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

Application of **SPACE EXPLORATION HOLDINGS, LLC** for Authority to Launch and Operate the SpaceX Orbital Data Center System	ICFS File No. SAT-LOA-_____ Call Sign: _____

APPLICATION FOR LAUNCH AND OPERATING AUTHORITY FOR THE SPACEX ORBITAL DATA CENTER SYSTEM

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SpaceX requests authority to launch and operate a constellation of satellites with unprecedented computing capacity to power advanced artificial intelligence ("AI") models and the applications that rely on them. By directly harnessing near-constant solar power with little operating or maintenance costs, these satellites will achieve transformative cost and energy efficiency while significantly reducing the environmental impact associated with terrestrial data centers. Launching a constellation of a million satellites that operate as orbital data centers is a first step towards becoming a Kardashev II-level civilization—one that can harness the Sun's full power—while supporting AI-driven applications for billions of people today and ensuring humanity's multi-planetary future amongst the stars.

SpaceX is designing its satellite system to accommodate the explosive growth of data demands driven by AI, machine learning, and edge computing, where processing needs are already beginning to outpace terrestrial capabilities. To deliver the compute capacity required for large-scale AI inference and data center applications serving billions of users globally, SpaceX aims to deploy a system of up to one million satellites to operate within narrow orbital shells spanning up to 50 km each (leaving sufficient room to deconflict against other systems with comparable ambitions). This system will operate between 500 km and 2,000 km altitude and 30 degrees and sun-synchronous orbit inclinations. SpaceX plans to design and operate different versions of satellite hardware to optimize operations across orbital shells.

SpaceX's system will rely nearly exclusively on high-bandwidth optical links for communications. These optical links will route traffic within the network and to satellites in the Starlink constellation, via its high capacity (petabit) and high reliability laser mesh, which in turn will transmit traffic to authorized earth stations on the ground. But to enhance the reliability of the system, especially during critical early mission and post-mission phases, satellites can include

equipment for backup communications capable of conducting telemetry, tracking, and command ("TT&C"), operating solely in the non-geostationary orbit ("NGSO") primary portion of the Ka-band on a non-interference, unprotected basis.

Orbital data centers are the most efficient way to meet the accelerating demand for AI computing power. Global electricity demand for data centers is projected to more than double by 2035 driven by growth in AI — reaching approximately 1,200-1,700 Terawatt hours and accounting for up to 4% of total worldwide electricity consumption.[1] Building power plants and other terrestrial energy infrastructure at scale to maintain this additional power continuously on Earth will be extremely challenging. Fortunately, the development of fully reusable launch vehicles like Starship that can deploy millions of tons of mass per year to orbit when launching at rate, means on-orbit processing capacity can reach unprecedented scale and speed compared to terrestrial buildouts, with significantly reduced environmental impact.

These satellites will have continuous access to nearly unlimited solar power to meet energy demands without dependency on terrestrial grids, enabling scalable, reliable, and sustainable AI growth. By harnessing the Sun's abundant, clean energy in orbit—cutting emissions, minimizing land disruption, and reducing the overall environmental costs of grid expansion—SpaceX's proposed system will enable sustainable AI advancement. In fact, harnessing even a millionth of the Sun's energy would be more than 10,000 times more energy than human civilization uses today. With Starship's ability to deliver unprecedented tonnage to orbit for AI compute, the capacity for intelligence processing in space could surpass the electricity consumption of the entire U.S. economy, without the immense cost and disruption of rebuilding Earth's strained electrical grid to support the explosive demand for data centers. In turn, satellites that function as solar-

[1] *See* International Energy Agency, *Energy and AI*, at 66–67 (2025), https://www.iea.org/reports/energy-and-ai.

powered orbital data centers are the most cost-effective, energy-efficient, and environmentally sound way to build infrastructure to meet accelerating demand for AI-enabled goods and services.

SpaceX's system will operate in a select set of narrow orbital shells spanning up to 50 km each within the altitude range of 500 km and 2,000 km to maximize power generation and compute efficiency, while focusing on largely unused orbital altitudes within that range. Operating satellites at these altitudes provides the opportunity for greater exposure to sunlight—up to more than 99% of the time for high-altitude, sun-synchronous orbits. The constant power generation in sun-synchronous orbits will reduce the need to rely on batteries and power cycling, making these orbits ideal for energy-intensive AI workloads that demand constant, reliable compute capacity. Lower inclination satellites will take advantage of time-variable demand to load balance compute to match the power-generation capabilities of the system. Finally, low-latency global access for real-time AI inference requires widespread coverage and redundancy across multiple orbital planes, enabling seamless integration with terrestrial systems without bottlenecks.

Another major factor driving the scaling capacity of data center deployment in space is the reliance on cooling through radiative heat dissipation. In contrast to highly energy-intensive terrestrial data centers that require cooling systems that use billions of gallons of water annually, radiative cooling enables passive heat dissipation into the vacuum of space, outpacing ground-based data centers that face escalating energy demands and infrastructure delays. This inherent efficiency ensures rapid scaling of AI compute infrastructure without proportionally increasing the environmental burden, fostering sustainable growth that supports global innovation while preserving planetary resources.

Moreover, with a fully reusable rocket driving down launch costs, even a conservative cost assessment for the deployment of AI compute in space beats terrestrial data center deployments.

With the inherent efficiencies of deploying solar-powered data centers and launch cost rapidly decreasing due to the development of the Starship launch vehicle, SpaceX will be able to cost-effectively scale up its constellation as demand increases and compute evolves. For instance, launching 1 million tonnes per year of satellites generating 100 kW of compute power per tonne would add 100 gigawatts of AI compute capacity annually, with minimal ongoing operational or maintenance needs. Freed from the constraints of terrestrial deployment, within a few years the lowest cost to generate AI compute will be in space. This cost-efficiency alone will enable innovative companies to forge ahead in training their AI models and processing data at unprecedented speeds and scales, accelerating breakthroughs in machine learning, autonomous systems, and predictive analytics to benefit humanity.

The constellation will build upon SpaceX's deep understanding of sustainable operations. This new constellation will build upon the well-established space sustainability design and operational strategies, including for safe orbit raising and end-of-life disposal, that have proven successful for SpaceX's first- and second-generation broadband satellite systems. Together these strategies have resulted in higher than 99% satellite reliability across nearly ten thousand satellites. The constellation will leverage SpaceX's advanced, automated collision avoidance system for low-latency risk assessment and response, as well as agile and highly-reliable electric propulsion systems that enable precise and efficient maneuvers. And SpaceX remains committed to transparent collaboration with other systems, including sharing data and proactively mitigating high-risk conjunctions. SpaceX strongly urges all operators to follow these procedures to ensure continuous sustainability of all orbits.

As with all of its satellites, SpaceX will continue to deploy at very low altitudes for initial testing and checkout prior to orbit raise. This approach capitalizes on the natural advantages of

atmospheric drag at these altitudes, which guarantees that any satellite encountering early operational failure—such as initial defects or malfunctions—will rapidly deorbit, fully demise, and pose no calculable risk to humans upon re-entry.

Post-mission operations for these satellites will comply with U.S. government and international orbital debris mitigation guidelines.[2] SpaceX will dispose of its satellites either by atmospheric re-entry or by placing them into disposal orbits around Earth or into heliocentric disposal orbits. SpaceX will attempt targeted re-entry when disposing its satellites through atmospheric reentry and will design its satellites to pose no calculable risk to humans upon re-entry and to minimize atmospheric impact. SpaceX will also choose safe disposal orbits, which may include high altitude Earth orbits or heliocentric orbits, to minimize physical interaction with active satellite constellations and to reduce collision risks in densely populated lower orbits. By safely relocating end-of-life satellites away from active operational shells, disposal orbits reduce collision risks and preserve more valuable orbits for future missions. Critically, each satellite will be outfitted with redundant maneuverability capabilities and propellant reserves to support all phases of its lifecycle, including orbit raising, station-keeping, collision avoidance, and disposal, which may include sufficient propellant to dispose of end-of-life satellites in heliocentric orbits. In addition, SpaceX will continue developing approaches to managing decommissioned satellites within disposal orbits to potentially create opportunities for future hardware recycling and material harvesting.

Finally, SpaceX will continue its long track record of successful collaboration and innovation with the scientific and astronomy community to preserve their critical missions,

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[2] *See* NASA, *U.S. Government Orbital Debris Mitigation Standard Practices*, Objective 4.1(c) (November 2019 Update), https://orbitaldebris.jsc.nasa.gov/library/usg_orbital_debris_mitigation_standard_practices_november_2019.pdf .

including by developing industry-leading brightness mitigations. Furthermore, SpaceX will explore with the scientific community ways to use the powerful AI tools enabled by this constellation to accelerate their research and enhance space exploration.

The constellation will use spectrum efficiently and cause no risk of harmful interference to other users. This system will primarily rely upon optical inter-satellite links, which may connect among or between those satellites and satellites in SpaceX's first- and second-generation Starlink system. But to further enhance the reliability of the system, satellites can include equipment for backup communications capable of conducting TT&C and only in the NGSO-primary portion of the Ka-band on a non-interference, unprotected basis. SpaceX's system will employ spectrum in the 18.8-19.3 GHz (space-to-Earth) and 28.6-29.1 GHz (Earth-to-space) bands, which the Commission designates for NGSO FSS operations on a primary basis.[3]

The Commission repeatedly found that non-interference TT&C operations serve the public interest by enhancing the reliability and sustainability of next-generation space station systems, especially during critical early-mission, post-mission, and emergency operations. Limiting radiofrequency operations to NGSO-primary bands on a non-interference basis will further narrow the scope of the system's operations to pose no risk to current or future uses of the spectrum.

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As SpaceX's request complies with all Commission rules, regulations, and policies, including technical rules for space station operations in the non-geostationary orbit primary Ka-band and orbital debris mitigation rules, the application serves the public interest. Accordingly,

[3] *See* 47 C.F.R. § 2.106, n.NG165.

and for the reasons set forth in the accompanying materials, SpaceX requests that the Commission expeditiously authorize SpaceX to launch and operate its Orbital Data Center system.

Respectfully submitted,

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