STATEMENT OF
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SPACE EXPLORATION TECHNOLOGIES CORP. (SPACEX)

BEFORE THE
COMMITTEE ON COMMERCE, SCIENCE & TECHNOLOGY
UNITED STATES SENATE

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Mr. Chairman, Ranking Member Nelson, and Members of the Committee,

Thank you for the opportunity to participate in this important and timely hearing. As this Committee reviews broadband infrastructure investments, measures to streamline the regulatory process, and policy reforms to reduce barriers to expansion of broadband access in the United States, we are grateful that the Committee is considering the potential capability that a new generation of U.S.-based low-Earth orbit ("LEO") satellite broadband services can contribute to connectivity.

New technologies in space and on the ground, significant downward adjustments in satellite manufacturing costs, improved software and computing power, and dramatic reductions in the cost of space launch are all driving an era where large constellations of satellites orbiting close to the Earth can provide the high-speed, low-latency internet service that many consumers have come to expect. Moreover, these systems offer the potential to provide reliable, high-quality broadband service to areas of the United States and the world that have been underserved or not served at all. Such systems can help alleviate the inherent challenges of providing high-speed internet to rural and "hard-to-reach" areas. Here, the geographic reach of satellite systems may obviate the need to build out the so-called "last mile" that, due to costs, environmental regulations, property rights issues, and other regulatory obstacles, starves so many communities of reliable, quality internet access. Because of the significant up-front cost of a global satellite system, there is an inherent incentive to connect customers, no matter where they are. The satellites can "see" them whether they are urban or rural, and the incremental cost of adding a rural customer to a satellite network is so much lower than adding that rural customer to a ground-based cellular network.

Last November, SpaceX filed an application with the Federal Communications Commission ("FCC") for a license to operate a new non-geostationary satellite orbit ("NGSO") broadband internet constellation, unveiling a development project we have been undertaking for nearly three years. While I will discuss some of the features of this system to help inform the Committee's views with respect to the capabilities offered by next-generation broadband satellite constellations (*see* Section III), my testimony today will focus more broadly on the following policy areas, and potential barriers, to the expansion of broadband access in the United States:

(1) The emergence of new technologies and cost structures that make large-scale, space-based broadband internet services more viable today than ever before, and the potential such services could provide in expanding affordable access to high-speed broadband, including in rural, exurban, and suburban areas;

(2) Efficient use of spectrum, and whether current regulatory frameworks provide the proper incentives for companies developing large constellations of satellites to invest in technologies that effectively share spectrum among these systems. The Committee should take proactive steps to encourage and reward companies that utilize and advance technologies that result in maximum spectrum sharing

and efficiency;

(3) The need to reconsider how current law, policy, and programs focused on expanding broadband access treat satellite systems, including a re-assessment of the potential data service and speeds offered, the application of "infrastructure" investments to space and ground systems, and subsidies for underserved consumers, school districts, rural health care providers, etc. for customer equipment. Here, it is timely to review how satellite broadband has improved and can contribute to the Nation's connectivity goals, and how to incorporate such services into any national infrastructure initiative.

(4) The need to streamline and modernize FCC and Federal Aviation Administration ("FAA") regulations associated with commercial space launch, which today create barriers for emerging broadband satellite constellations from the United States, as well as degrade the U.S. space launch industrial base and its ability to be globally competitive.

SpaceX has, from the beginning, leveraged American innovation, technical savvy, and an upstart, iterative culture to provide the most advanced launch and spacecraft systems in history. We are proud to have contributed to providing a dependable and affordable ride to space for NASA, the Department of Defense, and the world's most sophisticated commercial satellite manufacturers and operators. Today, we are regularly conducting cargo resupply missions to and from the International Space Station ("ISS") with our Dragon spacecraft, and next year, we will launch the first American astronauts from U.S. soil on an American rocket since the Space Shuttle was retired in 2011.

SpaceX has restored the U.S. as a leader in global commercial satellite launch by percentage of market share. Looking forward, the company intends to leverage its fifteen years of experience in cost-effectively building and deploying large, complex space systems to support our broadband satellite constellation. With a vertically-integrated approach to this initiative—from design, development, production, launch, and operations—SpaceX is addressing many of the challenges that have stymied past attempts to achieve affordable, high-speed broadband from space.

I. SpaceX Today

Founded in 2002, SpaceX today is the world's largest launch services provider, measured by missions under contract. We are an American firm that designs, manufactures, and launches rockets within the United States, with minimal reliance on foreign vendors or suppliers. SpaceX was founded with the express goal of dramatically improving the reliability, safety, and affordability of space transportation. We have made that goal a reality.

The SpaceX Falcon 9 launch vehicle has now successfully launched 32 times, all while achieving evolutionary but significant reductions in the cost of space launch. To achieve revolutionary reductions in launch costs, which will contribute to our ability to rapidly and cost-effectively deploy our broadband satellite constellation, SpaceX has focused on making our rockets reusable. Last month, SpaceX successfully launched and landed a previously-flown Falcon 9 booster, placing a high-value telecommunications satellite into orbit for SES, a global satellite operator.

SpaceX has nearly 70 missions on manifest, representing more than $10 billion in signed contracts for a diverse and growing set of customers, including NASA, the Department of Defense, commercial satellite operators, and allied international governments. SpaceX has a healthy, robust business; as technology companies should, we invest much of our profits back into the company's manufacturing and launch infrastructure and into advanced research and development, including satellite and ground system development.

Meanwhile, we continue to push ahead on rocket technology developments and innovations as we advance toward fully and rapidly reusable launch vehicles; design and fly, with Dragon, the safest crew transportation system ever produced for American astronauts for NASA; and develop and produce the initial prototypes for our broadband satellite system for initial launch by the end this year. Critically, all of this innovation is occurring in the United States, creating jobs, advancing technology, and generating substantial economic activity.

SpaceX maintains its manufacturing and engineering headquarters in Hawthorne, CA; a satellite system design and development office in Redmond, WA; a Rocket Development and Test Facility in McGregor, TX; and launch pads at Cape Canaveral Air Force Station, NASA Kennedy Space Center, Vandenberg Air Force Base, and, soon, a commercial launch site near Brownsville, TX. SpaceX maintains a network of more than 4,400 American suppliers and partners—an investment in the American industrial base when others are spending abroad.

II. Disparities in Broadband Availability & Quality: A Market Opportunity

SpaceX sees substantial demand for high-speed broadband in the United States and worldwide. As the Committee is aware, millions of Americans outside of limited urban areas lack basic, reliable access. Furthermore, even in urban areas, a majority of Americans lacks more than a single fixed broadband provider from which to choose and may seek additional competitive options for high-speed service.[1]

According to the FCC, thirty-four million Americans lack access to 25 megabits per second ("Mbps") broadband service, and 47 percent of the Nation's students lack the connectivity to meet the FCC's short-term goal of 100 Mbps per 1,000 students and staff. As the FCC has noted:

> there continues to be a significant disparity of access to advanced telecommunications capability across America with more than 39 percent of Americans living in rural areas lacking access to advanced telecommunications capability, as compared to 4 percent of Americans living in urban areas, and approximately 41 percent of Americans living on Tribal lands lacking access to advanced telecommunications capability.[2]

While more than twenty-three million Americans living in rural areas account for the majority of those who lack access, nearly ten million Americans living in non-rural areas also lack basic access to high-speed internet service. As this Committee well knows, the U.S. lags behind other developed nations in both its broadband speed and in price competitiveness, and many rural areas are simply not served by traditional broadband providers due to the high capital expenditure required for last-mile infrastructure relative to low revenue opportunities.

At the same time, worldwide demand for broadband services and internet connectivity continues to grow, with consumers increasing their requirements for speed, capacity, and reliability. The volume of traffic flowing over the world's networks continues to skyrocket, with one vendor estimating that annual global Internet Protocol ("IP") traffic surpassed the zettabyte threshold in 2016—meaning that over 1,000 billion gigabytes of data was exchanged worldwide last year.[3] By 2020, that figure is projected to more than double

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1 Federal Communications Commission, *2016 Broadband Progress Report,* (January 28, 2016), GN Docket No. 15-191, available at https://apps.fcc.gov/edocs_public/attachmatch/FCC-16-6A1.pdf.

2 Ibid.

3 Cisco Visual Networking Index: Forecast and Methodology, 2015-2020, at 1 (June 6, 2016), available at http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/complete-white-

(reaching a level nearly 100 times greater than the global IP traffic in 2005), global fixed broadband speeds will nearly double, and the number of devices connected to IP networks will be three times as high as the global population.

As consumer demands on speed and capacity continue to grow, disparities in access and competitive choice persist for many communities. Many consumers who have access to broadband today lack the multiplicity of choice that robust, competitive marketplaces tend to offer. The FCC has found that "only 38 percent of Americans have more than one choice of providers for fixed advanced telecommunications capability," with only "13 percent of Americans living in rural areas having more than one choice of providers of these services compared to 44 percent of Americans living in urban areas."[4]

In large measure, the disparity in available service to rural and "hard-to-reach" areas is the result of the heavy, up-front capital expenditures necessary to achieve connectivity to these locations. Further, regulatory hurdles and the general pace of regulatory approvals in the U.S. associated with siting broadband infrastructure and securing environmental approvals continue to pose challenges. According to the Government Accountability Office ("GAO"):

> Access to affordable broadband telecommunications is vital to economic growth and improved quality of life across the country. In rural areas in particular, broadband can serve to reduce the isolation of remote communities and individuals. The provision of broadband Internet infrastructure and services in the United States is generally privately financed. However, rural areas can have attributes that increase the cost of broadband deployment, such as remote areas with challenging terrain, or make it difficult to recoup deployment costs, such as relatively low population densities or incomes. These attributes can decrease the likelihood that a broadband service provider will build out or maintain a network in a rural area. For these reasons, some rural areas lag behind urban and suburban areas in broadband deployment or service speed.[5]

Despite a diverse set of technology platforms currently serving the ever-growing demand for broadband, from terrestrial fiber and cable systems to mobile cellular networks and, to a lesser degree, space-based systems, many parts of the United States and the world lack access to reliable broadband connectivity. However, next-generation satellite systems operating in orbits close to the Earth, with innovative technologies to provide rapid data rates and minimal latency, may offer a way around this gap in broadband access in the United States.

Beyond the United States, the United Nations Broadband Commission for Sustainable Development recently noted that 4.2 billion people, or 57 percent of the world's population, are simply "offline" for a wide range of reasons—but predominately because the necessary connectivity is not present or not affordable.[6] As the Committee knows, access to broadband and communications technologies are key to economic growth, social stability, access to healthcare, education, and basic services, particularly in lesser-developed countries.

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paper-c11-481360.pdf; *see also* http://blogs.cisco.com/sp/happy-zettabyte-day-2016. To fathom the volume of a zettabyte, if one byte is a litter, then a zettabyte is the equivalent of 7080 Pacific Oceans. *See id.*

4 FCC, *2016 Broadband Progress Report.*

5 U.S. Government Accountability Office, *Rural Broadband Deployment: Improved Consistency with Leading Practices Could Enhance Management of Loan and Grant Programs,* (April 2017), GAO-17-301, available at http://www.gao.gov/assets/690/684093.pdf.

6 Broadband Commission for Sustainable Development, "Open Statement from the Broadband Commission for Sustainable Development to the UN High-Level Political Forum (HLPF)" (July 11, 2016), available at http://broadbandcommission.org/Documents/publications/HLPF-July2016.pdf.

In numerous ways, satellite technology has long helped to alleviate inequities in the availability of communications services, in part due to its geographic reach. Historically, satellites first revolutionized the availability of international telephony, then pioneered global distribution of video content. More recently, satellite systems have introduced broadband connectivity for mobile platforms, such as aircraft and ships—establishing and supporting new markets and enhancing those businesses and their customer experience.

III. SpaceX's Proposed Satellite Architecture – Broadband from Space

SpaceX plans to bring high-speed, reliable, and affordable broadband service to consumers in the U.S. and around the world, including areas underserved or currently unserved by existing networks. Other companies have also recently announced plans for large-scale broadband satellite constellations, with the FCC currently undertaking a processing round considering the applications of a number of potential licensees requesting authority to operate in the United States.

For our part, we will apply cutting-edge space technologies and spectrum re-use approaches, while leveraging our unique space-based design, manufacturing, launch, and space operations experience. Specifically, technology advancements like dynamic beam forming and phased array antennas in space and on the ground, as well as optical inter-satellite links to establish a "mesh network" in space through which the satellites will communicate with each other, enhance the capacity and customer experience for broadband satellite service.

Initially, the SpaceX system will consist of 4,425 satellites operating in 83 orbital planes (at altitudes ranging from 1,110 km to 1,325 km). This system will also require associated ground control facilities, gateway earth stations, and end user earth stations.[7] Using Ka- and Ku-Band spectrum, the initial system is designed to provide a wide range of broadband and communications services for residential, commercial, institutional, governmental, and professional users worldwide. SpaceX has separately filed for authority to operate in the V-Band, where we have proposed an additional constellation of 7,500 satellites operating even closer to Earth. In the future, these satellites would provide additional broadband capacity to the SpaceX system and further reduce latency where populations are heavily concentrated.[8]

To implement the system, SpaceX will utilize the availability of significantly more powerful computing and software capabilities, which will enable SpaceX to allocate broadband resources in real time, placing capacity where it is most needed and directing energy away from areas where it might cause interference to other systems, either in space or on the ground. Because the satellites will beam directly to gateways or user terminals, the infrastructure needed on the ground—particularly in rural or remote areas—is substantially reduced, essentially addressing the "last mile" challenge and helping to close the digital divide. In other words, the common challenges associated with siting, digging trenches, laying fiber, and dealing with property rights are materially alleviated through a space-based broadband network.

SpaceX intends to continually iterate and improve the technology in the system, something that our satellite manufacturing cost profile and in-house launch capability uniquely enables. The ability to modify service as necessary, as well as refresh the technology of the satellite system through iterative spacecraft design changes and phased, continuous deployment, is critical to meet rapidly changing customer demands and

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7 Space Exploration Holdings, LLC, *Application for Approval for Orbital Deployment and Operation Authority for the SpaceX NGSO Satellite System* (November 15, 2016), Before the Federal Communications Commission, IBFS File No. SAT-LOA-20161115-00118.

8 Space Exploration Holdings, LLC, *Application for Approval for Orbital Deployment and Operating Authority for the SpaceX NGSO Satellite System* (March 1, 2017), Before the Federal Communications Commission, IBFS File No. SAT-LOA-20170301-00027.

responsibly utilize spectrum. This approach will ensure that the system remains adaptable to existing and future customer demands.

For the end consumer, SpaceX user terminals—essentially, a relatively small flat panel, roughly the size of a laptop—will use similar phased array technologies to allow for highly directive, steered antenna beams that track the system's low-Earth orbit satellites. In space, the satellites will communicate with each other using optical inter-satellite links, in effect creating a "mesh network" flying overhead that will enable seamless network management and continuity of service. The inter-satellite links will further help SpaceX comply with national and international rules associated with spectrum sharing, which distinguishes our system from some of the other proposed NGSO constellations.

Overall, SpaceX has designed our system to achieve the following key objectives:

(1) **Capacity.** By combining the umbrella coverage of the LEO Constellation with the more intensive coverage from the VLEO Constellation, the SpaceX System will be able to provide high volume broadband capacity over a wide area. SpaceX will periodically improve the satellites over the course of the multi-year deployment of the system, which may further increase capacity.

(2) **Adaptability.** The system leverages phased array technology to steer dynamically a large pool of beams to focus capacity where it is needed. As noted, optical inter-satellite links will permit flexible routing of traffic on-orbit. Further, the constellation ensures that a variety frequencies can be reused effectively across different satellites to enhance the flexibility, capacity and robustness of the overall system.

(3) **Broadband Services.** The system will be able to provide broadband service at fiber-like speeds, the system's use of low-Earth orbits will allow it to target latencies comparable to terrestrial alternatives. SpaceX intends to market different packages of data at different price points, accommodating a variety of consumer demands.

(4) **Efficiency.** SpaceX is designing the system from the ground up with cost-effectiveness and reliability in mind, from the design and manufacturing of the space and ground-based elements, to the launch and deployment of the system using SpaceX launch services, development of the user terminals, and end-user subscription rates.

Later this year, SpaceX will begin the process of testing the satellites themselves, launching one prototype before the end of the year and another during the early months of 2018. Following successful demonstration of the technology, SpaceX intends to begin the operational satellite launch campaign in 2019. The remaining satellites in the constellation will be launched in phases through 2024, when the system will reach full capacity with the Ka- and Ku-Band satellites. SpaceX intends to launch the system onboard our Falcon 9 rocket, leveraging significant launch cost savings afforded by the first stage reusability now demonstrated with the vehicle.

IV. Barriers to the Expansion of Broadband from Satellite Systems: Policy Recommendations for the Committee

As the Committee considers policy action that could facilitate the expansion of broadband access in the United States, SpaceX respectfully offers the following recommendations for satellite infrastructure:

Regulations for NGSO Systems Need Modernization. Congress should support the FCC's ongoing efforts to modernize certain regulations relating to NGSO satellite systems, which were originally developed nearly two decades ago and in many cases are outmoded given modern satellite system

technology and market conditions. For example, current FCC rules require an NGSO licensee to launch all satellites in its constellation within six years of receiving a license. While this may have been desirable in the past, this artificial timeline inhibits the organic growth of large satellite constellations, preventing them from growing with the market to respond to consumer demand. Instead, these systems should be allowed to grow more like cellular networks, where additional assets and updated technology are deployed over time to meet increased demand.

Moreover, in the case of large constellations like SpaceX's, the system is brought into operation with far fewer satellites, with additional satellites launched to add capacity and meet market demand as it evolves. As such, companies investing in a multi-year deployment strategy should not be penalized for enhancing their system over time. The FCC is currently conducting a rulemaking to modernize its satellite rules, especially those applicable to NGSO systems, which we hope will yield a regulatory regime more consistent with current market and technology realities.[9] Should the FCC not proceed quickly in addressing these issues, the Committee should support waivers to ensure these innovative broadband systems are not artificially constrained.

Next Generation Satellite Systems are Broadband Infrastructure and should be Included in any Infrastructure Legislation. The expansion of satellite broadband through U.S.-based constellations is, fundamentally, a national infrastructure project, even though many components of the infrastructure will be in space. In prior investment rounds and through funds like the Universal Service Fund ("USF"), satellite broadband was often an afterthought. For example, of the $6.9 billion awarded for broadband infrastructure through National Telecommunications and Information Administration's ("NTIA") Broadband Technology Opportunities Program ("BTOP") and the U.S. Department of Agriculture's Rural Utilities Service ("RUS"), only approximately $100 million went to satellite systems, or less than 1.5 percent of all funds appropriated.[10] In many ways, this was the result of limitations at the time on satellite capacity, high latency rates due to satellite distance from the Earth, and relatively slow data rates compared to terrestrial and mobile networks. It was also related to a general failure of imagination to make investment and subsidy structures applicable to satellite infrastructure and consumer hardware, since satellite systems have few "shovels in the ground."

However, as satellite-based broadband achieves speeds, latencies, and pricing equivalent to terrestrial and 5G wireless technologies, it becomes especially critical for Congress and federal agencies to reconsider how these systems can participate in national infrastructure investment programs and other federal initiatives to close the digital divide. Infrastructure associated with a satellite broadband system includes launch facilities, consumer terminals that are placed on homes or businesses, gateways that will be placed at potentially hundreds of internet points of presence ("PoPs") throughout the United States that are used to route traffic, large antennas to track and control the satellites in space, and satellite operations centers. The satellites themselves are essentially infrastructure in the sky, a network that is not dissimilar to cell towers or underground fiber.

As such, SpaceX encourages the Committee to take steps to ensure that broadband satellite system infrastructure is duly captured in any infrastructure, incentive, or tax policy legislation undertaken to expand

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[9] *Updates to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters*, 31 FCC Rcd. 13651 (2016) ("NPRM").

[10] National Telecommunications and Information Administration, U.S. Department of Commerce, Broadband Technology Opportunities Program (BTOP) Quarterly Program Status Report (March 2017), available at https://www.ntia.doc.gov/files/ntia/publications/ntia_btop_31st_qtrly_report.pdf; and U.S. Department of Agriculture, Rural Utilities Service, Broadband Initiatives Program Final Report (December 2016), available at https://www.rd.usda.gov/files/reports/RUS_BIP_Status_FinalReportDec_2016.pdf.pdf.

broadband access in the United States. Such an approach will not only ensure that Congress and regulatory agencies maintain a technology-neutral approach, but it will also ensure the U.S. Government and American consumers are positioned to benefit from the significant innovations and great promise of that satellite systems are poised to bring.

Systems and Technology that Achieve Spectrum Efficiency Should be Rewarded. The new generation of broadband NGSO constellations holds incredible potential to bring affordable, fiber-like broadband services to underserved and unserved areas of the United States. Investment in advanced technologies that provide spectral efficiency and operational flexibility are necessary for NGSO systems to increase access to reliable, high-speed broadband connectivity. Unfortunately, not all operators have chosen to make the investment necessary to include many of these technologies in their proposed systems. As a result, some systems would not only make inefficient use of the spectrum they seek to use, but also may prevent other NGSO systems from efficiently sharing the available spectrum.

As such, the Committee should ensure that the FCC takes steps to incentivize and reward efficient spectrum sharing. Spectrum sharing policies should ensure that all systems have equitable access to spectrum, avoid any warehousing of spectrum by non-operating systems, and incorporate sufficient flexibility to promote and accommodate spectrum coordination among operating systems. Given the advent of new space-based and ground technologies, spectrum sharing is most efficiently managed by using highly intelligent and flexible satellites, as this expands the range of potential sharing strategies available to the operators involved.

Congress should encourage regulatory authorities to adopt rules that create incentives that encourage the use of spectrally-efficient technologies. Spectrum is a valuable and increasingly scarce resource, which must be shared by multiple satellite and terrestrial systems. Licensing inefficient NGSO systems, or granting such systems access to the U.S. market, not only imposes a burden on more efficient systems, but also undermines the national interest in promoting efficient usage of spectrum and maximizing broadband service to the public. Yet at present, the FCC has no mechanism for rewarding more efficient systems for their investment in advanced and spectrum-friendly technologies. If Congress wants to ensure that valuable spectrum resources are put to intensive and efficient use, it should encourage the FCC to implement policies that reward NGSO spectral efficiency when making public interest determinations.

Spectrum Use Policy in the Ka- and V-Bands Should be Revised. SpaceX is concerned about FCC spectrum use policies that enable NGSO constellations, specifically in Ka- and V-bands. FCC rules effective today were written over a decade ago, and did not envision the potential of large constellations operating in low Earth orbit. As a result, these constellations are unduly restricted from using important segments of spectrum as compared to ground-based fixed systems. While the agency has granted waivers for NGSO systems to operate in parts of this spectrum on an unprotected, non-interference basis, this approach is not sustainable over the long-term, especially as these new systems come online. To partially remedy this challenge, FCC has released a Notice of Proposed Rulemaking ("NPRM") that would make an additional 1.3 GHz of Ka-band spectrum available for NGSO use, a positive development that SpaceX encourages the Committee to support. In addition, FCC should further remove impediments to NGSO use of 4.5 GHz of V-band spectrum (37.5-40.0/50.4-52.4 GHz), a step that would make U.S. spectrum rules more consistent with existing international allocations for use.

FCC Commercial Launch Spectrum Licensing Process Should be Streamlined. For four years, the FCC has been considering a Notice of Proposed Rulemaking (“NPRM”) that would make available a limited range of frequencies in the federal spectrum band that are commonly used for commercial launch

available to the commercial sector on a co-primary basis.[11] The FCC proposed moving away from approving commercial launch spectrum grants under Special Temporary Authorizations ("STA"), which are handled on an individual basis and remain in effect for a short period of time, to a more streamlined approach that reduces paperwork and regulatory burden. We encourage the Committee to support the pending NPRM, to enable the FCC to better manage spectrum allocations for commercial launch spectrum. This effort is a timely and important step for the Commission to adjust to the increasing cadence and complexity of launches and growth in number of U.S. launch service providers.

FAA Commercial Launch License Regulations Require Modernization. Aside from issues relating to spectrum and broadband policy specifically, SpaceX is also working with this Committee, and others, through its Subcommittee on Space, on an important effort to modernize and streamline the FAA regulations governing commercial space launch. These regulations were promulgated in a time when commercial spaces launches were rare, and launch was primarily the domain of the U.S. Government. However, as the industry transitions from a pace of a few commercial launches per year to a launch per week, or more, in the near future, it is essential that FAA regulations be updated to avoid obstructing industry growth and innovation in the U.S. domestic commercial space launch industry.

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Mr. Chairman, I appreciate your invitation to testify before the Committee today. SpaceX looks forward to being part of the solution to expand access to high-speed, reliable, and affordable broadband internet connectivity in the United States and worldwide. If we can answer any questions or provide any additional information, please contact Mat Dunn at mat@spacex.com; (202-649-2700).

[11] *Amendment of Part 2 of the Commission's Rules for Federal Earth Stations Communicating with Non-Federal Fixed Satellite Service Space Stations; Federal Space Station Use of the 399.9-400.05 MHz Band; and Allocation of Spectrum for Non-Federal Space Launch Operations,* (May 9, 2013), ET Docket No. 13-115, RM-11341 ("NPRM"), available at https://apps.fcc.gov/edocs_public/attachmatch/FCC-13-65A1_Rcd.pdf.