

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

Application of)
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SPACE EXPLORATION HOLDINGS, LLC)

For Modification of Authorization for the)
SpaceX Gen1 NGSO Satellite System)
_____)

Call Signs: S2983 and S3018

IBFS File No. SAT-MOD-_____

**APPLICATION FOR MODIFICATION OF AUTHORIZATION
FOR THE SPACEX GEN1 NGSO SATELLITE SYSTEM**

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SUMMARY

SpaceX is excited to submit this application to upgrade the hardware on its first-generation (“Gen1”) satellite network so that it can provide even faster speeds to more people no matter where they are in the United States or around the globe. SpaceX’s Gen1 NGSO constellation is currently providing unprecedented high-speed, low-latency satellite broadband service to Americans in even the most remote corners of the country. But with this application, SpaceX takes the next step in its evolution, by requesting authorization to upgrade its satellite hardware to feature new capabilities that were developed since it received its last authorization. This upgraded hardware will allow SpaceX to more efficiently meet the demand for its revolutionary broadband capabilities and demonstrates SpaceX’s continued commitment to safely and fully deploying a satellite constellation that will deliver high-speed, low-latency, competitively-priced broadband service to those living across the United States, in polar regions, and around the world—especially in unrved or underserved areas.

Specifically, SpaceX seeks to leverage the technical innovations it developed during the design of its Gen2 system to better serve consumers by upgrading its Gen1 hardware. This enhancement to the Gen1 system will enable the operation of upgraded hardware at the same orbits, altitudes and inclinations as licensed under its Gen1 license. This application captures the ways in which these upgraded satellites will vary from the technical or operating characteristics of the satellites the Commission has already authorized under the Gen1 license. This modification will not cause any additional interference to existing operators and will comply with applicable orbital debris mitigation requirements. To be clear, while SpaceX intends to populate its Gen1 constellation with upgraded satellites, it does not intend to more rapidly de-orbit its existing satellites. Rather, it seeks only to replace those satellites with upgraded hardware when those satellites reach the end of their planned operational period.

The satellite upgrades proposed herein will serve the public interest in a variety of ways. In keeping with SpaceX's prior authorizations, this modification will enable SpaceX to accelerate its deployment of high-speed, low-latency satellite broadband service, including to the most remote areas of the country. With this application, SpaceX seeks to upgrade the satellite hardware to introduce even more advanced beam-forming and digital processing technologies and enable narrower beam capabilities to provide more targeted and robust coverage for American consumers. The use of these narrow beams will augment SpaceX's capability to expand fast, low-latency broadband service throughout the United States and will allow for a high degree of frequency reuse. Thus, with these new capabilities, consumers can expect more connectivity from the same radiofrequency resources. The requested modification thus would serve the public interest by enabling SpaceX to continue to improve its efficient use of valuable spectrum resources to serve more Americans.

This modification will provide all of these benefits to the American public while ensuring harmonious operation with other spectrum users. SpaceX will satisfy applicable EPFD limits designed to promote compatibility with GSO satellite systems while also protecting terrestrial wireless systems. And critically, SpaceX will continue its extensive ongoing coordination efforts with both commercial and government entities. For example, SpaceX recently announced a ground-breaking coordination agreement with the National Science Foundation to protect both radio and optical astronomy operations, and its operations under the proposed modification would comply with the terms of that agreement.

In sum, this modification further unlocks the potential of SpaceX's Gen1 constellation to provide even better next-generation broadband services to Americans everywhere, and particularly

in underserved and unserved areas. It would enable even more highly efficient use of spectrum resources. Accordingly, SpaceX asks that the Commission expeditiously grant this application.

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**APPLICATION FOR MODIFICATION OF AUTHORIZATION
FOR THE SPACEX GEN1 NGSO SATELLITE SYSTEM**

In this application, Space Exploration Holdings, LLC (“SpaceX”) proposes to build on the success of its earlier modifications in accelerating broadband deployment by upgrading the satellites used in its first-generation (“Gen1”) Ku/Ka-band, non-geostationary orbit (“NGSO”) satellite system in the Fixed-Satellite Service (“FSS”). Specifically, SpaceX proposes modifications to upgrade its satellite hardware in ways that will enhance its ability to provide service to customers in every corner of the United States and around the world. Although NGSO satellite operators are not required to seek authority to make changes to their satellite equipment,¹ the changes SpaceX proposes here will affect some of the licensed parameters specifically provided in SpaceX’s prior authorizations.

¹ See, e.g., *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, ¶ 182 n.250 (1994) (“technically identical” satellites “need not . . . have the identical physical structure or microelectronics”).

This application identifies all changes that SpaceX requests for its *Current Authorization*.² SpaceX is also filing an FCC Form 312, Schedule S, and updated technical showings to account for the changes proposed. SpaceX certifies that all other information provided in its Gen1 applications, as modified, remains unchanged.³ Grant of this application will enable SpaceX to augment its capabilities and thereby provide next-generation services to fixed and in-motion users across the United States and around the world, including areas underserved or currently unserved by existing networks.

DISCUSSION

I. BACKGROUND

The Commission authorized SpaceX in 2018 to construct, deploy, and operate an NGSO constellation consisting of 4,425 satellites operating using Ku- and Ka-band spectrum.⁴ The Commission granted SpaceX a modification of that authorization in April 2019 to relocate 1,584 satellites previously authorized to operate at an altitude of 1,150 km to an altitude of 550 km. The Commission found that the modification would serve the public interest by improving broadband latency while decreasing the potential for orbital debris.⁵

² See *Space Exploration Holdings, LLC*, 36 FCC Rcd. 7995 (2021) (“*Current Authorization*”), *aff’d sub nom. Viasat, Inc. v. FCC*, 47 F.4th 769 (D.C. Cir. 2022).

³ See 47 C.F.R. § 25.117(c). See also Application for Approval for Orbital Deployment and Operating Authority for the SpaceX NGSO Satellite System, IBFS File No. SAT-LOA-20161115-00118 (Nov. 15, 2016); Application for Approval for Orbital Deployment and Operating Authority for the SpaceX NGSO Satellite System Supplement, IBFS File No. SAT-LOA-20170726-00110 (July 26, 2017); Application for Modification of Authorization for the SpaceX NGSO Satellite System, IBFS File No. SAT-MOD-20181108-00083 (Nov. 8, 2018); Application for Modification of Authorization for the SpaceX NGSO Satellite System, IBFS File No. SAT-MOD-20200417-00037 (Apr. 17, 2020).

⁴ See *Space Exploration Holdings, LLC*, 33 FCC Rcd. 3391, ¶ 11 (2018) (“*Initial Authorization*”).

⁵ *Space Exploration Holdings, LLC*, 34 FCC Rcd. 2526 (IB 2019) (“*First Modification*”).

The Commission granted SpaceX a modification in December 2019 to allow SpaceX to reconfigure its satellite locations within the same altitude to place coverage and capacity more evenly and rapidly across more of the U.S.⁶ By taking advantage of SpaceX’s advanced deployment methods, that modification has accelerated broadband service to middle and southern states, as well as to Hawaii, Puerto Rico, and the U.S. Virgin Islands. Critically, the Commission recognized that because both of these modifications either reduced or maintained the total number of satellites used, they resulted in no material change in interference.⁷

The Commission granted SpaceX a modification in April 2021, to relocate 2,824 satellites that were previously authorized for operation at altitudes ranging from 1,110 km to 1,325 km to new altitudes ranging from 540 to 570 km.⁸ In that order, the Commission similarly found that the modification would enable critical connectivity services for Americans, without causing any additional interference to other operators.⁹ The Commission also recently granted SpaceX authority to deploy and operate up to 7,500 satellites of its proposed second-generation (“Gen2”) constellation.¹⁰

⁶ See *Space Exploration Holdings, LLC*, DA 19-1294 (IB, rel. Dec. 19, 2019) (“*Second Modification*”).

⁷ See *First Modification* ¶ 11; *Second Modification* ¶ 15.

⁸ See *Current Authorization* ¶ 1.

⁹ See *id.* ¶¶ 21, 39, 52.

¹⁰ See *Space Exploration Holdings, LLC*, FCC 22-91 (rel. Dec. 1, 2022) (“*Gen2 Authorization*”). SpaceX does not seek any modification of the Gen2 authorization in this application.

A. Space Segment

The configuration of SpaceX's currently authorized Gen1 NGSO constellation is summarized in Table 1 below.

SpaceX Current Authorization					
Orbital Planes	72	72	36	6	4
Satellites per Plane	22	22	20	58	43
Altitude	550 km	540 km	570 km	560 km	560 km
Inclination	53°	53.2°	70°	97.6°	97.6°

Table 1. Summary of Currently Authorized Gen1 NGSO Constellation

Based on the success of the deployment of more than 3,800 satellites and in an effort to even further enhance the spectral efficiency of its constellation, SpaceX now proposes to upgrade its satellite hardware to enable new capabilities. Specifically, SpaceX seeks to leverage some of the advances in satellite design developed for the Gen2 system to enable the operation of upgraded hardware at the same orbits, altitudes and inclinations as licensed under its Gen1 license. This upgrade will feature narrower beams that will enable an even higher degree of frequency reuse. These narrow beams also maintain SpaceX's agility in coordinating spectrum use with other licensed satellite and terrestrial operators. SpaceX continues to be committed to being a good steward of spectral resources and hereby submits this modification to further enhance its spectral efficiency to the benefit of consumers across the United States.

B. Ground Segment

The upgraded satellites will be able to communicate with SpaceX's existing ground infrastructure and user terminals. To the extent these satellites also unlock additional capabilities beyond existing authorizations, SpaceX will submit applications to the Commission as needed to

request individual licenses for any additional enterprise user terminals and gateway earth stations, and a blanket license for new user terminals to be located in the United States, pursuant to Sections 25.115 and 25.130 of the Commission’s rules.

II. GRANT OF THE APPLICATION WOULD SERVE THE PUBLIC INTEREST BY IMPROVING SPECTRAL EFFICIENCY AND ENHANCING CAPACITY AVAILABLE FOR SERVICE TO AMERICAN CUSTOMERS

SpaceX has launched over 3,800 satellites of its Gen1 constellation so far. This system has begun delivering truly high-speed, low-latency broadband to users across the United States—including to the most remote corners and polar regions of the country that too often get left behind—and around the world. To complement this Gen1 constellation and provide the additional capacity to meet the accelerating demand for broadband, SpaceX recently obtained authority to begin deployment of its Gen2 system. SpaceX has also been granted authority to operate earth stations in motion (“ESIMs”) to provide broadband services on moving aircraft, ships, and motor vehicles that can support SpaceX’s sophisticated directional antennas.¹¹

In granting SpaceX’s initial Gen1 modification, the Commission noted that Section 25.117 governs the modification of space station licenses, and that the rule provides that such applications “will be granted” except in two limited circumstances: either when the modification involves a request for additional bandwidth or when it would not serve the public interest.¹² As in its prior modifications, SpaceX does not request any increase in bandwidth, so the application should be granted so long as it serves the public interest. In this regard, the Commission has further clarified that “[i]f the proposed modification does not present any significant interference problems and is

¹¹ See *SpaceX Services, Inc.*, DA 22-695 (IB rel. June 30, 2022).

¹² See *First Modification* ¶ 7 (citing 47 C.F.R. § 25.117(d)(2)(ii) and (iv)).

otherwise consistent with Commission policies,” it is generally considered to serve the public interest and granted.¹³

As discussed below, the modification proposed herein will not increase interference to any other licensed spectrum user and is generally consistent with the Commission’s policies. Moreover, the modification serves the public interest by using even narrower spatial beams to provide more targeted and robust coverage to American consumers. The use of these narrow beams will allow for a higher degree of frequency reuse and maintain SpaceX’s agility in coordinating spectrum use with other licensed satellite and terrestrial operators. Further, this modification would enable the deployment of a satellite design capable of delivering low-latency service to an increased number of unserved and underserved Americans, and yields a greater degree of broadband competition for more Americans, including in areas requiring polar coverage. The proposed system upgrades will ensure that all Americans—even those in polar regions—enjoy the same low-latency fixed and in-motion services.

III. SPACEX CONTINUES TO LEVERAGE ITS UNIQUE SATELLITE SYSTEM TO IMPROVE THE SERVICES IT WILL PROVIDE TO CONSUMERS WHILE MAINTAINING A SAFE ORBITAL ENVIRONMENT

SpaceX’s track record for maintaining sustainable orbits is unmatched. And with these proposed upgrades, SpaceX will maintain its status as an industry leader in space sustainability by meeting or exceeding industry best practices. Additionally, through detailed mission planning, SpaceX has carefully assessed and limited the probability of its modified Gen1 system becoming a source of debris by collisions with small and large debris or other operational space stations. It

¹³ *Current Authorization* ¶ 8 (quoting *Teledesic LLC*, 14 FCC Rcd. 2261, ¶ 5 (IB 1999)).

will maintain the accuracy of its orbital parameters at a level that will allow operations to minimize high risk conjunctions with adjacent satellites in the Gen1 constellation and other constellations.

SpaceX has and will continue to work closely with the 18th and 19th Space Defense Squadrons and other relevant agencies, as well as private companies like LeoLabs, to ensure the services provided for conjunction assessment to SpaceX and all operators is effective, robust, reliable, and secure. SpaceX will ensure that the propulsion system onboard all of its satellites can respond quickly and at high cadence, allowing SpaceX to coordinate in advance and respond to conjunction risks, whether with debris or active spacecraft. SpaceX will continue to innovate to further reduce collision risk. An example of effective innovation is our “duck-to-dodge” technique. With this technique, SpaceX satellites now further reduce collision probabilities by reorienting the solar array and presenting the smallest possible surface area to oncoming secondary objects at the time of closest approach of conjunctions just under our propulsive maneuver threshold. This allows SpaceX satellites the ability to continue serving customers while effectively reducing collision probability by a factor of 10, further reducing the constellation level risk posture. Additionally, SpaceX will also continue to regularly engage with operators of active satellites and constellations to ensure safe and coordinated space operations. SpaceX includes a more detailed discussion of its capabilities to maintain a safe orbital environment in the Technical Attachment.

IV. ITU COST RECOVERY

SpaceX does not anticipate that the modification proposed herein will require any modification to its ITU satellite network filings. Nonetheless, 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.

CONCLUSION

For the foregoing reasons, and for the reasons set forth in the accompanying materials, SpaceX requests that the Commission find that authorizing SpaceX to upgrade its satellite hardware as proposed herein will serve the public interest, and issue such grant expeditiously.

Respectfully submitted,

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