EARTHJUSTICE
BECAUSE THE EARTH NEEDS A GOOD LAWYER

NORTHWEST REGIONAL OFFICE
810 3RD AVENUE, SUITE 610
SEATTLE, WA 98104-1711
T: 206.343.7340

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

DarkSky International, Environment America, and Public Employees for Environmental Responsibility's Petition to Initiate Programmatic Environmental Impact Statement on Orbital Data Center Applications	)

Submitted July 8, 2026

Photo Credit: Josh Dury.

DarkSky International, Environment America, and Public Employees for Environmental Responsibility (hereinafter, "Petitioners") hereby formally petition the Federal Communications Commission ("FCC") for a Programmatic Environmental Impact Statement ("PEIS") covering satellite-based data centers under the National Environmental Policy Act ("NEPA"). This is a formal agency petition pursuant to the Administrative Procedure Act ("APA"), 5 U.S.C. § 553(e), and requires a formal response. *See id.* § 555(b) (agency must respond within a "reasonable time"). Please also consider this petition a formal petition pursuant to 47 C.F.R. § 1.1307(c) that the projects identified herein (or similar projects to be filed hereafter) necessitate additional environmental consideration in the decision-making process. *Am. Bird Conservancy, Inc. v. FCC*, 516 F.3d 1027, 1033 (D.C. Cir. 2008) ("interested persons can request analysis under NEPA of actions that are otherwise categorically excluded"). In addition, or in the alternative, please consider this petition as a "petition to deny" filed pursuant to 47 C.F.R. § 1.1313(a) for all the projects identified herein (or similar projects to be filed hereafter), pending completion of full compliance with NEPA. Under any and all of these scenarios, please include this petition and all related materials generated by your agency, any other governmental entity, and the public in the administrative record for all of the projects identified herein.

INTRODUCTION

The FCC is currently considering multiple requests for licensing extraordinary numbers of satellite-based data centers to be placed into low-earth orbit over the next decade. Collectively, the proposals seek to place well over a million data center satellites into orbit, increasing the existing volume of satellites in low-earth orbit by multiple orders of magnitude. The proponents of these proposals describe their plans in grandiose, civilization-changing terms. But these same proponents have refused to embrace any inquiry into the impacts of their self-claimed epochal technology on the environment, science, economy, or other values. This is not just poor planning and a missed opportunity: it violates federal law.

Petitioners respectfully petition the FCC to pause the licensing of these individual projects pending the completion of a rigorous examination of the risks, alternatives, needs, costs, and impacts of this sudden transformation of Earth's exosphere. NEPA provides both the opportunity and the obligation to undertake such an examination. Where, as here, multiple projects are being considered that have overlapping, cumulative, or synergistic impacts, NEPA provides for the preparation of a PEIS. If ever a situation warranted a PEIS, it is this one. A PEIS would allow for the comprehensive analysis of the impacts of multiple proposals that all seek to accomplish the same objective, namely, placing virtually countless new data center satellites into orbit, threatening to degrade the ozone layer and the quality of the night sky and change the very chemistry of the stratosphere itself. A PEIS could assess impacts, propose alternatives, examine mitigation, and disclose risks that would help inform whether such proposals are in the public interest—which is the key determination that the FCC must make prior to licensing any of these projects. Moreover, a PEIS could provide benefits to proponents, for example, by allowing for streamlined consideration of individual project proposals, as NEPA compliance would be assured on the front end rather than primarily on a project-by-project basis.

BACKGROUND ON ORBITAL DATA CENTERS

Under U.S. and international law, outer space is a globally shared public resource. According to the Outer Space Treaty, which the United States ratified in 1967, the use of outer space "shall be the province of all mankind."[1] No nation can appropriate or claim sovereignty over the heavens.[2] Parties to the treaty are obliged to "bear international responsibility for national activities in outer space . . . whether such activities are carried on by governmental agencies or by non-governmental entities."[3] In the decades following ratification of this treaty, the foundation of all international space regulation,[4] countries around the globe embedded these principles into their own systems for regulating the operation of satellites in outer space. In the United States, Congress vested in the FCC the authority to determine "whether the public interest, convenience, and necessity will be served by the granting" of an application to operate a satellite.[5]

In recent years, however, the FCC's regulatory regime has been tested by a veritable explosion of satellite applications.[6] Since the late 2010s, the number of satellites proposed and approved to enter orbit has grown exponentially. In 2015, there were about 1,400 active satellites, compared with almost 5,500 in mid-2022; experts have predicted the launch of nearly 60,000 additional satellites by 2030.[7] Of the approximately 15,000 satellites in orbit as of 2026, roughly 50 percent were launched in just the last five years.[8]

---

[1] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space Including the Moon and other Celestial Bodies, art. I, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 (entered into force Oct. 10, 1967; ratified by the United States Oct. 10, 1967).

[2] *Id.* art. II.

[3] *Id.* art. VI.

[4] Michael B. Runnels, *Protecting Earth and Space Industries from Orbital Debris: Implementing the Outer Space Treaty to Fill the Regulatory Vacuum in the FCC's Orbital Debris Guidelines*, 60 Am. Bus. L.J. 175, 176 (2023).

[5] 47 U.S.C. § 309(a).

[6] *See* Space Modernization for the 21st Century, 90 Fed. Reg. 56338, 56339 (Dec. 5, 2025) (FCC acknowledging that "change and rapid growth in the space industry has created new demands on the Commission's resources and raised new questions about how to apply the existing licensing framework to new satellite and earth station technologies").

[7] U.S. Gov't Accountability Off., Large Constellations of Satellites: Mitigating Environmental and Other Effects 1, 5–6 (Sept. 2022) ("GAO").

[8] Science7 (S7) Academies, Large Satellite Constellations: Perspectives and Challenges 13 (2026) ("S7").

According to an analysis by the Congressional Budget Office ("CBO"), this startling growth was spurred by so-called "mega-constellations"—that is, constellations[9] of at least 100 satellites.[10] Space Exploration Technologies Corporation, a.k.a. SpaceX, pioneered the mega-constellations with its Starlink project, a commercial mobile broadband venture. The FCC first granted SpaceX the authority to deploy 4,425 Starlink satellites in 2018.[11] By 2020 and 2021, Starlink communication satellites accounted for over half the launches of low-earth satellites; as of 2026, SpaceX had launched over 10,000 Starlink satellites.[12] Other examples of mega-constellations include Amazon's Kuiper satellites, China's Guowang satellites, and the OneWeb network.[13]

In the last year, a handful of companies have proposed a new generation of mega-constellations, which are designed to serve as massive data center networks that can orbit the Earth. Such proponents claim that these "orbital data centers" will facilitate the rapid expansion of artificial intelligence ("AI") computing without the social, economic, or environmental problems posed by terrestrial data centers, which have become politically controversial.[14] They claim that such satellites' sun-synchronous orbits will allow for the exploitation of "near-constant solar power."[15]

The first such proposal came on January 30, 2026, when SpaceX sought permission to deploy a mega-constellation "of a million satellites that operate as orbital data centers" and "can

---

[9] Satellites "constellations," coordinated collections of satellites that together are used to accomplish some joint end, have been orbiting the Earth for decades. The GPS constellation, for instance, first launched in the late 1970s and early 1980s. Until recently, however, such constellations were relatively small (in the case of the GPS constellation, about 30 satellites). *See* Cong. Budget Off., Large Constellations of Low-Altitude Satellites: A Primer 12 (May 2023) ("CBO").

[10] CBO at 12; *see also* GAO at 3.

[11] Space Exploration Holdings, LLC, Application for Approval for Orbital Deployment and Operating Authority for the SpaceX NGSO Satellite System, Memorandum Opinion, Order and Authorization, 33 FCC Rcd. 3391 (2018).

[12] COB at 12; SpaceX, Consolidated Opposition and Response No. PC0114150 to ICFS File No. SAT-LOA-20260108-00016, at 6 (Mar. 16, 2026).

[13] S7 at 9; Lois Miraux et al., *Environmental Sustainability of Future Proposed Space Activities*, 200 Acta Astronautica 329, 334 (2022).

[14] *See, e.g.*, Blue Origin, LLC, Application for Authority to Launch and Operate the Blue Origin Orbital Data Center System, ICFS File No. SAT-LOA-20260310-00118, at 4 (Call Sign S00830) (Mar. 19, 2026) ("Blue Origin Application") (proposing to expand existing compute infrastructure by deploying orbital data centers that operate "independently of Earth-based constraints," which in turn will support the "insatiable demand for AI").

[15] *Id.* at 4–5.

harness the Sun's full power—while supporting AI-driven applications for billions of people today."[16] According to SpaceX, the satellites will operate within sun-synchronous orbital shells spanning up to 50 km each at altitudes of between 500 and 2,000 km, which "provides the opportunity for greater exposure to sunlight."[17] SpaceX "plans to design and operate different versions of satellite hardware to optimize operations across orbital shells,"[18] though it does not provide details concerning such plans. Assuming an average five-year lifespan per satellite, SpaceX's proposal countenances as many as 200,000 satellites re-entering the atmosphere and another 200,000 satellites being launched, each year, for the indefinite future.[19]

Less than a week later, a startup called Starcloud (founded in 2024) sought FCC authorization to deploy a system of up to 88,000 data center satellites similarly operating within sun-synchronous orbital shells up to 50 km apart, though Starcloud proposed operating at a lower altitude of between 600 km and 850 km.[20] (For initial testing, Starcloud proposed using even lower altitudes.)[21]

More such proposals followed quickly. In March 2026, Blue Origin, a space technology company owned by Amazon founder Jeff Bezos, proposed "Project Sunrise," a mega-constellation consisting of up to 51,600 data center satellites operating in circular, sun-synchronous orbit.[22] The satellites will be organized in orbital planes between 500 and 1,800 km in altitude, consisting of approximately 300 to 1,000 satellites per plane.[23] The most recent orbital data center application was proposed by Cowboy Space Corporation, an aerospace and energy company founded by the "billionaire co-founder and former co-CEO of the financial services platform Robinhood," who aspires "to build an American power grid in space."[24] In May 2026, Cowboy Space proposed to launch and operate "Stampede," a system of up to 20,000

---

[16] SpaceX, Application for Launch and Operating Authority for the SpaceX Orbital Data Center System, ICFS File No. SAT-LOA-20260108-00016, at 1 (Call Sign S00798) (Jan. 30, 2026) ("SpaceX Application").

[17] *Id.* at 1–3.

[18] SpaceX Application, Technical Attachment at A-1.

[19] DarkSky Int'l, Reply No. PC0114248 to ICFS File No. SAT-LOA-20260108-00016, at 5 (Mar. 23, 2026).

[20] Starcloud, Inc., Application for Launch and Operating Authority for the Starcloud Orbital Datacenter System, ICFS File No. SAT-LOA-20260202-00073, at 1 (Call Sign S00803) (Feb. 4, 2026) ("Starcloud Application").

[21] *Id.* at 3.

[22] Blue Origin Application at 2.

[23] *Id.*

[24] Cowboy Space Corp., Application for Space Station License, ICFS File No. SAT-LOA-20260323-00135, at 3 (Call Sign S00851) (May 11, 2026) ("Cowboy Space Application").

satellites operating in sun-synchronous orbits contained in orbital shells between 700 and 1,000 km in altitude.[25] According to Cowboy Space, its first launch is scheduled for 2028, with subsequent launches to follow in the months and years thereafter.[26]

All of these pending proposals frame their projects with grandiose, overheated rhetoric—SpaceX, for instance, claims that its orbital data centers will "ensur[e] humanity's multi-planetary future amongst the stars."[27] But all are conspicuously vague on the subject of environmental impacts and mitigation. For instance, experts have warned that mega-constellations are creating significant light pollution, which is harming wildlife, academic and amateur astronomy, and indigenous cultural practices.[28] (The issue of light pollution is discussed in more detail below.) Civil society groups such as the American Astronomical Society have striven to work with commercial satellite operators to mitigate light pollution from mega-

[25] *Id.* at 6.

[26] *Id.* In addition to these applications, Google is reportedly developing its own orbital data center proposal, branded "Project Suncatcher," with the company hoping to launch a prototype "around 2027." *Google in Talks with SpaceX for Suncatcher Orbital Data Center Project*, Reuters (May 12, 2026), https://www.reuters.com/science/google-spacex-talks-explore-data-centers-orbit-wsj-reports-2026-05-12/. If this project progresses to a formal application to the FCC, the agency must include it in its PEIS. A further, related proposal came from a startup called Reflect Orbital, which sought FCC approval to launch a satellite prototype to a target altitude of 600 to 650 km, where it would open a mirror almost 60 feet wide. According to Reflect Orbital, this "first satellite . . . will serve as a crucial testbed for the development and use of space-based reflectors," which can purportedly direct "abundant sunlight . . . to specific locations at specific times." Though Reflect Orbital's application requests permission to launch only its "first satellite," the company seeks to launch 1,000 satellites by the end of 2028, 5,000 satellites by 2030, and 50,000 satellites by 2035, all reflecting sunlight on demand. The swiftness of this timeline, and the scale of Reflect Orbital's envisioned mega-constellation, necessitates the inclusion of Reflect Orbital's full projected scope in any programmatic analysis. *See* Reflect Orbital, Inc., Application for Authority to Construct, Launch, and Operate a Non-Geostationary Orbit Satellite in the Space Operation and Space Research Services, ICFS File No. SAT-LOA-20250701-00129, at 2, 5 (Call Sign S00711) (July 31, 2025); Kenneth Chang & Hiroko Tabuchi, *A Big Night Light in the Sky? Start-Up Wants to Launch a Space Mirror*, N.Y. Times (Mar. 9, 2026), https://www.nytimes.com/2026/03/09/climate/space-mirror-satellite-solar.html.

[27] SpaceX Application at 1.

[28] *See, e.g.*, Kevin J. Gaston et al., *Environmental Impacts of Increasing Numbers of Artificial Space Objects*, 21 Frontiers in Ecology and the Env't 289, 292 (2023) (collecting sources).

constellations, but studies suggest that such mitigation measures are insufficient to keep pace with the vastly growing number of satellites in orbit.[29]

No applicant explains how it will minimize or mitigate the increased brightness that will naturally accompany more than a million new points of light in the sky. Cowboy Space includes just two sentences promising that each of its satellites "will be designed and operated to minimize potential impact on the astronomy community," apparently due to its reliance on (unspecified) "measures to mitigate satellite reflectivity."[30] Blue Origin provides three sentences promising mitigation measures that will "be designed and will be operated to minimize impacts on the astronomy community,"[31] though it does not provide technical details or evidence of efficacy.[32] Starcloud's application mentions that it will implement "established brightness mitigation measures" but provides no further information.[33] And SpaceX's application contains a single reference to "developing industry-leading brightness mitigations,"[34] but it too provides no detail.[35]

---

[29] Przemek Mróz et al., *Impact of the SpaceX Starlink Satellites on the Zwicky Transient Facility Survey Observations*, 924 Astrophysical J. Letters 1 (2022) (recent study finding a dramatic increase in the number of astronomical images affected by light pollution caused by Starlink satellites); *id.* at 6 ("[t]he number of images affected by satellite trails is alarmingly growing as more and more Starlink satellites are being deployed in orbit"); DarkSky Int'l, Comment No. PC0112629 on ICFS File No. SAT-LOA-20260108-00016, at 12 (Mar. 6, 2026).

[30] Cowboy Space Application, Technical Annex at 7.

[31] Blue Origin Application, Technical Annex at A-9.

[32] In response to criticism of this lack of detail, Blue Origin responded that its application "includes multiple commitments to reduce impacts to the astronomy community" and that "Blue Origin is exploring a multi-faceted approach to reducing the visibility of satellites," though it provided no further details. Blue Origin, LLC, Consolidated Opposition and Response No. PC0115026 on ICFS File No. SAT-LOA-20260310-00118, at 12 (May 28, 2026).

[33] Starcloud Application at 4. In response to criticism for this vagueness, Starcloud "offer[ed] three purported solutions: greater transparency; mitigation conditions and commitments; and phased deployment and further study, but only *after* the Commission approves their mega-constellation." DarkSky Int'l, Reply No. PC0114902 to ICFS File No. SAT-LOA-20260202-00073, at 3 (May 14, 2026).

[34] SpaceX Application at 5–6.

[35] In response to criticism of this lack of detail, SpaceX claimed that it "will develop and implement advanced brightness mitigation techniques for its proposed system," though it provided no further detail. SpaceX, Consolidated Opposition and Response No. PC0114150 to ICFS File No. SAT-LOA-20260108-00016, at i (Mar. 16, 2026); *see also id.* at 12–15.

Numerous members of the public, public interest organizations, government agencies, and even competing applicants[36] have alerted the FCC to these and other omissions in the orbital data center applications.[37] Indeed, the SpaceX application received well over a thousand public comments. The National Aeronautics and Space Administration ("NASA"), for instance, has expressed concern about "the limited technical detail contained in [Blue Origin's] application and the absence of an orbital debris mitigation plan," which "make it unclear whether the proposed technical design and coordination measures will suffice to support spaceflight safety measures."[38] Similarly, NASA commented that "it is unclear whether [SpaceX's] plans are scalable and sustainable for the proposed system," in part because its application contains "minimal details on how many satellites will be disposed via atmospheric reentry, how many will be raised above 2000km for disposal, and when such transitions will occur across the lifetime of the fleet," while SpaceX's promises about mitigating orbital debris "cannot be considered viable."[39] NASA likewise noted it was "difficult" to determine whether Starcloud's

---

[36] SpaceX and Amazon have requested or suggested that the FCC deny the other's applications. *See* SpaceX, Comment No. PC0114202 on ICFS File No. SAT-LOA-20260310-00118 (Mar. 20, 2026) (attaching Amazon petition to deny SpaceX orbital data center application and requesting that FCC "assess the same substantive and procedural arguments with respect to Blue Origin's application"); SpaceX Comment No. PC0114934 on ICFS File No. SAT-LOA-20260310-00118, at 1 (May 18, 2026) (arguing that "Blue Origin's application provides inconsistent information on its proposed operations"); SpaceX, Consolidated Opposition and Response No. PC0114150 to ICFS File No. SAT-LOA-20260108-00016, at iii (Mar. 16, 2026) (discussing Viasat and Amazon criticisms of SpaceX's proposal). SpaceX claims, for instance, that Blue Origin's proposed antenna design is inefficient and risks creating harmful interference. SpaceX Comment No. PC0114934 on ICFS File No. SAT-LOA-20260310-00118, at 3 (May 18, 2026). Viasat, meanwhile, claims that Starcloud's proposal "would pose material interference and space safety risks if authorized." Viasat, Inc., Comment No. PC0114834 on ICFS File No. SAT-LOA-20260202-00073, at 1 (Apr. 13, 2026).

[37] DarkSky International, for instance, notes that SpaceX "makes no commitment to *any* mitigation measures, nor does it provide any actual facts about what it will do to mitigate the adverse impacts of its activities, or even if it is technically possible to do so." DarkSky Int'l, Comment No. PC0112629 on ICF File No. SAT-LOA-20260108-00016, at 11 (Mar. 6, 2026). The American Astronomical Society commented that Project Sunrise "involves numerous objects of unspecified but presumably very large size at higher orbital inclinations, which would therefore be visible for longer in the night sky" and could therefore cause sufficient light pollution and interference to "undermine decades of federal investment in astronomical facilities." Am. Astronomical Soc'y, Comment No. PC0114938 on ICFS File No. SAT-LOA-20260310-00118, at 2–3 (May 19, 2026).

[38] NASA, Comment No. PC0114787 on ICFS File No. SAT-LOA-20260310-00118, at 2 (Apr. 30, 2026).

[39] NASA, Comment No. PC0110423 on ICFS File No. SAT-LOA-20260108-00016, at 2 (Mar. 4, 2026).

proposal was scalable, an uncertainty that "poses risks to NASA's ability to plan future NASA mission deployments and operations," especially since Starcloud had not provided sufficient information for collision risk to be calculated.[40]

As of the submission of this petition, the orbital data center applications are still pending, but Petitioners are concerned that no proponent has yet provided more than a token acknowledgment of environmental risks. Moreover, no proponent has provided satisfactory detail to explain how it will mitigate the cumulative environmental harms flowing from the foreseeable operation of more than a *million* satellites, orbiting our planet, colliding and disintegrating and plummeting back to Earth.

Petitioners therefore urge the FCC to analyze the overlapping environmental impacts of the pending orbital data center applications prior to their approval, as NEPA requires and as detailed below.

ARGUMENT

I. NEPA REQUIRES AGENCIES TO "LOOK BEFORE THEY LEAP"

The National Environmental Policy Act of 1970 ("NEPA"), 42 U.S.C. § 4331 et seq., often called the "Magna Carta" of American environmental law, embodies our Nation's environmental conscience. In enacting NEPA, Congress issued a sweeping declaration of values and a call to action, centering the protection of human health and the environment in all federal agency decisions. The statute affirms the government's role to "fulfill the responsibilities of each generation as trustee of the environment for succeeding generations." *Id.* § 4331(b)(1). To implement these goals, NEPA institutes a national policy of "look before you leap" by requiring all federal agencies to carefully analyze and disclose to the public the potential environmental impacts of, and feasible alternatives to, federal agency actions. *Id.* § 4332(C). In other words, the statute "ensures that [federal] agenc[ies] and the public are aware of the environmental consequences of proposed projects." *Seven Cnty. Infrastructure Coal. v. Eagle County*, 605 U.S. 168, 177 (2025). And as the Courts have held, the need for careful NEPA review is heightened when "expanding technolog[y]" with unknown impacts is involved. *Found. on Econ. Trends v. Heckler,* 756 F.2d 143, 147 (D.C. Cir. 1985); *see also* 42 U.S.C. § 4331(a) (recognizing "the profound impact of . . . new and expanding technological advances").

Section 101 of NEPA sets forth a national policy "to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans." 42 U.S.C. § 4331(a). It also gives federal agencies "continuing responsibility" to fulfill their role as a "trustee of the environment for succeeding

[40] NASA, Comment No. PC0114595 on ICFS File No. SAT-LOA-20260202-00073, at 1 (Apr. 14, 2026).

generations"; assure all Americans have "safe, healthful, productive, and esthetically and culturally pleasing surroundings"; "attain the widest range of beneficial uses of the environment without degradation" or risk; preserve "natural aspects of our national heritage"; and "achieve a balance between population and resource use." *Id.* § 4331(b). Finally, Congress recognizes in Section 101 the right and responsibility of each person to "enjoy a healthful environment and . . . to contribute to the preservation and enhancement of the environment." *Id.* § 4331(c).

Section 102 of NEPA applies the national policy set forth in Section 101 to "proposals for . . . major Federal actions significantly affecting the quality of the human environment." *Id.* § 4332(C). Specifically, Section 102 requires Federal agencies to prepare a "detailed statement," which has become known as an environmental impact statement or EIS, analyzing: (i) the reasonably foreseeable environmental impact of the proposed action; (ii) any reasonably foreseeable adverse effects that cannot be avoided; (iii) the beneficial and adverse effects of a reasonable range of alternatives to the proposed action, including the no action alternative, that are technically and economically feasible and meet the purpose and need of the proposal; (iv) the relationship between local short-term uses of humankind's environment and the maintenance and enhancement of long-term productivity; and (v) any irreversible and irretrievable commitments of resources that would be involved in the proposed action. *Id.* § 4332(C). The congressional mandates set forth in Section 102 are to be implemented "to the fullest extent possible." *Id.* § 4332(C). NEPA demands a "systematic, interdisciplinary approach" to "ensure the integrated use of the natural and social sciences." *Id.* § 4332(A). The statute also recognizes the need to ensure "unquantified environmental amenities and values" are considered in agency decision-making. *Id.* § 4332(B).

NEPA also requires federal agencies to study and develop alternatives to proposed actions, *id.* § 4332(F); to recognize the "worldwide and long-range character of environmental problems" and "maximize international cooperation in anticipating and preventing a decline in the quality of mankind's world environment," *id.* § 4332(I); and make advice and information available to states, municipalities, and the public to be used in "restoring, maintaining, and enhancing the quality of the environment." *Id.* § 4332(J).

While the present Administration has taken steps to weaken NEPA, for example, by revoking most of its implementing regulations, *see* 90 Fed. Reg. 10610 (Feb. 25, 2025), NEPA remains the law of the land. In fact, despite pressures to undermine this decades-old statutory mandate, in 2023 Congress strengthened and reaffirmed NEPA as part of the Fiscal Responsibility Act, Pub. L. No. 118-5, § 321, 137 Stat. 10, 38–46 (2023).

The FCC is a federal agency subject to NEPA and issuance of satellite licenses constitutes major federal actions subject to NEPA. *See, e.g.*, *Ctr. for Biological Diversity v. Fed. Aviation Admin.*, 804. F. Supp.3d 86, 92 (D.D.C. 2025) ("Granting a license [for space-related activities] is considered a major action under NEPA."). The FCC promulgated NEPA regulations decades ago, *see* 47 C.F.R. § 1.1306–1.1307, and is evaluating whether to update them. *See Modernizing the Commission's National Environmental Policy Act Rules*, 90 Fed. Reg. 40295 (Aug. 19, 2025).

Some applicants have suggested in their filings that NEPA is inapplicable to the orbital mega-constellations because they are "extraterritorial" to the United States. The FCC itself stated as much in a recent notice of proposed rulemaking to amend its NEPA regulations: "We propose that space-based operations be excluded from NEPA because they are 'extraterritorial activities' with effects located entirely outside of the jurisdiction of the United States." 90 Fed. Reg. at 40300.[41] The argument makes no sense: if these projects were outside the jurisdiction of the United States, then they would not be regulated by the FCC at all. In any event, any questions about NEPA's applicability to activities in the exosphere were laid to rest in the 202e amendments to NEPA. While it is true that "extraterritorial" actions are excluded from NEPA, the proposed orbital data centers are not extraterritorial. NEPA defines extraterritorial actions as "agency activities or decisions with *effects located entirely outside* of the jurisdiction of the United States." 42 U.S.C. § 4336e(10)(B)(vi) (emphasis added). As documented herein and in the many administrative records for specific project proposals now pending before the FCC, the proposals involve many serious effects within U.S. jurisdiction, and hence are subject to NEPA.

II. NEPA PROVIDES FOR PREPARATION OF A PROGRAMMATIC EIS WHERE MULTIPLE PROJECTS SHARE SIMILAR OR CUMULATIVE IMPACTS.

When Congress amended NEPA as part of the Fiscal Responsibility Act, it added provisions explicitly authorizing the use of PEISs. Specifically, 42 U.S.C. § 4336b provides that "[w]hen an agency prepares a programmatic environmental document for which judicial review was available, the agency may rely on the analysis included in the programmatic environmental document in a subsequent environmental document for related actions . . ." under certain conditions. In turn, a "programmatic environmental document" means "an environmental impact statement or environmental assessment analyzing all or some of the environmental effects of a policy, program, plan, *or group of related actions*." *Id.* § 4336e(11) (emphasis added).

Courts have recognized the duty to prepare a "comprehensive" EIS since NEPA's earliest days. *See, e.g.*, *Kleppe v. Sierra Club*, 427 U.S. 390, 409 (1976).[42] In *Kleppe*, the U.S. Supreme Court confirmed that when "several proposals" for related actions that "will have cumulative or synergistic environmental impact . . . are pending concurrently before an agency, their environmental consequences must be considered together. Only through comprehensive consideration of pending proposals can the agency evaluate different courses of action." *Id.* at 409–10. Following this precedent, courts have agreed that a single EIS is required for multiple discreet actions under certain circumstances, for example, when the projects have common

[41] As of this filing, this proposed rulemaking has not been finalized.

[42] Federal guidance and courts have over time variously referred to broad NEPA reviews as comprehensive, programmatic, area-wide, or overview EISs. The label is not important; it is the content of such an assessment that matters. While the FCC may not have a "program" related to orbital data centers, the term "programmatic" best captures the review necessary to evaluate similar, shared, and cumulative impacts from multiple similar projects.

timing, geography, and/or impacts. *See Protect Our Cmtys. Found. v. LaCounte*, 939 F.3d 1029, 1038 (9th Cir. 2019) ("we require agencies to issue a single EIS for 'connected, cumulative, and similar actions' like this project"); *Native Ecosystems Council v. Dombeck,* 304 F.3d 886, 893–94 (9th Cir. 2002) ("A single NEPA review document is required for distinct projects when . . . the projects are 'connected,' 'cumulative' or 'similar' actions . . ."); *Blue Mountains Biodiversity Project v. Blackwood*, 161 F.3d 1208, 1215 (9th Cir. 1998), *cert. denied*, 527 U.S. 1003 (1999) (multiple timber sales must be evaluated in a single EIS where the sales were reasonably foreseeable, in a single general area, disclosed at the same time, and developed as part of a comprehensive strategy); *Earth Island Inst. v. U.S. Forest Serv.,* 351 F.3d 1291 (9th Cir. 2003) (confirming that "similar actions"—i.e., actions which have similarities, such as common timing or geography, that warrant comprehensive review—must be considered in a single EIS if it is the "best way" to consider their impacts).[43]

Agencies routinely embrace this obligation and opportunity. A few recent examples include:

- **BLM Utility-Scale Solar Energy Development PEIS** (2024): Instead of reviewing a single solar facility, the Bureau of Land Management ("BLM") evaluated a framework for future utility-scale solar development across eleven western states and multiple land-use plans simultaneously.[44]

[43] The Council on Environmental Quality ("CEQ") promulgated regulations governing PEIS standards that stood for decades. This Administration has withdrawn those regulations, *see Notification of Withdrawal of Guidance Documents*, 91 Fed. Reg. 39086 (June 29, 2026), replacing them with guidance and agency-specific regulations. But their content nonetheless remains a useful guide for implementing NEPA. And those regulations call for a PEIS in precisely such circumstances as this. Agencies were specifically directed to use PEISs to "prepare analytical, concise, and informative environmental documents." 40 C.F.R. § 1500.4(h) (2024). PEISs were urged for "group of projects or related types of projects." *Id.* § 1501.11(a)(2)(v) (2024); *see also id.* § 1508.1(ee) (2024) (defining programmatic environmental document). Previous iterations of these rules were even more directive. *See, e.g.*, 40 C.F.R. § 1508.25 (1978) (mandating single EIS for separate independent actions under some circumstances); 40 C.F.R. § 1502.4(a), (c) (1978) (requiring a single EIS where proposals are "related to each other closely"); *see also* Memorandum from Michael Boots, CEQ, for Heads of Federal Departments and Agencies: Effective Use of Programmatic NEPA Reviews (Dec. 18, 2014), https://ceq.doe.gov/docs/ceq-regulations-and-guidance/Effective_Use_of_Programmatic_NEPA_Reviews_Final_Dec2014_searchable.pdf.

[44] BLM, Final Programmatic Environmental Impact Statement and Proposed Resource Management Plan Amendments for Utility-Scale Solar Energy Development (Aug. 2024), https://www.energy.gov/documents/final-eis-0557-solar-programmatic-vol-1-2024-10-16pdf.

- **NASA Mars Return Programmatic EIS** (2023): NASA prepared a programmatic EIS to deal with a long-term, multi-stage federal program to explore Mars.[45]

- **U.S. Department of Agriculture APHIS Biotechnology Regulations PEIS** (2020): The Animal and Plant Health Inspection Service ("APHIS") prepared a PEIS for revisions to its biotechnology regulations governing genetically engineered organisms.[46]

- **National Oceanic and Atmospheric Administration ("NOAA") Restoration PEIS** (2015): NOAA's Restoration Center prepared a PEIS on a broad range of future habitat restoration activities, allowing streamlined NEPA consideration of specific projects.[47]

- **Department of Energy ("DOE") / BLM Energy Corridors PEIS** (2008): This multi-agency PEIS covered the designation of energy corridors on federal land in eleven western states.[48]

The FCC's NEPA regulations do not specifically address PEISs. This is unsurprising: As virtually all entities appear to agree, the FCC's NEPA regulations are woefully out of date. Its NEPA regulations have not been overhauled since 1986 and presume all actions to be categorically excluded from environmental review. 47 C.F.R. § 1.1306. Only if an action falls into a limited list of "extraordinary circumstances" is an Environmental Assessment ("EA") triggered. *Id.* § 1.1307. The FCC delegates the initial determination of whether an EA is warranted, and the preparation of said EA, to the applicants themselves. *Id.*

---

[45] NASA, Mars Sample Return (MSR) Campaign: Programmatic Environmental Impact Statement (June 2023), https://cdxapps.epa.gov/cdx-enepa-II/public/action/eis/details?eisId=416448; *see also* NASA, *Programmatic Environmental Impact Statement Approach*, https://www.nasa.gov/wp-content/uploads/2023/10/508-msr-peis-factsheet-2b-programmatic-eis-approach-111022.pdf.

[46] U.S. Department of Agriculture, Revisions to USDA-APHIS 7 CFR Part 340 Regulations Governing the Movement of Organisms Modified or Produced Through Genetic Engineering: Final Programmatic Environmental Impact Statement (May 2020), https://www.aphis.usda.gov/sites/default/files/340-secure-rule-eis.pdf.

[47] NOAA Restoration Center, Programmatic Environmental Impact Statement (June 2015), https://media.fisheries.noaa.gov/dam-migration/2015_noaa_restoration_center_final_peis.pdf.

[48] U.S. Department of Energy, Programmatic Environmental Impact Statement: Designation of Energy Corridors on Federal Land in 11 Western States (Nov. 2008), https://www.energy.gov/documents/eis-0386-feis-summary-2008pdf.

These regulations are especially inadequate to the task of dealing with modern proposals to develop mega-constellations of data centers.[49] The FCC's recent proposal to amend its NEPA regulations itself concedes that "[o]ur current rules for implementing NEPA do not include any provisions specific to satellite networks." 90 Fed. Reg. at 40299. A 2022 GAO analysis criticized the agency's outdated approach to NEPA compliance in the satellite context, concluding that it "has not explained and documented how its decision to categorically exclude licensing large constellations of satellites is current and appropriate."[50] And while the FCC has a process whereby interested parties can petition that the categorical exclusion from NEPA analysis be waived in "extraordinary circumstances," the GAO found that the "FCC has not provided guidance for doing so by documenting either internally or for the public what may constitute an extraordinary circumstance."[51]

In any event, even under these gravely outdated regulations, a full environmental review is warranted. The cumulative effect of multiple mega-constellation projects, with their attendant light and air pollution, safety risks, and other effects will impact "wilderness area[s]," "wildlife preserve[s]," "threatened [and] endangered species [and] designated critical habitat," "sites eligible for listing [under] the National Register of Historic Places," and "Indian religious sites." 47 C.F.R. § 1.1307(a)(1)–(5). All of these factors weigh against use of a categorical exclusion.

III. THE PROPOSED ORBITAL DATA CENTER CONSTELLATIONS SHARE COMMON ENVIRONMENTAL, HEALTH, AND ECONOMIC IMPACTS.

It is difficult to imagine a better example of multiple projects presenting essentially identical impacts and risks that compound synergistically and cumulatively than the present proposals for orbital data center constellations. The FCC's default position that such projects "individually and cumulatively" have no environmental impact is plainly inapplicable here. 47 C.F.R. § 1.1306(a). The impacts of each orbital data center proposal are not unique but build upon past orbital mega-constellations and each other to create significant environmental, public health, and cultural concerns. These include, at a minimum:

Environmental impacts of light pollution: Orbital data center proposals portend an unprecedented alteration of the night sky. Two different sources of light pollution are likely to result from the vast fleets of satellites that the mega-constellation applicants propose. First, the proposed satellites will reflect sunlight directly toward the Earth's surface. Second, the proposed

---

[49] *See generally* R.J. Ryan, *The Fault in Our Stars, Challenging the FCC's Treatment of Commercial Satellites as Categorically Excluded from Review under the National Environmental Policy Act*, 22 Vanderbilt J. of Ent. and Tech. Law 923 (2020) (arguing that FCC is violating NEPA by categorically excluding satellite operations).

[50] U.S. Gov't Accountability Off., Satellite Licensing: FCC Should Reexamine Its Environmental Review Process for Large Constellations of Satellites 23 (Nov. 2022).

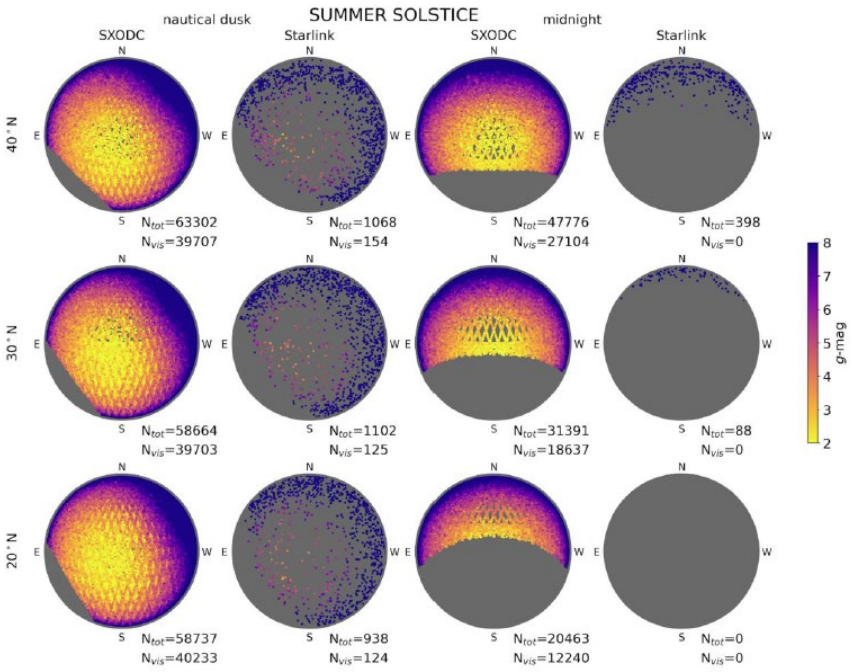
[51] *Id.* at 26. FCC has also recently proposed to "overhaul its space licensing processes." 90 Fed. Reg. at 56340. As of this filing, however, the FCC has yet to finalize its suggested overhaul.

satellites will increase "skyglow," i.e., background light. Such light pollution poses potentially significant aesthetic, scientific, and health effects on the human environment on Earth.

According to preliminary simulations reported by the American Astronomical Society, a mega-constellation on the order of a million satellites:

> would result in tens of thousands of satellites being easily visible to the unaided eye globally . . . appearing as crawling 'grids' of moving points of light . . . For much of the globe, for much of the night, for much of the year, these simulations show there would be far more visible satellites than stars. . . . [E]ven at the equinox, only roughly half of the dark hours of the night would leave much of the sky without interference from very bright satellite streaks.[52]

The staggering extent of this visual disturbance is best captured visually:



This figure compares the expected brightness of the SpaceX orbital data center proposal (one million satellites), compared to its Starlink constellation.[53]

---

[52] Am. Astronomical Soc'y, Petition No. PC0112469 on ICFS File No. SAT-LOA-20260108-00116, at 3–4 (Mar. 6, 2026).

[53] *Id.* at 5 fig. 1. Column 1 shows the sky at nautical twilight (at three different latitudes) in the presence of the SpaceX orbital data center constellation, while column 2 shows the same sky in the presence of the Starlink constellation. Column 3 shows the sky at midnight (at three different latitudes) in the presence of the SpaceX orbital data center constellation, while column 4 shows the same sky in the presence of the Starlink constellation.

Numerous studies have documented a range of negative impacts that light pollution can have on human health. Nighttime light exposure can disrupt sleep by suppressing melatonin production, result in visual discomfort or retinal damage, and possibly even increase risks of cancer.[54] Associations have been shown for breast and prostate cancer, while other potential associations include ovarian, colorectal, and non-Hodgkins lymphoma. According to a report from the United Nations Office for Outer Space Affairs, "strong evidence" suggests that "chronic exposure to light at night increases risk of cancer, diabetes, obesity, and heart disease."[55] Given the scale of proposed mega-constellations and their resulting brightness, it is important that FCC consider the potential human health impacts resulting from artificial light at night.

FCC must also study the potentially significant impacts of increased light pollution on animal and plant life. A third of vertebrates and a *majority* of invertebrates are nocturnal and therefore especially sensitive to nighttime light, which can affect reproduction, migration, feeding, orientation, and pollinator-plant and predator-prey relationships.[56] Studies show, for instance, that anthropogenic light impairs the ability of birds to migrate at night (especially concerning for birds that navigate by starlight), which can result in exhaustion or even mortality, and can disrupt their perception of day length, causing them to breed earlier in the spring than is optimal.[57] This includes many birds listed under the Endangered Species Act, such as the Newell's shearwater and the Hawaiian petrel.[58] Increases in nighttime light can harm bat roosting and foraging, reduce longevity and reproduction in rodents, and disrupt the daily and seasonal rhythms of many other mammals.[59] Indeed, only a small degree of light pollution can result in significant harm to the endangered little brown bat.[60] Nighttime light can reduce the

---

[54] Dark and Quiet Skies for Science and Society: Report and Recommendations 93–100 (United Nations Office for Outer Space Affairs, 2021); Kenneth P. Wright Jr. et al., *Entrainment of the Human Circadian Clock to the Natural Light-Dark Cycle*, 23 Current Biology 1554 (2013).

[55] Dark and Quiet Skies, *supra*, at 100; *see also* Jennifer A. Evans & Alec J. Davidson, *Health Consequences of Circadian Disruption in Humans and Animal Models,* 119 Progress in Molecular Biology & Translational Sci. 283 (2013).

[56] Kevin J. Gaston & Alejandro Sanchez de Miguel, *Environmental Impacts of Artificial Light At Night*, 47 Annual Rev. of Env't & Res. 373, 382–84 (2022); Dark and Quiet Skies, *supra*, at 92, 102–09. *See also* Javier Barbuzano, *Animal Navigators*, Sky & Telescope (June 2026), at 20–27.

[57] Annika K. Jägerbrand & Kamiel Spoelstra, *Effects of Anthropogenic Light on Species and Ecosystems*, 380 Science 1125, 1126 (2023).

[58] Brooke Friswold et al., *From Colony to Fallout: Artificial Lights Pose Risk to Seabird Fledglings Far From Their Natal Colonies*, 5 Conservation Sci. & Practice (2023), https://conbio.onlinelibrary.wiley.com/doi/10.1111/csp2.13000.

[59] Jägerbrand & Spoelstra, *Effects of Anthropogenic Light*, *supra*, at 1126.

[60] Chad L. Seewagen & Amanda M. Adams, *Turning to the Dark Side: LED Light at Night Alters the Activity and Species Composition of a Foraging Bat Assemblage in the Northeastern United States*, 11 Ecology & Evolution 5635 (2021).

ability of insects to use light for orientation cues, impair reproduction, and even induce exhaustion or mortality. Scientists have already identified light pollution as a driver of insect declines.[61] Artificial nighttime light also decreases plant diversity by as much as 43 percent, and production (i.e., biomass) by as much as 33 percent.[62] Such impacts should be considered in a programmatic way.[63]

Atmospheric pollution: The operation of more than a million data center satellites threatens potentially catastrophic forms and quantities of atmospheric pollution, risking damage to the climate, to the ozone layer, to human health, and to the chemistry of the stratosphere itself.

At the outset, satellites must be launched by rocket, and these launches release rocket exhaust emissions that contain pollutants such as aluminum oxides (alumina) and soot particles designated as black carbon.[64] Rockets are "unique" among anthropogenic sources of pollution because they inject pollutants directly into all atmospheric layers.[65] At the end of their lives,

---

[61] Jägerbrand & Spoelstra, *Effects of Anthropogenic Light*, *supra*, at 1126; Avalon C.S. Owens et al., *Light Pollution Is a Driver of Insect Declines*, 24 Biological Conservation (2020), https://www.sciencedirect.com/science/article/abs/pii/S0006320719307797?via%3Dihub.

[62] Solveig Franziska Bucher et al., *Artificial Light at Night Decreases Plant Diversity and Performance in Experimental Grassland Communities*, 378 Philosophical Transactions of the Royal Society B (Oct. 30, 2023), https://doi.org/10.1098/rstb.2022.0358.

[63] Additionally, mirrored mega-constellations such as Reflect Orbital's concentrate light in a manner that poses additional risks to the environment and to human health. *See, e.g.*, Jiangwei Zhu & Li Fu, *Ecological Risks of Orbital Solar Reflectors*, 392 Science 1132 (2026). Because the orbital mirror acts as a point source—visually 100,000 times smaller than a full moon—it concentrates light onto the human retina. At the angles most likely to be seen by an observer at ground level, such a reflection could have an intensity sufficient to cause damage in a fraction of a second, less time than is required for aversion or blink reflexes. *See* Eric Bretschneider, *Technical Report: Photobiological Hazard Assessment of Orbital Solar Reflectors*, All Things Lighting Ass'n (May 1, 2026), https://www.allthingslighting.org/technical-report-photobiological-hazard-assessment-of-orbital-solar-reflectors/. Indeed, directing a less-powerful laser at aircraft is a federal felony due to the risk of temporary or permanent ocular impairment. *See* 18 U.S.C. § 39A.

[64] S7 at 13. While the FAA has primary regulatory authority for rocket launches, the environmental effects of launches contribute to the cumulatively significant effects of orbital data center operations. In fact, launches and reentries—the latter of which FCC regulates—release similar suites of pollutants and should be analyzed cumulatively for that reason. For its part, FAA has yet to undertake its own programmatic environmental analysis of orbital data centers.

[65] Robert G. Ryan et al., *Impacts of Rocket Launch and Space Debris Air Pollutant Emissions on Stratospheric Ozone and Global Climate*, 10 Earth's Future (2022), https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2021EF002612.

satellites reenter the stratosphere, burning up by design and further releasing alumina and other metallic compounds as they break down.[66] The launches and reentries necessary to sustain a million or more satellites therefore promise to release pollutants at a scale far beyond anything to which space and Earth's atmosphere have previously been subjected.[67]

One likely consequence is climatic changes. Alumina particles reflect solar radiation and can therefore have a cooling effect in the lower atmosphere. Indeed, scientists have recently warned that the sheer quantity of alumina particulate matter likely to be produced by reentering mega-constellation satellites amounts to "an uncontrolled experiment" in geo-engineering.[68] Black carbon particles, in turn, absorb solar energy, heating the stratosphere while cooling the earth's surface. The scale of launches and reentries for orbital data centers could result in a significant climatic effect, potentially altering the planet's thermal balance. One analysis warned that even 1,000 annual launches of hydrocarbon-fueled rockets over a decade—a fraction of the number proposed by the orbital data center applicants—would result in a layer of black carbon particles sufficient to cause an energy imbalance (i.e., radiative forcing) comparable to that resulting from sub-sonic aviation.[69] Rockets fueled by methane produce soot that could likewise contribute to radiative forcing.[70] Reentry too is likely to produce statistically significant temperature anomalies.[71] The extent and likelihood of these climatic alterations must be studied with rigor.

Another likely chemical consequence of mega-constellation operation is depletion of the ozone layer. This is, according to one recent analysis, the "most immediately concerning"

---

[66] Daniel M. Murphy et al., *Metals from Spacecraft Reentry in Stratospheric Aerosol Particles*, 120 PNAS (2023), https://www.pnas.org/doi/10.1073/pnas.2313374120; Leonard Schulz & Karl-Heinz Glassmeier, *On the Anthropogenic and Natural Injection of Matter into Earth's Atmosphere*, 67 Advances in Space Research (2021), https://www.sciencedirect.com/science/article/abs/pii/S0273117720307663.

[67] Indeed, a recent study documented a lithium plume from the uncontrolled reentry of *a single* SpaceX Falcon 9 upper stage. Robin Wing et al., *Measurement of a Lithium Plume from the Uncontrolled Re-entry of a Falcon 9 Rocket*, 7 Commun. Earth Environ. (2026), https://www.nature.com/articles/s43247-025-03154-8.

[68] Aaron C. Boley & Michael Byers, *Satellite Mega-Constellations Create Risks in Low Earth Orbit, the Atmosphere and on Earth*, 11 Sci. Reps., at 4 (2021), https://www.nature.com/articles/s41598-021-89909-7.

[69] Martin Ross et al., *Potential Climate Impact of Black Carbon Emitted by Rockets*, 37 Geophysical Research Letters (2010), https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2010GL044548.

[70] Boley & Byers, *Satellite Mega-Constellations Create Risks in Low Earth Orbit*, *supra*, at 4.

[71] Christopher M. Maloney et al., *Investigating the Potential Atmospheric Accumulation and Radiative Impact of the Coming Increase in Satellite Reentry Frequency*, 130 J. Geophysical Research (2025), https://agupubs.onlinelibrary.wiley.com/doi/epdf/10.1029/2024JD042442.

environmental impact of space launches.[72] Almost all of the pollutants emitted during rocket launches and reentries deplete stratospheric ozone.[73] The depletion of the ozone layer, in turn, allows more ultraviolet solar radiation to reach earth and thereby increases the risk of skin cancer, cataracts and other ocular diseases, and other UV-radiation-related health effects.[74] It is vital that FCC consider the potential for ozone and human health impacts in a programmatic environmental analysis.

Finally, the discharge of metals from satellite reentry at this scale could potentially affect Earth's geomagnetic field.[75] While this possibility remains speculative, it must be studied, in part because it has the potential to disorient migratory birds and other species that rely on geomagnetic signals for navigation.[76]

Impacts on science and astronomy: Orbital data centers risk becoming a permanent disabling condition for professional and recreational astronomy. By design, the orbital data centers will remain illuminated by the sun for more than 99 percent of their orbital periods. Unlike satellites that enter earth's shadow after twilight, the orbital data centers will remain a source of light for hours, rendering the sky "inaccessible to professional astronomical observation" for "a significant fraction of the night."[77] Additionally, the sheer profusion and density of these mega-constellations will likely defeat astronomers' attempts to avoid them.[78] And the reflected sunlight aggregating from such an immense number of objects risks raising background sky brightness to a level that could make astronomical observations impossible,[79]

---

[72] J.A. Dallas et al., *The Environmental Impact of Emissions from Space Launches: A Comprehensive Review*, 255 J. Cleaner Production (2020), https://www.sciencedirect.com/science/article/abs/pii/S0959652620302560.

[73] Ryan et al., *Impacts of Rocket Launch and Space Debris*, *supra*.

[74] M. Norval et al., *The Effects on Human Health from Stratospheric Ozone Depletion and Its Interactions with Climate Change*, 6 Photochemical & Photobiological Sciences 232 (2007).

[75] Sierra Solter, *Ionospheric Perturbations from Satellite Dust*, in Geoengineering and Climate Change: Methods, Risks, and Governance 377 (Martin Beech, ed., 2025).

[76] Svenja Engels et al., *Anthropogenic Electromagnetic Noise Disrupts Magnetic Compass Orientation in a Migratory Bird*, 509 Nature 353 (2014).

[77] Am. Astronomical Soc'y, Comment No. PC0114938 on ICFS File No. SAT-LOA-20260108-00118, at 3–4 (May 19, 2026); Am. Astronomical Soc'y, Reply No. PC0107995 on ICFS File No. SAT-LOA-20260310-00116, at 3–4 (Mar. 23, 2026).

[78] Am. Astronomical Soc'y, Petition No. PC0112469, at 3.

[79] M. Kocifaj et al., *The Proliferation of Space Objects is a Rapidly Increasing Source of Artificial Sky Brightness*, 504 Monthly Notices of the Royal Astronomical Soc'y L40 (2021).

especially given that existing satellite constellations *already* exceed the limits for brightness set by the International Astronomical Union.[80]

The risks to astronomy, moreover, are not confined to reflectivity alone. The alumina particles released during satellite reentries can "nucleate clouds and change the transparency of the mesosphere and stratosphere," which risks reducing the scientific output of ground-based astronomical observatories.[81] The deposition of lithium can likewise result in visual anomalies that impair ground-based astronomy.[82] Additionally, interference from orbital data centers would extend across the electromagnetic spectrum, beyond optical wavelengths.[83] At infrared wavelengths, waste heat from AI computing nodes would raise the infrared background of the sky, threatening the study of stellar evolution and the search for exoplanets.[84] At radio frequencies, the aggregate unintended electromagnetic radiation from one million or more high-power server nodes risks establishing a new instrumental noise floor that would effectively "blind" radio telescopes across dozens of protected Radio Astronomy Service bands; observational evidence already demonstrates this effect with current constellations.[85]

In assessing these threats, the FCC must consider the grave warnings of scientific experts. A recent analysis of the mega-constellation proposals concludes that their presence "would have a devastating effect on astronomical observations," noting in particular the "cumulative" nature of light pollution.[86] Indeed, the Vera C. Rubin Observatory—an astronomical facility in which the U.S. federal government has invested hundreds of millions of dollars, and which just began science operations in 2025—has been projected to lose 10 percent of its observing time from

---

[80] Anthony Mallama & Richard E. Cole, *Satellite Constellations Exceed the Limits of Acceptable Brightness Established by the IAU*, 544 Monthly Notices of the Royal Astronomical Society L15 (2025).

[81] Murphy et al., *Metals from Spacecraft Reentry in Stratospheric Aerosol Particles*, *supra*; Am. Astronomical Soc'y, Comment No. PC0114938, at 6.

[82] Am. Astronomical Soc'y, Petition No. PC0112469, at 10.

[83] *Id.* at 6.

[84] C.G. Bassa et al., *Analytical Simulations of the Effect of Satellite Constellations on Optical and Near-Infrared Observation*, 657 Astronomy & Astrophysics (2022), https://www.aanda.org/articles/aa/full_html/2022/01/aa42101-21/aa42101-21.html.

[85] *See* F. Di Vruno et al., *Unintended Electromagnetic Radiation from Starlink Satellites Detected with LOFAR*, 676 Astronomy & Astrophysics (2023), https://www.aanda.org/articles/aa/full_html/2023/08/aa46374-23/aa46374-23.html; C.G. Bassa et al., *Bright Unintended Electromagnetic Radiation from Second-Generation Starlink Satellites*, 689 Astronomy & Astrophysics (2024), https://www.aanda.org/articles/aa/full_html/2024/09/aa51856-24/aa51856-24.html.

[86] O.R. Hainaut, *Large or Bright Satellite Constellations: Effects on Observations, Including on the Background Sky Brightness* (Apr. 13, 2026), https://arxiv.org/html/2604.09427v1.

today's Starlink and OneWeb satellites alone; for a million satellites or more, with larger and brighter satellites, avoidance could become impossible.[87] One study shows that mega-constellation proposals risk contaminating a third of the images of the Hubble Space Telescope and as much as 92 percent of other images from other space-based telescopes.[88] The American Astronomical Society adds that the "massive deployment of orbiting data centers would blind us to incoming hazardous asteroids and disable the observations required for space situational awareness, compromising national security."[89] These risks too must be carefully analyzed.

Orbital Debris/Accidents: Orbital data centers also threaten to fundamentally transform the orbital environment by introducing orders of magnitude more debris. Satellite debris originates from collisions, explosions, erosion, obsolescence, or the reentry process itself. According to the S7 Academies (the coalition of national science academies from the G7 nations), "[t]here are already in Earth orbit, ten thousand tons of debris, 28,000 objects over 10 centimeters in size, half a million marble-sized pieces of debris, one hundred million measuring about one millimeter."[90] The seventy-fold increase in satellites due to the proposed data center mega-constellations threatens a proliferation of orbital debris on a scale that necessitates urgent study.

Debris poses grave risks for the usability of space itself. Since the 1970s, scientists have posited that if the quantity of orbital debris becomes too great, collisions among debris could create an effectively unstoppable chain reaction, a perpetual pinballing effect known as the "Kessler Syndrome," which would render space unusable for further satellites or crewed missions.[91] As the S7 Academies recently wrote: "Predicting when and under which conditions such a phenomenon will take place is a complex task. Considering the huge growth of the number of [low earth orbit] satellites during the next decade, further research should be dedicated to this problem."[92]

Further, orbital debris can and does fall to earth, where it creates a risk of casualty or injury to humans and wildlife. As satellites reenter the atmosphere (which they do by design), they "burn up," but approximately 40 percent of their mass can survive as fragments that reach

---

[87] Jinghan Alina Hu et al., *Satellite Constellation Avoidance with the Rubin Legacy Survey of Space and Time*, 941 Astrophysical J. Letters (2022), https://iopscience.iop.org/article/10.3847/2041-8213/aca592.

[88] Alejandro S. Borlaff et al., *Satellite Megaconstellations Will Threaten Space-Based Astronomy*, 648 Nature 51 (2025).

[89] Am. Astronomical Soc'y, Petition No. PC0112469, at 4.

[90] S7 at 14.

[91] Donald J. Kessler & Burton G. Cour-Palais, *Collision Frequency of Artificial Satellites: The Creation of a Debris Belt*, 83 J. Geophysical Research 2637 (1978).

[92] S7 at 10.

the ground.[93] In 2024 alone, spacecraft debris struck houses in Florida and North Carolina, while a study identified fifteen fragments that had potentially survived reentry from a Starlink satellite.[94] As the number of satellites in orbit increases, so do the casualty risks: one recent calculation estimated a 40 percent risk of a ground casualty associated with fewer than 75,000 satellites,[95] while the Federal Aviation Administration ("FAA") has estimated that the casualty risk from reentering U.S. satellite constellations will be as high as 60 percent by 2035.[96] With orbital data center applicants proposing hundreds of thousands of satellites reentering the atmosphere annually, this risk must be considered.

Debris from orbital data centers poses other terrestrial risks as well. The International Marine Organization ("IMO") has documented "[c]oncerns about the potential marine impacts of debris falling from rocket launches," which "include the release of toxic substances; disturbances to the seabed and seabed organisms; marine litter and underwater noise."[97] The FCC should study such concerns as well as equivalent concerns associated with satellite reentries, especially because the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter has warned that "limited information is available in the public domain" addressing such concerns, and "more information is needed to properly assess effects on the marine environment."[98] This dearth of information makes the FCC's programmatic assessment all the more vital as the FCC considers licensing projects that would exponentially increase rocket and satellite debris falling into the seas.

Cultural Impacts: More than one million moving points of light—set against a background of approximately 5,000 stars visible to the unaided eye—threatens to fundamentally transform the night sky, an irreplaceable aesthetic resource across the country. As Petitioner DarkSky International has attested, the resulting increase in light pollution will "harm the wilderness experience DarkSky members and others value for the solitude and escape from technology and urbanization it provides. The light of multitudes of passing satellites will compromise the wilderness experience and the 'untrammeled' nature promised by the 1964 Wilderness Act will be lost."[99] The impact on indigenous cultural practices is particularly acute.

---

[93] Ewan Wright et al., *Satellite Megaconstellations and Collective Casualty Risks*, Space Pol'y 101749 (2026), https://www.sciencedirect.com/science/article/pii/S0265964626000044.

[94] *Id.*

[95] *Id.*

[96] FAA, Risk Associated with Reentry Disposal of Satellites from Proposed Large Constellations in Low Earth Orbit 18 (Sept. 22, 2023).

[97] *IMO Explores Ocean Threats from Rocket Launch Debris*, Int'l Mar. Org. (July 3, 2024), https://www.imo.org/en/mediacentre/pages/whatsnew-2102.aspx.

[98] *Id.*

[99] DarkSky Int'l, Comment No. PC0114634 on ICF File No. SAT-LOA-2026-0310-00118, at 7 (Apr. 20, 2026).

For Native Hawaiian and Pacific Islander communities, for instance, the night sky is a functional and sacred cultural landscape. The traditional art of non-instrument navigation, or Wayfinding, relies on the "Star Compass"—a mental map of the horizon organized around the rising and setting points of specific stars.[100] The obfuscation of celestial waypoints by artificial light or satellite interference is precisely the kind of impact FCC must evaluate at the programmatic level.

Impacts to Gateway Communities: The degradation of dark-sky resources threatens to impose direct, measurable harm on communities that depend on astro-tourism. DarkSky International has certified thirty-four National Park Service units as Dark Sky Parks,[101] meaning these are places "possessing an exceptional or distinguished quality of starry nights and nocturnal environment that is specifically protected for its scientific, natural, or educational value, its cultural heritage, and/or public enjoyment."[102] Yet recent survey data indicates that almost half of visitors might reduce future visitation if night sky quality declined.[103] The effects of such a decline in tourism are likely to be significant, as gateway communities depend on visitors for revenue. Dark-sky tourism on the Colorado Plateau alone is projected to generate $5.8 billion in visitor spending and support over 10,000 jobs annually through the 2020s.[104] The FCC must consider programmatically how the light pollution flowing from more than a million orbital data centers would impact these National Park Service units and the communities that serve as their gateways.

The foregoing summary canvasses precisely the kinds of impacts that NEPA requires the FCC to identify and examine before taking action on the pending proposals.

---

[100] *Cf.* Will Kyselka, An Ocean in Mind (1987); Nikita Amir, *Light Pollution Threatens Millennia-Old Indigenous Navigation Methods*, Discover Mag. (Oct. 27, 2021), https://www.discovermagazine.com/light-pollution-threatens-millennia-old-indigenous-navigation-methods-42949.

[101] Claire Gaposchkin, Note, *America's (Second) Best Idea: A Proposal for a Major Expansion of the National Park System*, 47 Wm. & Mary Envtl. L. & Pol'y Rev. 545, 551 n.43 (2023).

[102] *International Dark Sky Parks*, DarkSky Int'l, https://darksky.org/what-we-do/international-dark-sky-places/dark-sky-place-types/.

[103] Guanyi Yang et al., Tourism Response to Dark Sky Conservation at the Great Sand Dunes National Park and Preserve (Colorado College State of the Rockies Project, 2024).

[104] David M. Mitchell & Terrel Gallaway, *Dark Sky Tourism: Economic Impacts on the Colorado Plateau Economy, USA*, 74 Tourism Rev. 930 (2019).

IV. FCC CANNOT FULFILL ITS SUBSTANTIVE LEGAL OBLIGATIONS WITHOUT A COMPREHENSIVE NEPA ANALYSIS OF IMPACTS, RISKS, ALTERNATIVES, AND MITIGATION.

The FCC issues satellite licenses under the Communications Act of 1934 and subsequent amendments. The Commission is instructed to grant any application for a license that in its determination would serve the "public interest, convenience, and necessity." 47 U.S.C. § 309(a); *see also* 47 C.F.R. § 25.156 (implementing regulations). An FCC determination is unlawful if it is not "reasonable and reasonably explained," *Viasat Inc. v. FCC*, 47 F.4th 769, 776 (D.C. Cir. 2022), including a determination with respect to NEPA, *United Keetoowah Band of Cherokee Indians in Oklahoma v. FCC*, 933 F.3d 728, 740 (D.C. Cir. 2019). In light of the cumulative impacts of the multiple orbital data center applications, a PEIS is the best and potentially only way to assess whether these proposals are in the public interest. This is particularly true in light of the vague nature of the proposals, which are so short on details about the nature of the projects that full consideration of whether they are in the public interest is effectively impossible.

A PEIS would also facilitate the FCC in meeting its statutory obligation under NEPA to study and develop "alternatives to the proposed agency action." 42 U.S.C. § 4332(C)(iii). First, the no-action alternative establishes the environmental baseline against which all other alternatives must be measured, and is required as a matter of law. Second, a PEIS could examine a prototype or reduced-scale alternative—varying from a handful to hundreds of satellites, rather than over a million—that could provide comparable services with dramatically reduced environmental impacts. None of the applicants has provided any evidence that tens of thousands or even millions of satellites are necessary to meet projected demand: how can a public interest determination be made without such evidence? Third, a PEIS would allow the FCC to compare alternative orbital regimes (e.g., lower altitude, higher altitude, sun-synchronous, and inclined orbits) and alternative spacecraft design, configuration, and attitude (orientation in space) to identify which options minimize aggregate environmental harm and risks. While these options could be assessed in NEPA reviews for individual projects, it would be more useful and efficient to assess them cumulatively—which would in turn streamline NEPA reviews for individual proposals.

Moreover, a PEIS would enable the FCC to consider the direct, indirect, and cumulative impact of orbital data center satellites that are likely to be launched by or in other countries, as well as the obligations imposed on the United States by binding resolutions or protocols and enforcement mechanisms under existing treaties. *Cf.* 42 U.S.C. § 4332(I) (directing federal agencies to "recognize the worldwide and long-range character of environmental problems and, where consistent with the foreign policy of the United States, lend appropriate support to initiatives, resolutions, and programs designed to maximize international cooperation in anticipating and preventing a decline in the quality of mankind's world environment").

Finally, a PEIS would be the best mechanism to analyze specific mitigation measures to be employed as part of the licensing process. S*ee, e.g.*, *Robertson v. Methow Valley Citizens Council,* 490 U.S. 332 (1989) ("one important ingredient of an EIS is the discussion of steps that

can be taken to mitigate adverse environmental consequences"). Many such measures have already been proposed, for example:

- Mandatory satellite brightness standards meeting the International Astronomical Union threshold of magnitude 7 or fainter;
- A post-mission de-orbit timeline of two years or less rather than the existing five-year standard, which the Commission itself has stated warrants further study for large constellations of satellites;[105]
- Phased licensing in tranches subject to environmental review of observed cumulative impacts before each subsequent tranche is authorized;
- Enforceable limits on unintended electromagnetic radiation from satellite-mounted server hardware;
- Consideration of disposal orbits that minimize reflectivity and reduce pollution and safety risks;
- Mandatory collision bonding or insurance to internalize the debris-generation risk that is currently socialized across the global space community; and
- License requirements for plans for the capture and safe, guided reentry of satellites using methods such as those being developed for the European Space Agency, to be funded in advance by performance bonds or funds held not by the permittee but in independent trusts.

Careful analysis of the risks and benefits of these options are not just needed to comply with NEPA, they are crucial for a fulsome consideration of whether the projects are in the "public interest" under the FCC's substantive governing statute. *See Env't Health Trust v. FCC*, 9 F.4th 893, 903 (D.C. Cir. 2021) (FCC's failure to respond to record evidence was arbitrary and capricious); *accord AT&T Wireless Servs., Inc. v. FCC*, 270 F.3d 959, 968–69 (D.C. Cir. 2001). Indeed, the FCC itself recently recognized that "efforts to mitigate" light pollution "weigh[] in the public interest."[106]

In light of the foregoing, it would be unlawful for the FCC to fail to prepare a PEIS. In *American Bird Conservancy v. FCC*, the D.C. Circuit found unlawful the FCC's response to a similar PEIS petition requesting programmatic environmental analysis of the impacts of licensing cell towers on migratory birds. 516 F.3d at 1033. The Court found that the agency's

---

[105] In the Matter of Space Innovation Mitigation of Orbital Debris in the New Space Age, 37 FCC Rcd. 11818, 11825–26 (2022) ("Large constellations could impose specific risks to the orbital environment that may be mitigated by a shorter post-mission orbital lifetime[.]").

[106] Authorization and Order, *In the Matter of AST & Science, LLC*, ICFS File Nos. SAT-LOA-20200413-00034, SAT-AMD-20200727-00088, SAT-AMD-20201028-00126, SAT-AMD-20230717-00172, SAT-AMD-20240311-00053, SAT-MOD-20250612-00145, SAT-AMD-20250718-00181, SAT-AMD-20250903-00248, SAT-MOD-20251205-00370, SAT-AMD-20251211-00379 & SAT-MOD-20260121-00037, at 10 n.33 (Call Sign S3065) (Apr. 21, 2026), https://docs.fcc.gov/public/attachments/DA-26-391A1.pdf.

dismissal of the petition was inconsistent with its NEPA obligations, noting that at a minimum, the agency should have prepared an EA in light of the uncontroverted impacts to birds. *Id.* Here, the facts are far stronger, with sufficient evidence of environmental harm to skip the steps of preparing an EA. *Id.* at 1034 ("if *any* significant environmental impacts might result from the proposed agency action, then an EIS must be prepared *before* the action is taken") (emphasis in original) (cleaned up). Accordingly, a PEIS is warranted.

V. A PROGRAMMATIC EIS WOULD ENHANCE EFFICIENCY NOT ONLY FOR THE FCC BUT ALSO FOR THE OTHER AGENCIES THAT HAVE A ROLE IN REGULATING COMMERCIAL SPACE ACTIVITIES.

In addition to the FCC, other federal agencies have various roles related to these types of proposed commercial space ventures. A PEIS could facilitate the FCC's reviews as well, leading to a more coordinated and coherent interagency federal response. NEPA is designed to operate in precisely this manner, with several provisions addressing actions by multiple agency sponsors. *See, e.g.*, 42 U.S.C. §§ 4336a(a)–(b); 4336e(2), (8)–(9).

In the case of orbital data centers, the departments and agencies that have relevant authority and expertise include:

- The **Department of Transportation ("DOT")**, which implements its responsibilities through the **FAA**.[107]
- The **Department of Defense ("DOD")** and **NASA**, both of which have particular expertise and statutory roles under the Commercial Space Act.[108]
- The **Department of Energy ("DOE")**, which enjoys authority in the area of applied energy and energy-related research and development in space, including space based solar power.[109]

---

[107] The Commercial Space Act, 51 U.S.C. Chapter 509, provides that the Secretary of Transportation is to oversee and coordinate the conduct of commercial launch and reentry operations, issue permits and commercial licenses and carry out related responsibilities, but the Act specifically states that the law does not affect the FCC's authority under the Communications Act of 1934.

[108] 51 U.S.C. § 50910 and 51 U.S.C. § 50918, requiring consultation and coordination between DOT, DOD and NASA on matters affecting national security interests or other national needs, providing for coordination regarding launches or reentries between DOT, DOD, and NASA.

[109] Memorandum of Understanding between NASA and DOE Regarding Energy-Related Civil Space Activities (Oct. 19, 2020), https://www.nasa.gov/wp-content/uploads/2015/01/nasa_doe_mou_energy_related_space_activities.pdf; DOE, Space-Based Solar Power, https://www.energy.gov/cmei/systems/space-based-solar-power.

- The **Department of Commerce**, which likewise plays a role through its Office of Space Commerce, which is developing a traffic coordination system for space,[110] as well as through other steps the Department is taking to facilitate and promote commercial space travel.[111]

- The **National Oceanic and Atmospheric Administration**, which licenses the operation of private remote sensing space systems.[112]

- The **Department of State, Office of Space Affairs**.[113]

The FCC should also coordinate with its counterpart agencies worldwide, as orbital data centers are being proposed and considered globally and are certain to have worldwide environmental effects. This is especially so in light of the duties that bind the planet's nations under customary international law and treaties such as the Convention on Biological Diversity. In particular, the Convention obliges environmental impact assessments under article 14.1 and warnings under article 14.1(d) when areas beyond the limits of national jurisdiction or within the territories of other countries face imminent or grave danger due to actions originating under the jurisdiction or control of a party. At present, the United States is the only member of the United Nations that has not ratified this Convention, but the Convention's impact assessment obligations largely track those of NEPA and are useful for understanding the appropriate NEPA analysis for actions with international repercussions.

The coordination necessary for an adequate programmatic EIS might seem daunting. However, if done thoughtfully and efficiently, it could serve as a document that not only informs decisionmakers, state, tribal, and local governments, and the public about the environmental and related economic and social impacts of these proposed operations, but significantly expedites the process of evaluating individual applications throughout the executive branch.

---

[110] The purpose of the system will be to provide "basic space situational awareness (SSA) data and services to civil and private space operators in support of spaceflight safety." Off. of Space Commerce, *TRACSS: Traffic Coordination System for Space*, https://space.commerce.gov/traffic-coordination-system-for-space-tracss/.

[111] Executive Order 14335, "Enabling Competition in the Commercial Space Industry," Aug. 13, 2025.

[112] 51 U.S.C. § 60101 *et seq*.

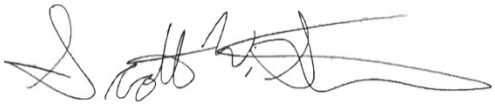
[113] https://2021-2025.state.gov/bureaus-offices/under-secretary-for-economic-growth-energy-and-the-environment/bureau-of-oceans-and-international-environmental-and-scientific-affairs/office-of-space-affairs/.

CONCLUSION

At the end of 2019, only 2,218 satellites orbited earth. Today, six and a half years later, that number is approximately 15,000 active satellites, with another several thousand defunct ones still in orbit. Collectively, the proposals currently before the FCC represent a potential increase of multiple orders of magnitude, transforming Earth's exosphere and threatening impacts that have never been assessed, as NEPA requires. Clearly, a different approach is needed. *Env't Def. Ctr. v. Bureau of Ocean Energy Mgmt*., 36 F.4th 850, 879 (9th Cir. 2022) ("When challenged actions are novel, there is more need for an EIS."). Performing a comprehensive PEIS on the pending applications (and any new ones submitted hereafter) is a necessary first step in such a different approach.

Pursuant to 5 U.S.C. § 555(e), we look forward to your response.

JAN E. HASSELMAN
EARTHJUSTICE
810 Third Ave., Suite 610
Seattle, WA 98104
Ph: (206) 343-7340
jhasselman@earthjustice.org



SCOTT W. STERN
EARTHJUSTICE
180 Steuart St., #194330
San Francisco, CA 94105
Ph: (415) 217-2000
sstern@earthjustice.org

On behalf of Petitioners DarkSky International, Environment America, and Public Employees for Environmental Responsibility