

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554**

Application of

SPACE EXPLORATION HOLDINGS, LLC

For Modification of Authorization for the
SpaceX Gen2 NGSO Satellite System to Add a
Mobile-Satellite Service System

IBFS File No. SAT-MOD-_____

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**APPLICATION FOR MODIFICATION OF AUTHORIZATION
FOR THE SPACEX GEN2 NGSO SATELLITE SYSTEM TO
ADD A MOBILE-SATELLITE SERVICE SYSTEM**

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SUMMARY

SpaceX's second-generation non-geostationary orbit Fixed-Satellite Service system ("Gen2 system") augments its existing first-generation constellation in providing unprecedented satellite broadband service to Americans throughout every corner of the country. SpaceX can leverage its constellations of satellites and intensive spectral reuse to meet the rapidly accelerating demand for high-speed, low-latency broadband and—through its Gen2 system in particular—deliver unprecedented satellite coverage and capacity throughout the United States. In addition, SpaceX has expanded its service offerings by acquiring Swarm Technologies, Inc., a satellite operator offering narrowband Mobile-Satellite Service for Internet-of-Things applications. Together, these developments ensure that SpaceX can provide next-generation fixed and mobile satellite services to all Americans.

With this application, SpaceX proudly announces its intent to utilize additional spectrum through the satellite network that its Gen2 system supplies, thereby supplementing its planned mobile services that reach far beyond the coverage capabilities of terrestrial networks. Specifically, SpaceX will add the 1610-1617.775 MHz and 2483.5-2500 MHz bands, 2000-2020 MHz and 2180-2200 MHz bands, and the 2020-2025 MHz band to its mobile service operations. By granting SpaceX access to this spectrum, the Commission will provide Americans more mobile service connectivity options, especially for those living in unserved and underserved areas of the country. These benefits will extend to other parts of the world as well, ensuring consumers everywhere can fully harness the growth and development of next generation mobile services and Internet-of-Things applications and devices.

As SpaceX demonstrates herein, the advanced capabilities of its proposed mobile satellite system will enable SpaceX to operate in these bands without causing harmful interference to other licensed systems. Moreover, SpaceX will include non-geostationary orbit Mobile-Satellite Service

transceivers that support these frequencies as an additional modular payload on its Gen2 system. Therefore, granting SpaceX's application provides the benefits detailed above without the cost, effort, and time needed to develop a standalone mobile satellite system and with numerous additional unique benefits: SpaceX's proposed MSS operations would not increase the number of satellites in orbit, would not pose an additional risk from orbital debris, and would not require any additional physical coordination. Accordingly, the Commission should expeditiously grant SpaceX's application.

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INTRODUCTION

In this application, Space Exploration Holdings, LLC (“SpaceX”) requests modification of its second-generation non-geostationary orbit (“NGSO”) Fixed Satellite Service (“FSS”) license¹ to authorize deployment and operation of a Mobile-Satellite Service (“MSS”) payload in the 1610-1617.775 (Earth-to-space) and 2483.5-2500 (space-to-Earth) bands (together, the “1.6/2.4 GHz band”), the 2000-2020 MHz (Earth-to-space) and 2180-2200 MHz (space-to-Earth) bands (together, the “2 GHz band”) and the 2020-2025 MHz (Earth-to-space) band (collectively, with the 1.6/2.4 GHz band and the 2 GHz band, the “MSS bands”). Granting this application will enable SpaceX to augment its MSS capabilities and leverage its next-generation satellite constellation to provide increased capacity, reduced latency, and broader service coverage for mobile users across the United States and the world, including those users underserved or unserved by existing networks.

¹ See *Space Exploration Holdings, LLC*, FCC 22-91 (rel. Dec. 1, 2022) (“*Gen2 Authorization*”).

This application identifies all changes that SpaceX requests for its Gen2 system. SpaceX is also filing an FCC Form 312, Schedule S, requests for waiver, and updated technical showings to account for the changes proposed. SpaceX certifies that all other information provided in its Gen2 applications remains unchanged.²

I. SPACEX’S 2 GHZ MSS SYSTEM WILL BRING UBIQUITOUS CONNECTIVITY TO MOBILE CUSTOMERS WITHOUT CAUSING INTERFERENCE TO OTHER LICENSED OPERATORS

A. SpaceX Background

SpaceX is a private company revolutionizing space technologies, with the ultimate goal of enabling humanity to become a multi-planetary species. The company designs, manufactures, and launches advanced rockets and spacecraft. It has over 9,500 employees based in the United States at the company’s headquarters in Hawthorne, California and facilities located across the country.

Since its founding in 2002, SpaceX has achieved a series of historic milestones. In December 2010, SpaceX became the first private company ever to successfully launch and return a spacecraft (Dragon) from low-Earth orbit. In May 2012, the company again made history when Dragon berthed with the International Space Station (“ISS”), delivered cargo, and returned safely to Earth—a technically challenging feat previously accomplished only by governments. In December 2015, SpaceX successfully returned a first-stage rocket booster to land after carrying a payload to space. SpaceX has since landed a first-stage booster more than 165 times and has re-flown over 135 boosters, including up to 16 re-flights of a single booster. In May 2020, SpaceX used its Crew Dragon capsule, the only U.S. human-rated orbital transport spacecraft, to become

² See 47 C.F.R. § 25.117(c). See also Application for Approval of Orbital Deployment and Operating Authority for the SpaceX Gen2 NGSO Satellite System, IBFS File No. SAT-LOA-20200526-00055 (May 26, 2020) (“Gen2 Application”); Amendment, IBFS File No. SAT-AMD-20210818-00105 (Aug. 18, 2021) (“Gen2 Amendment”); Letter from William M. Wiltshire to Karl A. Kensinger, IBFS File Nos. SAT-LOA-20200526-00055 and SAT-AMD-20210818-00105 (Jan. 7, 2022).

the first and only commercial operator to deliver astronauts to the ISS. And by leveraging the reusability of its rockets, SpaceX has launched over 3,700 of its Starlink satellites, which will be used to provide high-speed broadband across the country and around the world.

SpaceX's current and planned space-based activities underscore its commitment to space sustainability. SpaceX is proud that NASA has entrusted the company to safely carry American astronauts to and from the ISS, a more than \$100 billion multinational facility with human beings onboard. Nothing is more important to SpaceX than safely and successfully accomplishing this mission. The company is highly experienced with space-based operations and debris mitigation practices.³ SpaceX maintains deep ties with the domestic and international institutions tasked with ensuring the continued safety of space operations, which facilitates aggressive and effective space-debris mitigation practices. SpaceX brings this commitment and experience to all aspects of its space-based operations. The modular architecture of MSS payload embodies this commitment, as it will permit SpaceX to introduce important new capabilities without launching a single additional satellite.

B. Realizing the Commission's Vision for Mobile-Satellite Service

i. 1.6/2.4 GHz Band (1610-1617.775 MHz and 2483.5-2500 MHz)

The 1610-1617.775 MHz (Earth-to-space) and 2483.5-2500 MHz (space-to-Earth) bands are allocated worldwide for MSS on a co-primary basis.⁴ The Commission adopted conforming domestic allocations for the bands, which are recorded in its rules.⁵

³ See *SpaceX's Approach to Space Sustainability and Safety*, SpaceX (Feb. 22, 2022), <https://www.spacex.com/updates/>.

⁴ INT'L TELECOMM. UNION ("ITU"), Final Acts of the World Admin. Radio Conference (WARC-92), Malaga-Torremolinos (1992); *Amendment of Section 2.106 of the Rules to Allocate the 1610-1626.5 MHz and the 2483.5-2500 MHz Bands for Use by the Mobile Satellite Service*, 9 FCC Rcd. 536 (1994).

⁵ 47 C.F.R. § 2.106.

When the Commission first authorized MSS operation in these bands in 1994, it envisioned a service that would “offer an almost limitless number of services, [. . .] offer Americans in rural areas that are not otherwise linked to the communications infrastructure immediate access to a feature-rich communications network[,] . . . [and] extend these benefits throughout the world.”⁶ To further these goals, the Commission established a spectrum sharing plan that would accommodate each of the then-anticipated NGSO systems, only two of which ultimately materialized.⁷ One of these systems, Globalstar, has enjoyed exclusive access to portions of these bands, even though the Commission never granted it exclusive use.⁸ To the contrary, the Commission has made multiple changes to the bands over time to reflect real world uses.⁹

While the currently-operating MSS systems provides important services, the circumstances surrounding the 1.6/2.4 GHz band have changed from when it was last examined by the Commission fifteen years ago. Satellite and communication system technology has evolved significantly, and the ability to share this satellite spectrum among operators under the Commission’s rules has advanced considerably. As a result, the spectrum resources in the 1.6/2.4 GHz band now offer untapped potential for serving the American public in coordination with currently licensed operators, such as Globalstar.

⁶ See *Amendment of the Commission’s Rules to Establish Rules and Policies Pertaining to a Mobile Satellite Service in the 1610-1626.5/2483.5-2500 MHz Frequency Bands*, 9 FCC Rcd. 5936, ¶ 3 (1994) (“*Big LEO Order*”).

⁷ *Id.* ¶¶ 44-46; see also *Review of the Spectrum Sharing Plan Among Non-Geostationary Satellite Orbit Mobile Satellite Service Systems in the 1.6/2.4 GHz Bands*, 19 FCC Rcd. 13386, ¶ 3 (2004) (“*Big LEO Spectrum Sharing Order*”).

⁸ See *Spectrum and Service Rules for Ancillary Terrestrial Components in the 1.6/2.4 GHz Big Leo Bands/Review of the Spectrum Sharing Plan Among Non-Geostationary Satellite Orbit Mobile Satellite Service Systems in the 1.6/2.4 GHz Bands*, 22 FCC Rcd. 19733, ¶ 24 (2007) (“*Big Leo Spectrum Rebalancing Order*”) (“the grant of spectrum to Globalstar under its license was made with the understanding that it was both to be shared with other operators and subject to modification if only one CDMA operator launched and operated a satellite system”).

⁹ *Id.* ¶ 4 (basing the current band plan on the fact that “[t]he Commission currently has no application before it for any new Big LEO MSS system”).

After evaluating the current use of the 1.6/2.4 GHz band, SpaceX has determined that it can leverage its state-of-the-art space technology and rapid launch cadence to deploy and operate an NGSO MSS system to meet consumer demand for mobile services without causing harmful interference to other licensed systems. Using the network of satellites in its Gen2 system, SpaceX can deliver on the objectives the Commission initially set out for the 1.6/2.4 GHz band. Furthermore, SpaceX has proven its ability to share spectrum and coordinate with co-frequency operators. As discussed in the Technical Attachment to this application, SpaceX can use a variety of strategies enabled by the advanced capabilities of its Gen2 system to facilitate MSS operations that coexist with incumbent MSS operators. The SpaceX MSS System thus can share the 1.6/2.4 GHz band with incumbents according to the Big LEO Order and Big LEO Spectrum Sharing Order to achieve an “equitable allocation of interference noise” and ensure that the SpaceX MSS System does not detrimentally affect the interference environment.¹⁰

ii. 2 GHz Band (2000-2020 MHz and 2180-2200 MHz)

The 2000-2010 MHz (Earth-to-space) and 2180-2200 MHz (space-to-Earth) bands are allocated worldwide for MSS on a co-primary basis; and the 2010-2020 MHz (Earth-to-space) band is allocated for Region 2 on a co-primary basis.¹¹ The Commission adopted conforming domestic allocations for the bands, which are recorded in its rules.¹²

¹⁰ *Big LEO Spectrum Sharing Order* ¶ 66; see also Final Report of the Majority of IWG1 at 2-2 (“It is proposed that a technical approach based on an equitable allocation of interference noise would be used in the application of international coordination procedures set forth in Resolution 46 of the Final Acts of WARC-92.”).

¹¹ See ITU, *Final Acts of the World Administrative Radio Conference* at 62-64 (Geneva, 1993); see also *Amendment of Section 2.106 of the Rules to Allocate Spectrum at 2 GHz for Use by the Mobile-Satellite Service*, 12 FCC Rcd. 7388 (1997); *Fixed and Mobile Services in the Mobile Satellite Service Bands at 1525-1559 MHz and 1626.5-1660.5 MHz, 1610-1626.5 MHz and 2483.5-2500 MHz, and 2000-2020 MHz and 2180-2200 MHz*, 26 FCC Rcd. 5710 (2011) (“2 GHz Band Co-Allocation NPRM”).

¹² See 47 C.F.R. § 25.202(a)(4)(ii).

In allocating these bands for MSS operation, the Commission “intended for MSS to provide communications in areas where it is difficult or impossible to provide communications coverage via terrestrial base stations and at times when coverage may be unavailable from terrestrial-based networks.”¹³ To date, the Commission has authorized two (non-U.S. licensed) MSS systems access to this spectrum to serve the United States market—Gamma Acquisition, L.L.C. (“Gamma”) and New DBSD Satellite Services G.P. (“DBSD”). Both Gamma and DBSD are wholly owned subsidiaries of DISH Network Corporation (“DISH”), and each consists of a single GSO satellite.¹⁴ DISH is also the sole licensee of terrestrial AWS-4 service in the band.¹⁵

Notably, when the Commission gave these terrestrial rights to DISH for free with no auction, it acknowledged that neither DBSD nor Gamma (then known as TerreStar) was making much (if any) productive use of the 2 GHz band.

Despite having MSS and ATC [Ancillary Terrestrial Component] authority and an orbiting satellite, DBSD never offered either commercial satellite or terrestrial service and TerreStar offered only minimal satellite service (partnering with AT&T to offer a non-ATC satellite/terrestrial service using AT&T terrestrial spectrum and TerreStar satellite spectrum). To date, there remains little commercial use of this spectrum for MSS and none for terrestrial (ATC) service.¹⁶

The Commission also found that DBSD had still not offered MSS service three years *after* DBSD certified that its satellite had begun operations.¹⁷

¹³ *Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands*, 16 FCC Rcd. 15532, ¶ 1 (2001).

¹⁴ *See Service Rules for Advanced Wireless Services in the 2000-2020 MHz and 2180-2200 MHz Bands*, 27 FCC Rcd. 16102, ¶ 14 (2012) (“AWS-4 Order”).

¹⁵ *See DISH Network Corporation*, 28 FCC Rcd. 16787, ¶ 6 (2013).

¹⁶ *AWS-4 Order* ¶ 10.

¹⁷ *Id.* (citing *2 GHz Band Co-Allocation NPRM* ¶ 6).

Now, a decade later, DISH and its subsidiaries have made little productive use of the 2 GHz band. DISH claims to have begun terrestrial operations, but even these questionable claims are limited to a portion of the band and selected markets.¹⁸ Even more importantly for this application, there is no evidence that either Gamma or DBSD is offering or plans to offer any MSS service in the band in the United States. In fact, DISH’s certified public filings suggest the opposite. According to DISH’s most recent annual report filed with the Securities and Exchange Commission, the MSS satellite operated by Gamma has a useful lifetime of 14.25 years—which would mean that it should be retired sometime in 2023—while the useful lifetime of the MSS satellite operated by DBSD is listed as “N/A.”¹⁹ Meanwhile, the U.S. market access grants for the Gamma and DBSD MSS satellites will expire in July 2024 and May 2023, respectively.²⁰ And despite this record, DISH has not announced a contract to build a replacement for either of these MSS satellites. Accordingly, these satellites will likely cease U.S. operations within the next year or two, thereby eliminating even the potential for SpaceX service in the band to pose any issue to DISH.

Further supporting DISH’s intention to abandon any possibility of MSS operations in the band, in that same annual report, DISH revealed that it “wrote down the fair value of the [MSS] satellites to their estimated fair value of zero.”²¹ In other words, DISH places no value on the

¹⁸ See DISH NETWORK CORP., *DISH Network Corporation 5G Buildout Status Report*, WT Docket No. 22-212, 6-7, Attachment A (filed July 14, 2022), available at <https://www.fcc.gov/ecfs/document/10714418910058/1>.

¹⁹ See DISH NETWORK CORP., Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934 for Fiscal Year Ended December 31, 2021, F-39 (2022), available at <https://dish.gcs-web.com/staticfiles/4e8db017-b1d9-4d94-a208-1233a1770f95> (“DISH Annual Report”).

²⁰ See 47 C.F.R. § 25.121(a)(1) (specifying a license term of 15 years); Letter from Joseph A. Godles to Marlene H. Dortch, IBFS File No. SAT-LOI-19970926-00161 (July 20, 2009) (certifying commencement of operations for Gamma predecessor on July 19, 2009); Letter from Suzanne Hutchings Malloy to Marlene H. Dortch, IBFS File No. SAT-PDR-20050110-00024 (May 9, 2008) (certifying commencement of operations for DBSD predecessor on April 25, 2008).

²¹ DISH Annual Report at F-39.

hardware that drives its alleged MSS business—a conclusion confirmed by the conspicuous absence of any discussion of an MSS service in the annual report or any other evidence that DISH is in fact providing a commercial MSS service in the United States.

In these circumstances, there is no reason to believe that DISH would invest the hundreds of millions of dollars required to replace its aging MSS satellites to support a non-existent service, and no reason for the Commission not to license an additional operator to step in and provide MSS services in the 2 GHz band whether or not DISH has formally relinquished its MSS authorizations.

DISH's inaction is not only a fundamental waste of valuable MSS spectrum, but also an opportunity for another more motivated and capable operator to use the spectrum to provide mobile services to Americans in underserved and unserved areas. Specifically, while DISH has squatted on its spectrum rights for a decade with little to show for it, SpaceX has in just a fraction of that time launched more than 3,700 satellites that offer high-speed broadband services to Americans across the country, no matter where they live, and in more than 40 other countries around the world. After evaluating the current use of the 2 GHz band, SpaceX has concluded that it can leverage its technology and its rapid deployment to operate an NGSO MSS system that can serve consumers in the band without substantially affecting other licensed operators.

As discussed in the Technical Attachment to this application, SpaceX also can use a variety of strategies enabled by the advanced capabilities of its next-generation MSS system to coexist with DISH's MSS operations in the unlikely event that DISH launches replacement satellites. Furthermore, the Commission has explicitly acknowledged the differences between the GSO satellites operated by DISH and SpaceX's NGSO constellation. Specifically, "NGSO systems can provide complete and continuous global coverage, whereas, a single GSO satellite, while capable

of providing continuous coverage, typically only can provide regional service.”²² So, whatever service that DISH satellites could provide is limited to the United States and nearby regions, leaving the rest of the world in need of mobile service from a different operator using this spectrum.

And unlike DISH’s non-existent service, grant of SpaceX’s application would realize the Commission’s intent for MSS use of the 2 GHz band to serve and benefit consumers. Even when the Commission authorized terrestrial use of the 2 GHz band for Advanced Wireless Services (“AWS”), it made clear that such a service was not meant to transform the band into primarily terrestrial spectrum.²³ The Commission thus took steps to ensure the protection of MSS vis a vis terrestrial service in the 2 GHz band, promulgating a rule that an AWS-4 terrestrial licensee must accept any interference received from duly authorized MSS operations and must protect MSS operations from harmful interference.²⁴ The Commission thereby preserved the opportunity for MSS service in the band on behalf of American consumers, wherever they are located.

Although it would appear that DISH has all but abandoned MSS service in favor of the specter of a limited terrestrial network, there is no reason or basis for the Commission to do the same. By granting SpaceX access to this spectrum, the Commission can finally recognize the public interest benefits that this band can provide to Americans—truly ubiquitous mobile connectivity, especially to those in underserved and unserved areas.

²² *Establishment of Policies and Service Rules for the Mobile Satellite Service in the 2 GHz Band*, 15 FCC Rcd. 16127, ¶ 14 (2000).

²³ *See, AWS-4 Order* ¶ 180 (“[N]othing we do today eliminates the existing mobile satellite allocation for the 2 GHz MSS band or limits the licensees’ continued satellite use rights for this spectrum” (footnote omitted)); *see also* Letter from Jeffrey H. Blum to Marlene Dortch, WT Docket No. 13-225, n.2 (filed June 1, 2016) (“[Dish’s] election [of terrestrial downlink] has no effect on the MSS licenses held by DISH”).

²⁴ *See* 47 C.F.R. § 27.1136.

iii. 2020-2025 MHz Band

The 2020-2025 MHz band is currently allocated in ITU Region 2 for MSS uplink (Earth-to-space) on a co-primary basis with the Fixed and Mobile services. The United States, however, does not currently have an MSS allocation for the band.

In 2020, Kepler Communications, Inc. and Spire Global, Inc., filed a Petition for Rulemaking to add an MSS allocation to the band.²⁵ SpaceX supports these petitioners and believes that this band provides critical spectrum resources for new operators to meet the growing need for uplink MSS operations.²⁶ SpaceX requests a waiver of the U.S. Table of Frequency Allocations to use the 2020-2025 MHz band for uplink for its mobile satellite user terminals consistent with the ITU Region 2 allocation, subject to the outcome of the Kepler/Spire Petition.

C. Description of MSS System Architecture

The SpaceX MSS system will consist of a constellation of low and very low Earth orbit satellites that will leverage SpaceX's existing ground equipment as well as add new equipment that aims to optimize performance for consumers. It will be spectrally efficient and capable of sharing the MSS bands with conventional GSO satellite and terrestrial networks without causing harmful interference. It will operate under new network filings to be made on behalf of SpaceX at the ITU by the United States.

²⁵ SPIRE GLOBAL, INC. & KEPLER COMMUNICATIONS INC., *Petition to Revise Sections 2.106 and 25.142 of the Commission's Rules to Expand Spectrum Availability for Small Satellites by adding Mobile-Satellite Service Allocation in the Frequency Band 2020-2025 MHz*, RM-11869 (filed Oct. 30, 2020) ("Kepler/Spire Petition") (pending).

²⁶ See IBFS File No. SAT-MOD-20220906-00100. Kepler reciprocates its support for SpaceX's MSS system within each of the frequency bands specified in this application. See Letter from Nickolas G. Spina to Marlene Dortch (filed Oct. 28, 2022).

i. Space Segment

The proposed SpaceX MSS system will consist of a payload on the satellites currently authorized to deploy as part of SpaceX's Gen2 system, and subject to the conditions set forth in the *Gen2 Authorization* initially granting SpaceX authority to launch and operate 7,500 satellites.²⁷ SpaceX requests a waiver of certain geographic coverage requirements while it awaits authorization of the remainder of its proposed constellation. Once fully deployed, the Gen2 system will provide complete and continuous service to virtually any place on Earth. SpaceX requests authority to operate on the 1610-1617.775 MHz and 2000-2025 MHz (Earth-to-space) bands and the 2180-2200 MHz and 2483.5-2500 MHz (space-to-Earth) bands. SpaceX will use the gateway spectrum assigned to its FSS constellation to provide feeder links for the SpaceX MSS system. A more precise description of the frequency and channelization plan for the SpaceX MSS system is included in Schedule S and the Technical Attachment accompanying this application.

ii. Ground Segment

The SpaceX MSS system will communicate with user terminals capable of providing connectivity virtually anywhere. While SpaceX plans to leverage its existing FSS ground infrastructure to support MSS operations, it will submit applications to the Commission as needed to request blanket authority for user terminals that will operate in the United States and its territories, pursuant to Section 25.115 of the Commission's rules.²⁸

²⁷ See *Gen2 Authorization* ¶¶ 6-8.

²⁸ 47 C.F.R. § 25.115.

II. GRANT OF THIS APPLICATION WILL SERVE THE PUBLIC INTEREST BY ENABLING SPACEX TO OFFER NEXT-GENERATION SERVICES TO UNDERSERVED AND UNSERVED MOBILE USERS ACROSS THE UNITED STATES AND AROUND THE WORLD

SpaceX is dedicated to iteratively improving its systems and leveraging advancements in satellite technology to ensure that high-speed, low-latency broadband can be a reality for all people. The Commission previously granted modifications to SpaceX’s first-generation constellation to facilitate greater coverage, higher capacity, and reduced latency for consumers.²⁹ SpaceX has realized these objectives by launching over 3,700 operational satellites to date in that system, thereby extending true broadband connectivity across the United States—including Americans living in the most remote corners and polar regions of the country.³⁰ Moreover, SpaceX continues to explore innovative approaches to expand its service capacity. For example, the Commission has authorized SpaceX to operate earth stations in motion (“ESIMs”) that reflect American consumer and business realities on the ground by enabling broadband services on moving aircraft, ships, and motor vehicles.³¹

In the meantime, consumer demand for broadband is surging, and extending connectivity to all Americans, especially those on the wrong side of the digital divide, requires an infusion of innovative capabilities and capacity. Recognizing this, the Commission recently authorized SpaceX to deploy its high capacity Gen2 system—a next-generation satellite network that augments its existing first-generation constellation.³² The Gen2 system consists of a constellation

²⁹ See, e.g., *Space Exploration Holdings, LLC*, 36 FCC Rcd. 7995 (2021).

³⁰ *Id.*

³¹ See IBFS File Nos. SES-LIC-20210309-00698, SES-AMD-20210731-01295, SES-LIC-20210803-01360, and SES-LIC-20210803-01361.

³² See generally *Gen2 Authorization*.

of low and very low Earth orbit satellites, and will leverage SpaceX existing ground equipment and user terminals, as well as add new equipment, to optimize performance for consumers.

By designing its overall system from the ground up, SpaceX can ensure that each element of its Gen2 system is optimized for performance while keeping cost-effectiveness and reliability in mind throughout the entire deployment lifecycle. Satellites that operate in the Gen2 system will have a much greater data capacity than SpaceX's first-generation satellites, and SpaceX will continue to iteratively improve its satellites over the course of the Gen2 system's multi-year deployment to further increase network capacity. The Gen2 system is also configured to ensure frequency reuse across different satellites to enhance the flexibility, capacity, and robustness of the overall system. And by leveraging phased-array technology, satellites in the Gen2 system can dynamically steer their beams to focus capacity to meet consumer demand. Furthermore, optical inter-satellite links permit flexible routing of traffic on-orbit to satisfy consumer demand, enhance network efficiency, and preempt network congestion.

While these assets enable SpaceX to provide unparalleled broadband capacity from its space-based platform, Americans are increasingly demanding connectivity while on the move, wherever they are, whenever they want, and for whatever they are doing. To expand into this mobile services arena, SpaceX recently acquired Swarm Technologies, Inc., a company authorized to deploy and operate 150 small NGSO satellites designed to provide narrowband services in the very-high frequency 137-138 MHz and 148-150.5 MSS bands.³³ Swarm has already launched most of its authorized satellites and is offering services to customers in the agriculture, maritime, energy, environmental, and transportation sectors, among others in need of global satellite connectivity for Internet-of-Things devices.

³³ See Public Notice, 36 FCC Rcd. 14264 (IB 2021) (confirming authority for Swarm transfer of control to SpaceX).

In the same way that SpaceX's Gen2 system augments its NGSO FSS capabilities beyond those of its first-generation constellation, with this application SpaceX proposes to further expand its next-generation NGSO MSS capabilities throughout the country. SpaceX has determined that its recently authorized Gen2 system is the most efficient, fastest, and best way to bring enhanced mobile satellite services using the MSS bands to all corners of the United States and therefore is concurrently withdrawing its previously filed applications to modify its first-generation system to add these bands.³⁴

The spectrum available in the MSS bands will support a range of services, enabling SpaceX to craft a compelling array of offerings to address the connectivity needs of Americans wherever they are and whatever they are doing. By operating at low and very low altitudes, SpaceX's MSS System can broaden its coverage and reduce transmission latencies below 50 milliseconds, ensuring that all Americans—even those in remote and polar regions—experience the same low-latency mobile services. And consumers are not the only beneficiaries of this improved service. For many Federal users, satellite service is the only communications option to support critical missions. Improving capacity and reducing latency in these communications could have significant national security benefits. All of these services are in the public's best interests and advance the Commission's objectives.

SpaceX's MSS system will employ a host of cutting-edge innovations to ensure its system does not cause harmful interference for others. As discussed in the Technical Attachment accompanying this application, the system will not create harmful interference to other systems authorized to provide service in these frequency bands.³⁵ By operating at low and very low

³⁴ See IBFS File Nos. SAT-MOD-20220725-00074, SAT-MOD-20220906-00100.

³⁵ See Technical Attachment.

altitudes, the SpaceX's MSS System will enable small spot beams and greater satellite diversity, efficiently achieving a high degree of frequency reuse of valuable spectrum resources and significantly enhancing the data capacity available anywhere in the world. And by offering a typical user multiple satellites in view from any given point on the ground, SpaceX's MSS System will have flexibility to deliver robust service, even in a crowded spectrum environment. As it has done previously, SpaceX will seek in every case to reach coordination agreements that optimize spectrum efficiency and leverage its flexibility to share spectrum with other licensed systems.

Finally, SpaceX has engineered its MSS capabilities to require no additional satellites on orbit beyond those the Commission has already licensed, or any change to their orbital characteristics. SpaceX has also designed its MSS payload to be incorporated into SpaceX's Gen2 NGSO FSS satellites without materially increasing the extremely low risk that these satellites will become a source of orbital debris. SpaceX's Gen2 system utilizes the built-in advantages of operating at low altitude so that, in the unlikely event that any debris does result, atmospheric drag will ensure that such debris will quickly disintegrate in the atmosphere and pose no further danger to space operations or life on the ground. Moreover, its satellites will have sufficient maneuverability to avoid other satellites and orbital debris throughout their mission lifetime and through the de-orbit process. The MSS payload for SpaceX's Gen2 system will have no effect on this reliability on orbit or satellite demisability.

III. ITU COST RECOVERY

SpaceX is aware that, as a result of the actions taken at the 1998 Plenipotentiary Conference, as modified by the ITU Council in 2005, the ITU now charges processing fees for satellite network filings. As a consequence, Commission applicants are responsible for any and all fees charged by the ITU. SpaceX confirms that it is aware of this requirement and accepts

responsibility to pay any ITU cost recovery fees associated with this application. Invoices for such fees may be sent to the contact representative listed in the accompanying FCC Form 312.

IV. ELIGIBILITY AND OPERATIONAL REQUIREMENTS

To the extent necessary, SpaceX confirms that (1) it will post a surety bond as required under Section 25.165 of the Commission's rules; (2) it will comply with the Commission's milestone requirements; and (3) it does not have any other application for an NGSO-like satellite system license on file with the Commission, or any licensed-but-unbuilt NGSO-like system, in any frequency band involved in this application.

CONCLUSION

For the foregoing reasons, and for the reasons set forth in the accompanying materials, SpaceX requests that the Commission find that modifying SpaceX's Gen2 system to include a mobile satellite service system using the 1610-1617.775, 2000-2025, 2180-2200, and 2483.5-2500 MHz bands will serve the public interest, and issue such grant expeditiously.

Respectfully submitted,

SPACE EXPLORATION HOLDINGS, LLC

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