services such as international telephone and television broadcast relay to the entire globe, but their distance from the Earth and availability of radio spectrum limited their bandwidth. Advances in satellite manufacturing

and the rapidly decreasing cost of rocket launches have made space-based broadband offered by low Earth orbit (LEO) "constellations"—clusters of hundreds or thousands of small satellites closer to Earth—available to more Americans, increasing connectivity options for consumers.

But until recently, satellite licensing relied on a bespoke, or individualized, application and review process built for a world where GEO satellites were launched relatively infrequently. This model of satellite process was not scalable to meet the demands and challenges presented by LEO constellations, which are created by launching large numbers of smaller, standardized communications satellites.

The Federal Communications Commission (FCC) recently revamped its satellite licensing rules to shift away from the old, bespoke model toward a rules-based, scalable process. The House and Senate each have passed out of their respective commerce committees their own version of the proposed Satellite and Telecommunications (SAT) Streamlining Act. The SAT Streamlining Act would revise the FCC's regulatory authority over satellite communications, add explicit timelines and decision triggers to the licensing process, and clarify the commission's authority to regulate space safety concerns around communications satellites. Both chambers, however, will need to resolve the differences in their respective versions before the SAT Streamlining Act can become law.

A Giant Leap for Space-based Communications: From GEOs to LEOs

Arthur C. Clarke, the futurist and science fiction writer most famous for writing *2001: A Space Odyssey*, first proposed routing communications through space in his 1945 article "Extra-Terrestrial Relays." In his concept, global communications coverage could be achieved through three manned "space stations" positioned in a GEO configuration and spaced at three even intervals around the globe. While Clarke's specific proposed system never got off the ground (and some of its assumptions turned out to be wrong), the underlying ideas reverberated in the following decades.

Serious discussion of the technical and economic viability of satellite communications began a decade later, led by John R. Pierce of Bell Labs, AT&T's research division. Pierce was the first to explore satellite relay as an alternative to using transoceanic cables for routing international phone calls. In doing so, he was also the first to consider the tradeoffs between positioning satellites at different orbital levels (e.g., GEO vs. LEO).

Satellites in GEO configurations always appear in the same position in the sky, making it easier to build ground stations and for one large satellite to serve a broad area. But their orbital levels are significantly farther from Earth, increasing the cost to launch each

satellite, as well as the power level and time delay (or "latency") necessary to send signals. Satellites in LEO and medium Earth orbit (MEO) configurations, on the other hand, are closer to Earth (LEO extends from 100 miles to 2,000 miles above sea level, while MEO operates between LEO and GEO altitudes). They can therefore be launched more cheaply and operate at lower power levels and with lower latency. But because objects in LEO and MEO configurations orbit faster than the Earth rotates, ground stations need tracking capabilities to follow each satellite as it passes by. Furthermore, consistent coverage requires launching sufficient satellites to ensure each ground station has a satellite in its line of sight with which to communicate.

The Soviet Union's launch of Sputnik 1 in 1957 made satellites a reality rather than an object of science fiction and spurred a flurry of research and development (R&D) activity by both the military and private sector in the United States. The Communications Satellite Act of 1962 eventually centralized the communications satellite industry in a government-backed monopoly, the Communications Satellite Corporation (COMSAT). This, combined with the government's effective monopoly on rockets (and, therefore, rocket launches), consolidated the United States' approach to communications satellite R&D. While some MEO satellites were launched as successful experiments before this consolidation, COMSAT favored GEO-based systems that could serve more people with fewer satellites, requiring fewer launches and simpler ground systems.

Over the next few decades, GEO satellites dominated space-based communications, becoming integral to international telephone routing, television broadcasts, and other communications services. Although various policy changes in the 1970s and 80s reduced COMSAT's monopoly in the United States, existing infrastructure and economies of scale continued to give GEO-based systems an advantage. By the 1990s, alongside increasing competition in launch services, some private companies began exploring LEO constellations as an alternative to GEO-based systems for their lower latency characteristics. Most of these endeavors ended in bankruptcy as limited demand could not yet cover the still sky-high costs of building sufficient infrastructure to support LEO constellations. As broadband became more ubiquitous in the early 2000s, most satellite-based broadband providers still relied on GEO satellites for their networks.

The 2010s saw a dramatic drop in the cost of rocket launches thanks to private-sector entrance into the market, as well as a transition from bespoke satellite manufacturing to mass production assembly lines. New technologies allowed for more efficient use of radio spectrum by satellites, meaning each satellite could provide more bandwidth for broadband customers. Together, these developments lowered the cost of creating large LEO constellations while positioning LEO-based satellite broadband as a new connectivity option

for consumers.

From Bespoke Licensing to a Licensing Assembly Line

The FCC derives its regulatory authority over commercial communications satellites from the Communications Act of 1934 and the Communications Satellite Act of 1962. The Communications Act gives the commission broad authority to regulate the use of radio spectrum for communications by any non-federal entity. Thus, even before the passage of the Communications Satellite Act, the FCC—alongside its international counterpart, the International Telecommunications Union (ITU)—began allocating spectrum for space communications in the late 1950s. Not long after this, the FCC began issuing authorizations for experimental communications satellites.

The Communications Satellite Act, in addition to creating COMSAT, gave the FCC express authority over commercial communications satellites and earth stations, with broad discretion to promulgate regulations over every aspect of their operation, even beyond the radio frequencies used. The FCC has regulated non-amateur and non-experimental communications satellites through its "Part 25" rules since the 1960s.

Part 25 was amended many times over its existence in response to changing conditions (such as the end of COMSAT's monopoly on U.S. commercial satellite communications), but one consistency throughout the years was the need for operators to submit lengthy narrative-based applications that would in turn need lengthy individualized review from the FCC. Applications needed to provide, among other things, detailed descriptions of the satellites and ground stations to be deployed, radio frequency bands used to communicate between them, and services to be provided by the satellite system. Operators also needed to provide a copy of their draft ITU application (the ITU is the global regulator of satellite communications, running a parallel review process that covers many of the same aspects as the FCC's process). The commission added a requirement to develop an orbital debris mitigation plan in 2004. The narrative-based nature of these applications meant no two were alike, increasing the time needed for review.

Filing an application was just the first step. In the post-COMSAT satellite competition era, the first entrant in a new radio frequency band would trigger a "processing round," a limited filing window where potential competitors could file to launch more satellites in the new band. These processing rounds exist because satellite operators must share spectrum, as the global nature of satellite communications precludes geographically exclusive licenses used in other communications technologies. Part of the licensing process involves ensuring competing satellite operators in the same spectrum band will coordinate sharing with each other, as well as any other users of the same band. Yet the process also created incentives

for first movers, including speculators, to time lead applications such that competitors would often face a choice of rushing to submit applications before the round closed, or waiting for a new round to open in the future, sometimes not for several years.

After the deadline for competing applications passed, all filings in a processing round were put through a public notice process that included an opportunity to answer or correct questions, errors, or omissions, as well as a public comment period. Following these public notice periods, FCC staff technical review could take years before applicants received a decision.

In July, the FCC replaced Part 25 with a new Part 100. Notably, this was not primarily a deregulation, but a new regulatory paradigm. The commission retained many of the same substantive operational and technical rules from Part 25, alongside selective deregulation and new requirements. Most of the reforms focus on creating a standardized, modular application process where system operators that certify that their systems will comply with those rules can receive faster review (although not guaranteed approval), while system operators who wish to seek a waiver from the commission's general rules will instead receive more bespoke review. In other words, where operators can attest that their systems will function within the parameters of Part 100 rules, the commission will "default to yes," focusing review on aspects of their systems that need more attention because they will operate outside of bounds where the commission is confident satellite communications will not create harmful interference, safety, or other concerns.

Modularizing the licensing process also allows the commission to create a "licensing assembly line," where the commission can review individual modules in parallel. While some modules necessarily interact with each other, parallel review means those modules requiring more scrutiny won't hold up review of an entire application. When a module requires more review, such as coordination in a given spectrum band, the commission can grant conditional approval for the rest of the application so that the operator may move forward with deployment (although, in this example, they would not be able to transmit in that band before final approval).

Processing rounds triggered by lead applications are no longer the default. While systems that are deployed in processing rounds will benefit from higher priority access to shared spectrum, operators can now opt-out of participating in processing rounds to potentially launch faster and with fewer requirements (albeit with lower priority access to satellite spectrum). Furthermore, processing rounds will now run on an annual open submission basis from January to October, initially for four key satellite spectrum bands (with more to be added as needed in future years). In adopting the new Part 100, the commission also deferred making rules on several aspects it felt the technical record was not sufficiently

developed on and asked for further comment on a wide range of potential new "operational envelopes" that it could create general rules for instead of relying on bespoke review.

Alongside this streamlined licensing process, the commission adopted clearer and expanded enforcement mechanisms, giving itself more tools to remedy violations such as misrepresentations in the certification process or violations of operational rules, up to and including revocation or termination of a license. In short, the commission is seeking to streamline prior review of satellite licensing while shifting emphasis toward compliance enforcement when violations occur.

Legislative Outlook

The shift from Part 25 to Part 100 has happened concurrently with congressional action to update the Communications Act's approach to satellite regulation. In the 119th Congress, the House and Senate each have their own version of the SAT Streamlining Act, which would be the first major update to the FCC's satellite licensing authority since the Communications Satellite Act of 1962. Beyond simply ratifying the FCC's new Part 100 rules, the SAT Streamlining Act would place more explicit timelines on the licensing process and clarify the commission's authority to regulate space safety concerns around communications satellites.

Both versions add a new section, numbered 346, to the Communications Act, which broadly requires that the commission establish more standardized procedures for considering satellite license applications. The commission's new Part 100 would broadly fulfill this requirement, although either version would require the commission to engage in further rulemaking to conform to more specific requirements that do not overlap with existing rules. Both versions also implement timelines by which the commission must take certain actions on license applications, including completeness determinations (30 days), initial decisions (1 year), and renewal decisions (180 days). Both also contain "deemed granted" provisions, where a non-decision from the commission by the deadline would constitute an approval.

Yet important differences exist between the two bills. The House's version, passed by the Energy and Commerce Committee last month, incorporates elements of the promulgated Part 100 rules into its language. It also has stricter limits on the FCC's ability to grant itself extensions during the review process and preempts the ability of state and local governments to regulate prices charged by covered satellite communications providers. The Senate's version, passed by the Commerce, Science, and Transportation Committee last year (before Part 100 was adopted by the FCC), leaves more implementation discretion to the FCC. For example, the Senate's deemed granted provision requires the FCC to conduct a rulemaking to determine what elements of applications will be subject to or exempted

from automatic approvals after deadlines pass with no decision (the House's deemed granted provision has only one exception related to market access written directly into its language).

Given the complexity of space communications operations, from managing spectrum sharing to establishing safety plans, the satellite licensing process provides necessary information to all stakeholders so they may avoid issues like harmful communications interference and avoid satellite collisions. Yet the old process was designed for a different era, when fewer, larger GEO satellites dominated space communications. The growth in LEO constellations presents both new opportunities to expand broadband access and competition, as well as new challenges for issues like spectrum sharing and orbital management that policymakers must take seriously. The FCC's new Part 100 and the SAT Streamlining Act offer a new regulatory paradigm for satellite licensing that emphasizes scalability of review while preserving more detailed review when necessary. As the House and Senate consider a compromise of their respective versions of the SAT Streamlining Act, policymakers will need to carefully weigh how much discretion they should grant the FCC to effectively balance speed and thoroughness while reviewing new satellite license applications.