Journal of Air Law and Commerce

Volume 88 | Issue 1 Article 5

2023

On Launching Environmental Law into Orbit in the Age of Satellite Constellations

Michael B. Runnels
California State University

ON LAUNCHING ENVIRONMENTAL LAW INTO ORBIT IN THE AGE OF SATELLITE CONSTELLATIONS

MICHAEL B. RUNNELS*

ABSTRACT

In September 2022, the Federal Communications Commission adopted a new rule changing the deorbiting timeframe for satellites ending their missions in low Earth orbit from a twenty-five-year recommendation to a five-year legal requirement. The adoption of this rule, which seeks to cultivate a sustainable orbital environment for satellites, followed the United States' July 2022 National Orbital Debris Implementation Plan, which tasked federal agencies with reviewing the effectiveness of their orbital debris-related rules. In the wake of the Supreme Court's June 2022 *West Virginia v. EPA* decision, however, federal rulemaking in the area of orbital debris may not survive judicial scrutiny in the absence of explicit congressional authorization to do so. The purpose of this Article is to provide arguments for why Earth's orbital environment should be protected under the National Environmental Policy Act and to provide draft legislation that is responsive to both the Orbital Debris Plan and the Supreme Court's recent *EPA* ruling, which will enable FCC rulemaking in the area of orbital debris.

TABLE OF CONTENTS

I. INTRODUCTION 182
II. THE RELATIONSHIP BETWEEN ORBITAL DEBRIS AND SATELLITE CONSTELLATIONS IN LOW EARTH ORBIT 186

DOI: https://doi.org/10.25172/jalc.88.1.5

* Assistant Professor of Business Law, College of Business and Economics, California State University, Los Angeles. J.D., Fordham University School of Law. B.A., University of Georgia. The Author would like to thank Sara Hamel and the Editor-in-Chief of the Journal of Air Law & Commerce, Pauline Hodencq, for their insightful comments and helpful suggestions.

III. WHY NEPA SHOULD APPLY TO THE EARTH'S ORBITAL ENVIRONMENT 191
IV. FCC ENFORCEMENT OF NEPA IN THE LICENSING OF SATELLITES 197
V. THE IMPLICATIONS OF THE *WEST VIRGINIA V. EPA* DECISION AND THE MAJOR QUESTIONS DOCTRINE 201
VI. RECOMMENDATIONS TO INCLUDE THE EARTH'S ORBITAL ENVIRONMENT UNDER THE SCOPE OF NEPA 203
A. AMEND TITLE 42 OF THE U.S. CODE TO INCLUDE EARTH'S ORBITAL ENVIRONMENT UNDER THE SCOPE OF NEPA 204
B. AMEND TITLE 47 OF THE U.S. CODE TO REQUIRE THAT COMMERCIAL SATELLITE OPERATORS PREPARE AN ENVIRONMENTAL ASSESSMENT ON LEO ORBITS 205
VII. CONCLUSION 206

I. INTRODUCTION

"THE SETTLEMENT OF SPACE and the environmental stewardship of the Earth are one and the same challenge."[1]

In September 2022, the Federal Communications Commission (FCC) adopted a new rule changing the deorbiting timeframe for satellites ending their missions in low Earth orbit (LEO)[2] from a twenty-five-year recommendation[3] to a five-year

---

[1] CHARLES S. COCKELL, SPACE ON EARTH: SAVING OUR WORLD BY SEEKING OTHERS 1 (1st ed. 2007).

[2] LEO is defined as the region from Earth's edge to 2,000 kilometers of altitude, or roughly 1,200 miles above Earth's edge. *See Photo Gallery*, NASA-ARES, https://www.orbitaldebris.jsc.nasa.gov/photo-gallery/ [https://perma.cc/T6FS-UCBH]; Thomas G. Roberts, *Aerospace Security: Popular Orbits 101*, CTR. FOR STRATEGIC AND INT'L STUD., https://aerospace.csis.org/aerospace101/popular-orbits-101/ [https://perma.cc/X7SN-AZNG] (last updated June 14, 2022). The majority of all orbital debris is located in LEO. *See* NASA OFF. OF INSPECTOR GEN., NASA'S EFFORTS TO MITIGATE THE RISKS POSED BY ORBITAL DEBRIS 3 (2021), https://oig.nasa.gov/docs/IG-21-011.pdf [https://perma.cc/ZL2U-7XDW].

[3] *See* Debra Werner, *Will Megaconstellations Cause a Dangerous Spike in Orbital Debris?*, SPACE NEWS (Nov. 15, 2018), https://spacenews.com/will-megaconstellations-cause-a-dangerous-spike-in-orbital-debris/ [https://perma.cc/2APY-75A8]. The twenty-five-year rule is a voluntary UN guideline, published in 2007 by the Inter-Agency Space Debris Coordination Committee, recommending that satellites in LEO be deorbited no more than twenty-five years after the end of operations to minimize the risk of collisions that would create debris. *Id.*

legal requirement.[4] In explaining the rationale for this rule, FCC Chairwoman, Jessica Rosenworcel, noted that NASA entered the space race in 1958 by launching the satellite Vanguard 1, which "still circles the planet today."[5] Characterizing this launch as representing "a bold undertaking and a commitment to our connected future,"[6] Chairwoman Rosenworcel went on to note that it now "represents something else—a reminder of the work we have to do to address orbital debris."[7] Since 1957, she explained, humankind has launched approximately 10,000 satellites into orbit, over half of which are now defunct, and that:

> [m]any of them were launched with the understanding that they were cheaper to just abandon than take out of orbit. That means that like Vanguard 1 they stay in orbit for decades, careening around our increasingly crowded skies as space junk. That's bad because it raises the risk of collisions that harm satellites we count on, makes it harder to launch new objects into higher orbits, and even has environmental consequences back on Earth.[8]

Indeed, in emphasizing the environmental consequences of not adopting this rule, Chairwoman Rosenworcel further argued that while "[w]e take action to care for our skies," "[o]ur space economy is moving fast. The second space age is here. For it to continue to grow, we need to do more to clean up after ourselves so space innovation can continue to respond."[9]

The adoption of this rule followed on the heels of the July 2022 unveiling of the United States' National Orbital Debris Implementation Plan (Orbital Debris Plan),[10] which declared that "[t]he challenges posed by orbital debris to the sustainability of outer space have inherent similarities to other human-made

---

[4] Press Release, Federal Communications Commission, FCC Adopts New '5-Year Rule' for Deorbiting Satellites to Address Growing Risk of Orbital Debris (Sept. 29, 2022), https://www.fcc.gov/document/fcc-adopts-new-5-year-rule-deorbiting-satellites [https://perma.cc/VHN8-CN5C].

[5] Statement from Chairwoman Jessica Rosenworcel, Re: Space Innovation, IB Docket No. 22-271; Mitigation of Orbital Debris in the New Space Age, IB Docket No. 18-313 (Sept. 29, 2022), https://docs.fcc.gov/public/attachments/DOC-387720A2.pdf [https://perma.cc/2UK9-WE9B].

[6] *Id.*

[7] *Id.*

[8] *Id.*

[9] *Id.*

[10] Nat'l Sci. & Tech. Council, National Orbital Debris Implementation Plan (2022), https://www.whitehouse.gov/wp-content/uploads/2022/07/07-2022-NATIONAL-ORBITAL-DEBRIS-IMPLEMENTATION-PLAN.pdf [https://perma.cc/X5UK-97ZH].

global environmental challenges,"[11] and tasked several federal agencies, including the FCC,[12] with reviewing the efficacy of U.S. policies regarding the expanding risks of Earth's orbital debris.[13] Consistent with the Orbital Debris Plan, the FCC's new rule is expected to be the first of several draft rules on orbital debris from the FCC,[14] "with others possibly tackling the issue of liability and financial compensation in the event of orbital collisions or requiring satellites above certain altitudes to have thrusters to avoid collisions if necessary."[15] Yet, given the U.S. Supreme Court's June 2022 ruling in *West Virginia v. EPA*,[16] which reversed Environmental Protection Agency (EPA) carbon dioxide regulations by arguing that the Clean Air Act[17] does not explicitly authorize the EPA to regulate carbon dioxide emissions,[18] FCC rulemaking in the area of orbital debris may not

---

[11] *Id.* at 5.

[12] The Orbital Debris Plan details several federal agencies as engaged in orbital debris risk management, explaining that numerous U.S. Government departments and agencies are involved in orbital debris risk management.

> The National Aeronautics and Space Administration (NASA) uses radars, telescopes, and in situ measurements to statistically sample debris too small to be tracked but still large enough to threaten human spaceflight and robotic missions. NASA also leads the development of the U.S. Government Orbital Debris Mitigation Standard Practices (ODMSP), which are directly applicable to U.S. Government operators. NASA also maintains an office to monitor the space environment for its own satellites. The Department of Defense (DOD) collects data on and tracks space objects and notifies spacecraft operators of possible collision. DOD is transitioning the responsibility of providing notifications for civil and commercial operators to the Department of Commerce (DOC). The Federal Aviation Administration (FAA) and the Federal Communications Commission (FCC) have policies or regulations that are intended to limit the creation or accumulation of debris.

Id. at 7.

[13] *Id.* at 9.

[14] Jonathan O'Callaghan, *The FCC is Finally Taking Space Junk Seriously*, SCI. AM. (Nov. 24, 2022), https://www.scientificamerican.com/article/the-fcc-is-finally-taking-space-junk-seriously [https://perma.cc/U83X-WTWJ] (lauding the FCC for proactively regulating in the area of orbital debris and detailing the FCC's potential next steps).

[15] *Id.*

[16] *See* 142 S. Ct. 2587, 2587 (2022) (reversing EPA carbon dioxide regulations, the Court articulated that the Clean Air Act does not explicitly authorize the EPA to regulate carbon dioxide emissions in a manner that triggers a nationwide transition away from the use of coal, and that Congress must speak clearly on this subject in order for the EPA to exercise this power).

[17] 42 U.S.C. §§ 7401–7671 (1963).

[18] *EPA*, 142 S. Ct. at 2616.

survive judicial scrutiny, as the FCC is not explicitly authorized by Congress to regulate orbital debris.

The purpose of this Article is to provide arguments for why Earth's orbital environment should be protected under the National Environmental Policy Act (NEPA)[19] and to provide draft NEPA legislation that is responsive to both the Orbital Debris Plan and the Supreme Court's recent *EPA* ruling.[20] This Article proceeds in five parts. Part I summarizes the problem that orbital debris in LEO poses to the satellite-based technologies that many developed countries depend upon and explains how the advent of satellite constellations, which are networks of dozens to tens of thousands of mass-produced satellites unified in a common task (such as providing global broadband internet),[21] compounds this problem. Part II details the purposes and scope of NEPA and provides arguments for why LEO should fall under NEPA's scope. Part III briefly discusses, in relevant detail, the FCC's role in implementing NEPA in its satellite licensing procedures. Part IV briefly summarizes the Supreme Court's recent *EPA* ruling and its implications for FCC rulemaking in the area of orbital debris. Part V then recommends language to amend two sections of the U.S. Code to include Earth's orbital environment under the scope of the NEPA, which will then enable the FCC to regulate orbital debris in a manner that is responsive to the Supreme Court's requirement that federal agencies have "clear congressional authorization"[22] for any power not explic-

---

[19] NEPA "requires federal agencies to take a 'hard look' at the environmental consequences of their projects *before* taking action." Brady Campaign to Prevent Gun Violence v. Salazar, 612 F. Supp. 2d 1, 13 (D.D.C. 2009). An agency is responsible for a NEPA review of its actions if it is reasonably foreseeable that those actions could lead a third party to engage in activity that could significantly impact the environment. *See id.* at 14.

[20] *See EPA*, 142 S. Ct. at 2587.

[21] Starlink, for example, "is a broadband internet service [provider], specializing in the expansion of coverage to rural and remote communities." Michelle Shen & Elizabeth Pattman, *What is Starlink? Inside the Satellite Business that Could Make Elon Musk a Trillionaire*, USA TODAY (Dec. 6, 2021), https://www.usatoday.com/story/tech/2021/12/05/elon-musk-starlink-satellites-spacex-broadband-internet-globe/8881858002/ [https://perma.cc/2QBU-A3K7]. It accomplishes this task by launching a satellite constellation of satellites into LEO. *Id.*; Yaroslav Trofimov et al., *Ukraine Leans on Elon Musk's Starlink in Fight Against Russia*, WALL. ST. J, (July 16, 2022), https://www.wsj.com/articles/ukraine-leans-on-elon-musks-starlink-in-fight-against-russia-11657963804 [https://perma.cc/Z4A8-8P5Y] (describing how the Starlink internet service provider has kept front line Ukrainian troops connected when regular cell networks failed).

[22] *EPA*, 142 S. Ct. at 2614 (quoting Util. Air Regul. Grp. v. EPA, 573 U.S. 302, 324 (2014)).

itly provided by Congress. In this way, adopting such language is also responsive to both the Orbital Debris Plan's declaration that "Earth orbits . . . are finite resources and can be threatened by the rapid, uncontrolled increase in orbital debris,"[23] and Chairwoman Rosenworcel's stated rulemaking goals for the FCC that the rules "will mean more accountability and less risk of collisions that increase orbital debris and the likelihood of space communication failures."[24]

II. THE RELATIONSHIP BETWEEN ORBITAL DEBRIS AND SATELLITE CONSTELLATIONS IN LOW EARTH ORBIT

Currently, abandoned satellites and millions of pieces of orbital debris from defunct spacecraft remain in LEO,[25] which has endangered space activities for decades.[26] According to NASA, now encircling our world are approximately 23,000 pieces of space debris larger than a softball, 500,000 pieces of debris roughly the size of a marble, and approximately 100,000,000 pieces of debris one millimeter or larger, all traveling at speeds of up to 17,500 miles per hour.[27] At such speeds, even minute flecks of paint can impair spacecraft.[28] Remaining in LEO are much more pieces of debris that are too small to track, though large enough to imperil both human spaceflight and robotic

---

[23] NAT'L SCI. & TECH. COUNCIL, *supra* note 10, at 5.

[24] Chairwoman Jessica Rosenworcel, *supra* note 5.

[25] *See* NASA OFF. OF INSPECTOR GEN., *supra* note 2, at 3.

[26] *See* Samantha Masunaga, *A Satellite's Impending Fiery Demise Shows How Important It Is to Keep Space Clean*, L.A. TIMES (June 27, 2021), https://www.latimes.com/business/story/2021-06-27/satellites-self-destruct-clean-up-space-junk [https://perma.cc/QRG8-F9TJ]; Adrian Moore & Rebecca Van Burken, *It's Time for US to Get Serious About Cleaning Up Space Junk*, THE HILL (July 27, 2021), https://thehill.com/opinion/technology/564945-its-time-for-us-to-get-serious-about-cleaning-up-space-junk?rl=1 [https://perma.cc/YQ5X-Y3Z9]; see also Ryan Morrison, *International Space Station is Forced to Carry Out an Emergency Manoeuvre to Avoid Being Hit by a Piece of Debris From a 2018 Japanese Rocket*, DAILY MAIL (Sept. 23, 2020) https://www.dailymail.co.uk/sciencetech/article-8761867/ISS-initiates-avoid-space-debris.html [https://perma.cc/29SD-YRKF].

[27] *Space Debris and Human Spacecraft*, NASA (May 26, 2021), https://www.nasa.gov/mission_pages/station/news/orbital_debris.html [https://perma.cc/V57A-3KMX].

[28] NASA reports that "a number of space shuttle windows were replaced because of damage caused by material that was analyzed and shown to be paint flecks." *Id.* Indeed, NASA further documents that "millimeter-sized orbital debris represents the highest mission-ending risk to most robotic spacecraft operating in [LEO]." *Id.*

missions.[29] This untracked debris can lead to potentially dangerous orbital collisions on a more frequent basis, which is due to the phenomenon of a self-generating cascade of debris triggered where each additional collision creates more debris, thereby increasing the likelihood of new collisions.[30] Describing the features of this phenomenon in the New Yorker Magazine, Raffi Khatchadourian writes that:

> [e]ven a minuscule shard could smash a satellite to pieces, dispersing more high-velocity debris. If the population of objects became dense enough, collisions would trigger one another in an unstoppable cascade. The fragments would grow smaller, more numerous, more uniform in direction, resembling a maelstrom of sand—a nightmare scenario that became known as the Kessler syndrome. At some point, the process would render all of near-Earth space unusable. Theoretically, Kessler mused, our planet could acquire a ring akin to Saturn's, but made of garbage.[31]

Various studies by NASA and other space agencies demonstrate that LEO is now in the protracted initial stages of the "Kessler Syndrome."[32] Despite the perils of the Kessler Syndrome, companies are launching satellites at an unprecedented rate in a pursuit to modernize their satellite operations in LEO.[33]

---

[29] *Id.*

[30] *See* Raffi Khatchadourian, *The Elusive Peril of Space Junk*, NEW YORKER MAG. (September 21, 2020), *https://www.newyorker.com/magazine/2020/09/28/the-elusive-peril-of-space-junk [https://perma.cc/5V5J-ERZT]; see also*, Donald J. Kessler & Burton G. Cour-Palais, *Collision Frequency of Artificial Satellites: The Creation of a Debris Belt*, 83 J. GEOPHYSICAL RSCH. 2637, 2637 (1978).

[31] Khatchadourian, *supra* note 30; *see also* Paul B. Larsen, *Solving the Space Debris Crisis*, 83 J. AIR L. & COM. 475, 476–82 (2018); STEPHAN HOBE, SPACE L. 112–14 (2019); Alexander William Salter, *Space Debris: A Law and Economics Analysis of the Orbital Commons*, 19 STAN. TECH. L. REV. 221, 224–27 (2016).

[32] *See* NASA OFF. OF INSPECTOR GEN., *supra* note 2, at 2. "Multiple studies by NASA and other space agencies have found that orbital debris has already reached critical mass, and collisional cascading will eventually happen even if no more objects are launched into orbit. According to NASA, by 2005 the amount and mass of debris in LEO had grown to the point that even if no additional objects were launched into orbit, collisions would continue to occur, compounding the instability of the debris environment and increasing operational risk to spacecraft by 2055 unless measures were taken to curb the growth of the debris population. However, the amount of orbital debris has not decreased, or even stabilized, since 2006. Instead, the largest increases of new spacecraft and debris generation have occurred in LEO since 2006." *Id.* at 14–15.

[33] *See* Samantha Masunaga, *supra* note 26. It is stated in Masunaga's article by a college professor that "'[t]he rate at which we're launching is increasing exponentially and is proposed to increase five to tenfold over the coming decade . . .

Since the 1960s, conventional communications satellites with geosynchronous (GEO) orbits[34] have proved valuable.[35] At roughly 21,000 miles above Earth, their altitude provides them with a wide field of view, allowing operators to cover most of the Earth's surface with only three satellites spaced at set intervals.[36] Recent technological advances, however, have improved both satellite efficiency and performance.[37] These modern LEO satellite constellations, orbiting at approximately 310 to 1,200 miles above Earth, provide faster communications since they have lower latency and often provide higher bandwidth per user than GEO satellites, cable, copper, and pre-5G fixed wireless.[38] Due to their lower orbital altitude and higher orbital speed, however, LEO satellites must be deployed globally, in configurations that unfurl across their assigned orbital shells "like spreading a deck of cards on the table,"[39] to provide continuous global coverage. Despite their clear societal and technological benefits,[40] the age

---

[w]e don't want to raise alarm by saying it's so, so terrible, but the thing is, it potentially could be so, so terrible if we don't do anything about ensuring that people think more sustainably about how to do space activities.'" *Id.*

[34] GEO is an orbital zone above Earth's equator where the satellite remains above the same point on Earth. *See* Michael J. Finch, Comment, *Limited Space: Allocating the Geostationary Orbit*, 7 NW. J. INT'L L. & BUS. 788, 788 (1986). GEO is important for satellite communication because it allows permanent installations on Earth to point directly to the satellite, receiving information without constant recalibration. *Id.* The number of satellites that can use a GEO at a time is limited to approximately 2,000 satellites due to the potential for communication frequency interference. *Id.* at 789.

[35] Chris Daehnick et al., *Large LEO Satellite Constellations: Will it be Different This Time?*, MCKINSEY & CO. (May 4, 2020), https://www.mckinsey.com/industries/aerospace-and-defense/our-insights/large-leo-satellite-constellations-will-it-be-different-this-time [https://perma.cc/5RRX-J7TE].

[36] *Id.*

[37] *Id.*

[38] *Id.*

[39] Marina Koren, *Private Companies are Building an Exoskeleton Around Earth*, THE ATL. (May 24, 2019), https://www.theatlantic.com/science/archive/2019/05/spacex-satellites-starlink/590269/ [https://perma.cc/4N3H-5H2X] (noting the development of mega-constellations by several companies; the article quotes the CEO of SpaceX, Elon Musk, regarding how its Starlink mega-constellation, the aim of which is to provide high-speed and low latency broadband internet across Earth, will unfurl. Once thousands of these satellites are in LEO, Musk notes that they will fan out across LEO "like spreading a deck of cards on the table").

[40] *See, e.g.*, Trofimov et. al., *supra* note 21 and accompanying text; *see also generally* DAVID JARVIS ET AL., TECHNOLOGY, MEDIA, AND TELECOMMUNICATIONS PREDICTIONS 2020, at 46 (2019), https://www2.deloitte.com/content/dam/insights/us/articles/722835_tmt-predictions-2020/DI_TMT-Prediction-2020.pdf [https://perma.cc/8KBF-D7TW]. Satellites deployed in LEO can connect with small handheld receivers, such as mobile phones and personal computers, while pro-

of satellite constellations poses significant environmental challenges for the long-term sustainability of LEO orbits due to the looming orbital threat of the Kessler Syndrome.[41]

Indeed, several recent studies highlight how the risk of LEO collisions will be increased by the deployment of satellite constellations, which includes the collision risk between individual satellite constellations.[42] As the Starlink and OneWeb satellite constellation projects are the two projects closest to full deployment and, therefore, have the most available information for analysis,[43] one study found that, in the case of Starlink, the constellation increased the total LEO collision probability by 5%[44] and, in the case of OneWeb, the study concluded that the full deployment of its 48,000 second-generation satellites would simply be "hazardous in terms of collision probability."[45] Moreover, a 2017 study from the University of Southampton concluded that adding only one satellite constellation, of several thousand satellites, to LEO would surge the number of catastrophic collisions by 50% for the next 200 years.[46] Furthermore, NASA

viding low latency connection times. JARVIS ET AL., *supra*, at 5. This makes LEO satellites prime candidates to bring about global high-speed Internet coverage and bridge the digital divide that has left rural, poor, and underdeveloped areas without reliable Internet access. *See id.* at 51. "At present, the vast majority of consumers rely on terrestrial solutions, and the [business-to-business] use of satellites is limited to a few end markets where terrestrial solutions don't work." Chris Daehnick et al., *Large LEO Satellite Constellations: Will It Be Different This Time?*, MCKINSEY & CO. (May 4, 2020), https://www.mckinsey.com/industries/aerospace-and-defense/our-insights/large-leo-satellite-constellations-will-it-be-different-this-time [https://perma.cc/SVJ2-ZTEU]. For example, in-flight internet, long-distance mobile backhaul, maritime internet, remote oil and gas extraction, and certain military applications. *Id.* That's true largely because GEO satellite connectivity options are so expensive—a dynamic soon to change due to the advent of satellite mega-constellations. *Id.*

[41] *See* JARVIS ET AL., *supra* note 40, at 51–52.

[42] *See* Chuan Chen & Wulin Yang, *The Impact of Large Constellations on Space Debris Environment and its Countermeasures*, 8TH EUR. CONF. FOR AERONAUTICS & SPACE SCIS. 1, 6 (2019); S. Le May et al., *Space Debris Collision Probability Analysis for Proposed Global Broadband Constellations*, 151 ACTA ASTRONAUTICA 445, 453 (2018); Jonas Radtke et al., *Interactions of the Space Debris Environment with Mega Constellations—Using the Example of the OneWeb Constellation*, 131 ACTA ASTRONAUTICA 55, 63, 67 (2017).

[43] C. Álvaro Arroyo-Parejo et al., *Effect of Mega-Constellations on Collision Risk in Space*, 8TH EUROPEAN CONF. SPACE DEBRIS 2 (2021).

[44] *Id.* at 12.

[45] *Id.*

[46] *Biggest Ever Space Debris Study Highlights Risk Posed by Satellite 'Mega-Constellations,'* UNIV. SOUTHHAMPTON (Apr. 19, 2017), https://www.southampton.ac.uk/news/2017/04/space-debris-mega-constellations.page [https://perma.cc/REN7-55Y8].

echoed these concerns in a 2022 letter[47] to the FCC regarding SpaceX's application[48] for the launch authorization of an additional 30,000 Starlink satellites, arguing that "[a]n increase of this magnitude into [LEO] inherently brings additional risk of debris-generating collision events based on the number of [Starlink satellites] alone. NASA anticipates current and planned science missions, as well as human space flight operations, will see an increase in conjunctions."[49]

In the face of these looming dangers, and in only a two-year period, the number of active and defunct satellites in LEO have increased by over 50% by March 30, 2021.[50] SpaceX alone has launched more than 3,200 satellites in the construction of its Starlink satellite constellation since 2019[51] and after receiving FCC authorization to launch an additional 29,988 Starlink satellites in 2022.[52] SpaceX now accounts for over half of the close encounters between two spacecrafts in LEO[53] and is projected to

---

[47] *See* Letter from Samantha Fonder, NASA Representative to the Commercial Space Transportation Interagency Group, Space Operations Mission Directorate, Launch Services Office to Marlene Dortch, Secretary, Federal Communications Commission 1 (Feb. 8, 2022), https://www.scribd.com/document/557924666/NTIA-NASA-NSF-letter-to-FCC-regarding-Starlink-Gen-2 [https://perma.cc/NAJ7-S4U3].

[48] Space Exploration Holdings, LLC: Request for Orbital Deployment and Operating Authority for SpaceX Gen2 NGSO Satellite System, FCC 22-91, at 6 (Nov. 29, 2022).

[49] Dortch, *supra* note 45, at 1. A "conjunction event" is a "close approach between two objects that is predicted to occur because the secondary object passes within a chosen geometric or statistical safety area around the primary (protected) asset." NASA, NASA SPACECRAFT CONJUNCTION ASSESSMENT AND COLLISION AVOIDANCE BEST PRACTICES HANDBOOK 44 (2020), https://nodis3.gsfc.nasa.gov/OCE_docs/OCE_50.pdf. A "conjunction assessment" assesses the likelihood of a conjunction event. *See id.*

[50] Aaron C. Boley & Michael Byers, *Satellite Mega-Constellations Create Risks in Low Earth Orbit, the Atmosphere and on Earth*, NATURE (May 20, 2021) (noting that the exponential development of satellite constellations "risks multiple tragedies of the commons" to all LEO orbits, the chemical makeup of Earth's upper atmosphere, and ground-based astronomy, due to the increased likelihood of orbital collisions and other externalities associated with such satellite launches. The article further argues that "international cooperation is urgently needed, along with a regulatory system that takes into account the effects of tens of thousands of satellites").

[51] Tereza Pultarova & Elizabeth Howell, *Starlink Satellites: Everything You Need to Know About the Controversial Internet Megaconstellation*, SPACE.COM (Nov. 23, 2022), https://www.space.com/spacex-starlink-satellites.html [https://perma.cc/H6GY-MU3W].

[52] *See* Space Exploration Holdings, LLC, *supra* note 48, at 2.

[53] Tereza Pultarova, *SpaceX Starlink Satellites Responsible for Over Half of Close Encounters in Orbit, Scientist Says*, SPACE.COM (Aug. 20, 2021), https://

be involved in 90% of all close approaches.[54] Similar to SpaceX and OneWeb,[55] other companies have plans for satellite constellations, including Amazon[56] and Telesat.[57]

III. WHY NEPA SHOULD APPLY TO THE EARTH'S ORBITAL ENVIRONMENT

It is uncontroversial to note certain physical truths about the Earth. Earth orbits,[58] for example, are a mere physical manifestation of Earth's mass,[59] as is the Earth's atmosphere.[60] With the exception of the Apollo Moon missions, these orbital and atmospheric environments have provided the only homes of life as we

---

www.space.com/spacex-starlink-satellite-collision-alerts-on-the-rise [https://perma.cc/8D7H-TUV4]. Quoting Professor Hugh Lewis, Head of the Aeronautics Research Group at the University of Southampton and Europe's leading expect on space debris, Pultarova writes,

> I have looked at the data going back to May 2019 when Starlink was first launched to understand the burden of these mega-constellations . . . Since then, the number of encounters picked up by the Socrates database has more than doubled and now we are in a situation where Starlink accounts for half of all encounters.

Id.

[54] *Id.*

[55] *See* Jonathan Amos, *OneWeb Lays Path to Commercial Broadband Services*, BBC NEWS (July 1, 2021), https://www.bbc.com/news/science-environment-57674882 [https://perma.cc/2UGF-PKP2].

[56] *See* Elizabeth Howell, *Amazon's 1st Kuiper Megaconstellation Satellites will Launch on a ULA Atlas V Rocket*, SPACE.COM (Apr. 20, 2021), https://www.space.com/amazon-kuiper-megaconstellation-atlas-v-rockets [https://perma.cc/2ZZP-2342].

[57] *See* Eva Mathews & Steve Scherer, *Telesat Closer to Financing Satellite Network After Canada Investment*, REUTERS (Aug. 12, 2021 12:19 PM), https://www.reuters.com/technology/telesat-get-14-billion-investment-canadian-government-2021-08-12/ [https://perma.cc/6MSF-V4V4].

[58] *See What Is an Orbit?*, NASA (July 7, 2010), https://www.nasa.gov/audience/forstudents/5-8/features/nasa-knows/what-is-orbit-58.html [https://perma.cc/Z4Y9-5FLP] (explaining that an object in motion will remain in motion unless something either pushes or pulls on it, a principle known as Newton's first law of motion. Without Earth's gravity, which is directly proportional to Earth's mass, any Earth-orbiting satellite would hurl into space along a straight line. With Earth's gravity, however, the satellite is pulled back towards Earth. This constant tug-of-war takes place between the satellite's tendency to move in a straight line and the tug of Earth's gravity pulling the satellite back. In this way, both Earth, and its orbital environment, operate as a unified environmental system.).

[59] *Id.*

[60] *See Planetary Mass*, SCIENCEDIRECT (2015), https://www.sciencedirect.com/topics/earth-and-planetary-sciences/planetary-mass [https://perma.cc/9LUL-CTAB] (explaining that "[t]he mass and composition of an atmosphere depends on the planetary mass. . .).

know it.[61] That is why, as new technologies entered into these environments, laws developed to curtail the environmental damage caused by some of these technologies.[62] The United States declared its national environmental policy through NEPA in 1969,[63] which "requires federal agencies to take a 'hard look' at the environmental consequences of their projects *before* taking action,"[64] consequences that extend beyond an agency's individual actions to any actions by third parties that the agency authorizes.[65] This "hard look," however, has yet to extend to Earth orbits, the technological use of which is now fully integrated into nearly all aspects of life in economically developed countries.[66] Indeed, the sustainability of LEO orbits are critical to internet, telephone, and television communications; critical to car, airplane, and maritime GPS navigation; and critical to weather forecasting, climate research, and Earth resources monitoring—each of which rely on satellite technology.[67] For these reasons, the failure to mitigate the orbital debris risks posed to Earth's orbital environment could imperil the functioning of Earth's information infrastructure.[68]

---

[61] *See NASA Counts Down to Twenty Years of Continuous Human Presence on International Space Station*, NASA (Oct. 31, 2019), https://www.nasa.gov/feature/nasa-counts-down-to-twenty-years-of-continuous-human-presence-on-international-space-station [https://perma.cc/K9JT-YY45].

[62] *See generally* David Enrico Reibel, *Environmental Regulation of Space Activity: The Case of Orbital Debris*, 10 STAN. ENV'T L.J. 97, 124–29 (1991).

[63] *See* 42 U.S.C. § 4321. For this reason, any arguments relating to the U.S.'s environmental policy must begin with NEPA. *See* Brady Campaign to Prevent Gun Violence v. Salazar, 612 F. Supp. 2d 1, 13 (D.D.C. 2009). An agency is responsible for NEPA review of its actions if it is reasonably foreseeable that those actions could lead a third party to engage in activity that could significantly impact the environment. *Id.* at 13–14.

[64] *Brady*, 612 F. Supp. 2d at 13.

[65] *Id.* at 13–14; *see also* Scientists' Inst. for Pub. Info., Inc. v. Atomic Energy Comm'n, 481 F.2d 1079, 1088–89 (D.C. Cir. 1973).

[66] *See* David A. Koplow, *Reverse Distinction: A U.S. Violation of the Law of Armed Conflict in Space*, 13 HARV. NAT'L SEC. J. 25, 53–54 (2021) (noting the critical importance of orbital resources to nearly all aspects of life in economically developed countries).

[67] *Id.*

[68] *See generally* RICHARD GREEN ET AL., SATCON2: POLICY WORKING GROUP REPORT 1, 5 (2021), https://baas.aas.org/pub/q099he5g [https://perma.cc/285H-ZCQ2] (noting how the advent of satellite constellations harmfully interferes with ground-based astronomy and the potential steps the U.S. government can take to mitigate this harmful interference); *see also* THE MITRE CORP., THE IMPACTS OF LARGE CONSTELLATIONS OF SATELLITES 1, 103 (2021), https://www.nsf.gov/news/special_reports/jasonreportconstellations/#:~:text=review%20the%20full-,PDF%20report [https://perma.cc/A5MT-6G4Y]. JASON was

NEPA requires federal agencies "to use all practicable means and measures to foster and promote the general welfare, 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."[69] This proclamation followed Congress's acknowledgment of the "profound impact of man's activity on the interrelations of all components of the natural environment . . ."[70] Congress further declared that it was the federal government's responsibility to utilize "all practicable means . . . to improve and coordinate Federal plans, functions, programs and resources" so that the United States may "(1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations; . . . [and] (3) attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences . . ."[71] The Council on Environmental Quality (CEQ) was created under NEPA to review federal government activities through the lens of this declaration.[72] In this way, NEPA sought "to ensure [that] Federal agencies consider the environmental impacts of their actions in the decision-making process."[73]

The CEQ promulgates rules establishing guidelines for federal agencies when enacting their own NEPA implementing procedures.[74] Accordingly, when adopting their NEPA procedures, agencies must adhere to the CEQ.[75] When undertaking a major federal action, such as FCC licensing, federal agencies must prepare an environmental assessment when a proposed action may

---

asked by the National Science Foundation and Department of Energy to assess the possible growth and impact of future satellite constellations on orbital debris, optical astronomy generally, infrared astronomy, radio astronomy, cosmic microwave background studies, and laser guide-star observations. THE MITRE CORP., *supra*, at 1; *see also* OWEN BROWN ET AL., ORBITAL TRAFFIC MANAGEMENT STUDY: REPORT ON SPACE TRAFFIC MANAGEMENT ASSESSMENTS, FRAMEWORKS AND RECOMMENDATIONS 1, 4 (2016), https://spacepolicyonline.com/wp-content/uploads/2016/12/Orbital-Traffic-Mgmt-report-from-SAIC.pdf [https://perma.cc/C6J3-LLTN.

[69] 40 C.F.R. § 1500.1(a) (1978).

[70] 42 U.S.C. § 4331(a).

[71] 42 U.S.C. § 4331(b).

[72] *See* 40 C.F.R. § 4344(3) (1978).

[73] *See* 40 C.F.R. § 1500.1(a).

[74] *See* 40 C.F.R. § 4344(3)–(4).

[75] *See* GREEN ET AL., *supra* note 68, at 13 (detailing the centrality of NEPA in drafting any legislation affecting Earth's "natural environment").

have a significant effect or "when the significance of the effects is unknown."[76] Further, "[w]hen actions do not have an effect on the environment either individually or cumulatively, the agency may categorically exclude [(CE)] the action from NEPA review (unless certain requirements are present)."[77]

Yet key definitions used within U.S. environmental policy are unsettled, particularly the definition of "human environment,"[78] which CEQ Implementing Regulations define to

> be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment . . . When an environmental impact statement is prepared and economic or social and natural or physical environmental effects are interrelated, then the environmental impact statement will discuss all of these effects on the human environment.[79]

---

[76] 40 C.F.R. § 1501.5(a) (1978).

[77] *See* GREEN ET AL., *supra* note 68, at 150.

[78] *Id.* at 150–51. Although NEPA discussed "environment" and "natural environment," the CEQ Implementing Regulations use the term "human environment" for the title of the definition. *See, e.g.*, 42 U.S.C § 4321; *see also* 40 C.F.R. § 1508.1(m) (2022); Alexander Q. Gilbert & Monica Vidaurri, *Major Federal Actions Significantly Affecting the Quality of the Space Environment: Applying NEPA to Federal and Federally Authorized Outer Space Activities*, 44 ENVIRONS: ENV'T. L. & POL'Y J. 233, 238–41 (2021) (arguing from a perspective of legislative intent, NEPA jurisprudence before the Supreme Court's recent *West Virginia v. EPA* decision, and the practicality of ongoing human activities in Earth orbits, the authors offer several reasons for why the Earth's orbital environment should satisfy the CEQ's definition of "human environment" and should, therefore, be covered under NEPA. However, given the Supreme Court's decision, arguments such as these, based as they are upon legislative intent and NEPA jurisprudence rather than statutory language, will likely not satisfy the Court's requirement of "clear congressional authorization" to enforce NEPA in this manner); Charles Mottier, *One Giant Heap for Mankind: The Need for National Legislation or Agency Action to Regulate Private Sector Contributions to Orbital Debris*, 31 PACE ENV'T L. REV. 857, 875–77 (2014) (providing arguments that despite nothing in the legislative text of NEPA classifying LEO as a "human environment," LEO ought to be classified as such due to the fact that the "Kessler Syndrome" will significantly affect the terrestrial "human environment" beneath it. In lieu of the Supreme Court's recent EPA decision, however, this textual interpretation will likely not survive judicial scrutiny.).

[79] 40 C.F.R. § 1508.14. The full text is as follows:

> Human environment shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment. (See the definition of "effects" (§ 1508.8)) This means that economic or social effects are not intended by themselves to require preparation of an environmental impact statement. When an environmental impact statement is prepared and economic or social and natural or physical environmental effects are interrelated, then the environmental impact

Independent of the terrestrial nomenclature suggested by "human environment,"[80] the definition provided by CEQ Implementing Regulations includes Earth's "natural and physical environment" as well as the "relationship of people with that environment,"[81] leaving open the argument that NEPA is intended to cover all of Earth, including its orbital environment,[82] which is a physical manifestation of Earth's mass.[83] Indeed, the provision in NEPA concerning major federal actions affecting the quality of the human environment is meant to be broadly interpreted.[84] For example, "'[e]nvironment' means something more than rocks, trees, and streams, or the amount of air pollution[; i]t encompasses all the factors that affect the quality of life: crowding, squalor, and crime are obviously adverse environmental factors."[85] Consequently, "[t]his interpretation suggests that when a major United States federal action could have significant impact on an area with a human presence, NEPA may be applicable."[86]

Accordingly, LEO may be considered a "human environment," as it houses the International Space Station, which has maintained a constant human presence for over twenty years.[87] Moreover, LEO orbits are the primary location for the majority of existing human space objects, and all human space missions, except the Apollo Moon missions, have occurred in LEO orbits.[88] Additionally, LEO may be interpreted as a "human environment" under NEPA, as its continued use "stimulate[s] the health and welfare of man."[89] since the benefits to humankind of maintaining a sustainable LEO environment are as manifest

---

> statement will discuss all of these effects on the human environment.

Id.

[80] *See id.*

[81] *Id.*

[82] *See* GREEN ET AL., *supra* note 68, at 13.

[83] *See What Is an Orbit?*, *supra* note 58 and accompanying text.

[84] Jones v. U.S. Dep't of Hous. & Urb. Dev., 390 F. Supp. 579, 591 (E.D. La. 1974) (citing Calvert Cliffs' Coordinating Comm. v. Atomic Energy Comm'n, 449 F.2d 1109 (D.C. Cir. 1971)).

[85] *Jones*, 390 F. Supp. at 591 (alteration in original).

[86] Mottier, *supra* note 78, at 876.

[87] *See NASA Counts Down to Twenty Years of Continuous Human Presence on International Space Station*, *supra* note 61.

[88] *Id.*

[89] *See* 42 U.S.C. § 4321 (2018).

as they are myriad.[90] As one of NEPA's purposes is to "enrich the

[90] *See Space: Investing in the Final Frontier*, MORGAN STANLEY (July 24, 2020), https://www.morganstanley.com/ideas/investing-in-space [https://perma.cc/SX9F-2JDC] (estimating that the "global space industry could generate revenue of more than $1 trillion or more in 2040, up from $350 billion, currently."); *Capital Flows as Space Opens for Business*, MORGAN STANLEY (July 21, 2020), https://www.morganstanley.com/ideas/future-space-economy [https://perma.cc/R9D7-D32G] (describing the nascent space economy as demonstrable fertile grounds for private investment). The article notes that this new "space race is being powered not just by government but by a new crop of startups and visionaries[,] . . . entrepreneurs, strategic partnerships, and venture capital have been leading the charge on funding" for these ventures and that, for some of these investments, "the exit plans can be 50 years out." *Capital Flows as Space Opens for Business*, *supra*. The article further discusses that we're

> seeing a tremendous amount of interest in this area from angel investors, venture capital and private-equity firms" and that much of this is real passion in the industry, though "some of it is simply fear of being late to the party. Things are changing at such a rapid pace that investors are saying they have to keep up with the times . . . [and] [b]ecause success in space promises to be a multidecade endeavor—with returns on some lofty endeavors that could be many years away—this new economy requires patient investors. One sign of investors' willingness to wait is the increasing reliance on permanent and long-term capital funds.

Id.; *see also* EUROPEAN SPACE AGENCY, ESA SPACE RESOURCES STRATEGY 5 (2019), https://sci.esa.int/documents/34161/35992/1567260390250-ESA_Space_Resources_Strategy.pdf [https://perma.cc/ZGH3-6E76] (concluding that 88 billion to 206 billion dollars over the 2018–2045 period are expected from space resource utilization). The report further argues,

> The resources of space offer a means to enable sustainable exploration of the Moon and Solar System . . . [and the] utilisation of space resources for exploration may be within reach for the first time; made possible by recent advances in our knowledge and understanding of the Moon and asteroids, increased international and private sector engagement in space activities and the emergence of new technologies.

EUROPEAN SPACE AGENCY, *supra*, at 2; LUXEMBOURG SPACE AGENCY, OPPORTUNITIES FOR SPACE RESOURCES UTILIZATION: FUTURE MARKETS & VALUE CHAINS 9 (2018), https://space-agency.public.lu/dam-assets/publications/2018/Study-Summary-of-the-Space-Resources-Value-Chain-Study.pdf [https://perma.cc/FZ5R-9N6K] (noting that the nascent space resources utilization industry is expected to generate a market revenue of 88 billion to 206 billion dollars over the 2018–2045 period, supporting a total of 845,000 to 1.8 million full time employees). The report further notes that the "[i]ncorporation of space resources into exploration missions will reduce costs and improve their economic viability" and that, as such, "[s]pace resources will play a foundational role in the future of in-space economies." LUXEMBOURG SPACE AGENCY, *supra*, at 3. Furthermore, the report argues that:

> [t]he exploitation of volatiles – mainly water – and other resources such as raw regolith or metals available on celestial bodies requires the establishment of new supply chains for effective utilization. Although the time horizon for the first operational applications are

understanding of . . . natural resources important to the Nation,"[91] and future space missions are being considered to harvest natural resources present in asteroids and other celestial bodies,[92] it should be clear that the harvesting and exploitation of celestial resources can only exist when access to these bodies is unimpeded by the looming dangers of the Kessler Syndrome. As this potential boon of natural resources has yet to be exploited, it is appropriate for NEPA to encompass activities in regions that may limit humanity's ability to access and exploit these natural resources. For these reasons, LEO orbits may satisfy CEQ's definition of a "human environment." As a federal agency, the FCC is obligated to ensure that its activities comply with both NEPA and NEPA's CEQ Implementing Regulations.[93] Given that NEPA is a federal obligation, FCC applicants must similarly comply with these obligations.

IV. FCC ENFORCEMENT OF NEPA IN THE LICENSING OF SATELLITES

The FCC derives its authority to regulate satellites from the United States' signatory status to the International Telecommunication Union (ITU) Treaty, which requires private entities to obtain a license from their host government before establishing or operating a transmitting station.[94] To comply with the treaty,

---

> expected to be in the next decade, preparatory steps are being taken today in developing the enabling technologies and obtaining prospecting information on future exploitable space resources. It is in the interest of pioneering space companies, space agencies, and other visionary organizations to ensure they capture early opportunities and anticipate future needs for the space resources utilization.

Id. at 3; *See also* POPONAK ET AL., SPACE: THE NEXT INVESTMENT FRONTIER 4 (2017), http://www.fullertreacymoney.com/system/data/files/PDFs/2017/October/4th/space%20-%20the%20next%20investment%20frontier%20-%20gs.pdf [https://perma.cc/342P-48WC] (noting that "[w]hile relatively small markets today, rapidly falling costs are lowering the barrier to participate in the space economy, making new industries like space tourism, asteroid mining, and on-orbit manufacturing viable . . .").

[91] *See* 42 U.S.C. § 4321 (2018).

[92] See LUXEMBOURG SPACE AGENCY, *supra* note 90, at 3, and accompanying text.

[93] *See* GREEN ET AL., *supra* note 68, at 149–50.

[94] *See* 1995 Revision of Radio Regulations art. S18.1, Nov. 17, 1995, S. Treaty Doc. No. 108-28 (2008). For more information on ITU regulatory publications see the ITU Radiocommunication Sector (ITU-R) webpage at: https://www.itu.int/en/ITU-R/Pages/default.aspx [https://perma.cc/L9VY-CDJ8]. The United States is bound by ITU documents and implements many of the specific technical obligations through regulations, such as those promulgated by the

Congress amended the Communications Act of 1934 (the Act) to delegate the authority to grant these licenses and regulate commercial satellites to the FCC.[95] The catalyst for the FCC's first orbital debris rules in 2004 was an acknowledgment from the U.S. government that orbital debris poses a significant risk to operational spacecraft.[96] However, the FCC's 2004 rules, and the subsequent 2020 update,[97] merely require informational disclosure with little guidance provided to applicants as to the content of the disclosures.[98] Moreover, the FCC orbital debris rules fail to substantively enforce NEPA, as they apply a narrow interpretation of NEPA requirements.[99]

Indeed, the FCC's rules implementing NEPA at 47 C.F.R. § 1.1307 interprets CEQ Implementing Regulations in a remarkably narrow manner.[100] Rather than identifying classes of actions

---

FCC. *See generally* Lawrence D. Roberts, *A Lost Connection: Geostationary Satellite Networks and the International Telecommunication Union*, 15 BERKELEY TECH. L.J. 1095, 1106, 1111 (2000).

[95] *See* Communications Act of 1934, Pub. L. No. 73-416, 48 Stat. 1064 (codified as amended in multiple sections of 47 U.S.C.).

[96] *See* Mitigation of Orbital Debris, FCC 04-130, at 4–5 (June 9, 2004) (explaining that between 2000 and 2003 the FCC adopted orbital debris mitigation disclosure for certain classes of satellites).

[97] *See generally* Mitigation of Orbital Debris in the New Space Age, FCC 20-54, at 4157 (Apr. 23, 2020) (voting to adopt additional debris mitigation rules while also seeking public comment on additional proposed rules).

[98] Mitigation of Orbital Debris, FCC 04-130, at 5; *see, e.g.*, THE MITRE CORP., *supra* note 68, at 101–02 (arguing that the FCC's 2020 orbital debris guidelines are mere requirements for disclosure rather than mandated thresholds, and concluding that FCC regulations fail to effectively mitigate orbital debris in LEO orbits and "fall well short of what the FCC evidently thinks are required for safe traffic management in space . . .").

[99] *See* 47 C.F.R. § 25.114(d)(14) (2019).

[100] *See, e.g.*, Ramon 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 VAND. J. ENT. & TECH. L. 923, 931 (2020) (arguing that the FCC's current argument that commercial satellite constellation projects are categorically excluded from NEPA-required environmental reviews may not survive judicial scrutiny). Ryan contends that the FCC has opened itself up to litigation by not following the NEPA statute and assessing environmental impacts of commercial satellites, such as the orbital debris likely resulting from satellite constellations. *Id.* at 927. He argues that these impacts clearly merit an assessment under the NEPA statute, which requires the FCC to assess the environmental impacts of commercial satellite projects before approving them for launch. *Id.* at 928; *see also* Space Exploration Holdings LLC, FCC 21-48, at 42–51 (discounting arguments against their approval of SpaceX's satellite constellation that increasing the density of satellites in LEO will also increase orbital debris, thereby negatively impacting the human environment in a manner that triggers a NEPA review, the FCC sidestepped the issue of whether Earth orbits are a "human environment" in

that are categorically excluded, the FCC opts to categorically exclude most of its actions, except for those few falling within a narrow set of circumstances.[101] In defining the scope of 47 C.F.R. § 1.1307, the FCC explained that "[b]ased upon the Commission's experience, we have determined that the telecommunications industry does not generally raise environmental concerns. The comments filed in this proceeding support the Commission's determination. Thus, we have categorically excluded most Commission actions from environmental processing requirements."[102] The FCC went on to describe the three general areas where actions by the telecommunications industry may have a significant environmental impact. Namely, when their facilities: "(1) [w]ill be located in sensitive areas (e.g., wildlife preserves); (2) will involve high-intensity lighting in residential areas; and/or (3) will expose workers or the general public to levels of radiofrequency radiation which would exceed the

---

issuing their sweeping CE, arguing with skepticism that "[w]ithout deciding whether such alleged impacts in space are even within the scope of NEPA (which applies to effects on the quality of the human environment)," satellite constellations are "categorically excluded" from NEPA's environmental review process). Space Exploration Holdings LLC, FCC 21-48, at 50.

[101] Ryan, *supra* note 100, at 943–46.

[102] Environmental Rules in Response to New Regulations Issued by the Council on Environmental Quality, 51 Fed. Reg. 14999 (Apr. 22, 1986) (to be codified at 41 C.F.R. pts. 1, 21, 63, 90, 94). The FCC "regulates interstate and international communications by radio, television, wire, satellite and cable in all 50 states, the District of Columbia and U.S. territories." *What We Do*, FCC, https://www.fcc.gov/about-fcc/what-we-do [https://perma.cc/4MCM-GYZD]. The Communications Act of 1934 delegates expansive regulatory authority to the FCC for the telephone, television, and radio communications industries. *See, e.g.*, Communications Act of 1934, Pub. L. No. 73-416, 48 Stat. 1064 (codified as amended in multiple sections of 47 U.S.C.) [hereinafter the Act]. For more on the Act, see *Establishment of Domestic Communication-Satellite Facilities by Nongovernmental Entities* 22 F.C.C.2d 86, 129 (1970) (explaining the Commission's opinion that the Act "clearly include[s] non-Government satellite and earth station facilities used for interstate communication or transmission of energy by radio"); *id.* at 133 (concluding that the Act provides the Commission with the requisite legal authority to "authorize domestic communications satellite facilities upon finding that such facilities would serve the public convenience, interest, or necessity"). Additionally, courts have held that public safety and the allocation of scarce communications resources are permissible public interest goals for the FCC to consider in its licensing procedures. *See, e.g.*, Deep South Broad. Co. v. FCC, 278 F.2d 264, 267 (D.C. Cir. 1960); Simmons v. FCC, 145 F.2d 578, 579 (D.C. Cir. 1944); *See* Fed. Commc'n Comm'n v. Nat'l Citizens Comm. for Broad., 436 U.S. 775, 796 (1978) (holding that the scarcity of the broadcast spectrum justified consideration of monopolistic ownership practices in granting licenses to promote diversification of media in furtherance of the public interest); *see also* 47 U.S.C. § 307(a).

applicable health and safety standards set forth in § 1.1307(b) of our rules."[103]

The "FCC delegates the initial determination of whether a facility is categorically excluded to the applicant."[104] Accordingly, FCC satellite license application forms inquire whether the facility would have a "significant environmental impact as defined by 47 CFR §1.1307."[105] Given the FCC's narrow interpretation of CEQ Implementing Regulations and the absence of guidance provided to applicants regarding the due diligence required to answer this question, it should be unsurprising that applicants consistently answer "no," just as SpaceX did when it applied for its initial Starlink launch authorization,[106] ensuring that no EA is required.[107]

The regulatory void created by the FCC's decision not to substantively enforce NEPA in LEO may facilitate growth of orbital debris,[108] an argument seemingly not lost on the Government Accountability Office (GAO), which was tasked in 2020 with reviewing whether the FCC's broad CE practices are appropriate and whether Congress should revoke them.[109] In its resulting

---

[103] Environmental Rules in Response to New Regulations Issued by the Council on Environmental Quality, 51 Fed. Reg. 14999 (Apr. 22, 1986) (to be codified at 41 C.F.R. pts. 1, 21, 63, 90, 94).

[104] GREEN ET AL., *supra* note 68, at 158.

[105] Application for Satellite Space Station Authorizations, FCC 312 Main Form (Nov. 15, 2016).

[106] Application for Satellite Space Station Authorizations, FCC 312 Main Form, Space Exploration Holdings, LLC (Nov. 15, 2016, 9:03 PM), https://fcc.report/IBFS/SAT-LOA-20161115-00118/1158353.pdf [https://perma.cc/B93L-EQDR].

[107] *See* GREEN ET AL., *supra* note 68, at 158.

[108] *See generally* Michael B. Runnels, *On Clearing Earth's Orbital Debris & Enforcing the Outer Space Treaty in the U.S.*, A.B.A.: BUS. L. TODAY 1, 3, 14 (Jan. 13, 2022), https://businesslawtoday.org/2022/01/on-clearing-earths-orbital-debris-enforcing-outer-space-treaty-in-us/ [https://perma.cc/4EHG-YHBD] (discussing how, from the perspective of U.S. treaty obligations under the 1967 Outer Space Treaty, FCC rulemaking in the area of orbital debris is insufficient in addressing the looming problem of orbital debris and provides draft legislation that would begin to fill this regulatory void).

[109] *See* Jonathan O'Callaghan, *Satellite Constellations Could Harm the Environment, New Watchdog Report Says*, SCI. AMERICAN (Nov. 24,2022), https://www.scientificamerican.com/article/satellite-constellations-could-harm-the-environment-new-watchdog-report-says/ [https://perma.cc/X7WE-NQVD] (detailing that the GAO report notes that Elon Musk's Starlink and other satellite constellation projects are sources for orbital debris and, thus, should face an environmental review).

November 2022 report,[110] the GAO found that the FCC "has not sufficiently documented its decision to apply its categorical exclusion when licensing large constellations of satellites,"[111] and recommended that the FCC "(1) review and document whether licensing large constellations of satellites normally does not have significant effects on the environment [and] (2) establish a timeframe and process for a periodic review of its categorical exclusion under NEPA . . . ."[112] In developing its recommendations, the GAO presumed, without opining on the intent of NEPA's text, that satellite operations in LEO do have an environmental effect due to "orbital debris and risk to satellites" in LEO, explaining that "although these effects might be small for single satellites, the effects of many satellites operating in large constellations are larger, or in some cases, unknown."[113] The GAO report then noted that the FCC agreed with their recommendations.[114]

V. THE IMPLICATIONS OF THE *WEST VIRGINIA V. EPA* DECISION AND THE MAJOR QUESTIONS DOCTRINE

While it may be reasonable to argue that the FCC's broad CE practices are an unreasonably narrow interpretation of its statutory obligations under NEPA, the Supreme Court clarified in its recent *EPA* ruling that any such argument may be unavailing in lieu of explicit authorization from Congress.[115] Categorizing the case as falling under the "major questions doctrine,"[116] the

---

[110] U.S. GOV'T ACCOUNTABILITY OFF., SATELLITE LICENSING: FCC SHOULD REEXAMINE ITS ENVIRONMENTAL REVIEW PROCESS FOR LARGE CONSTELLATIONS OF SATELLITES 1 (2022) [hereinafter SATELLITE LICENSING].

[111] *Id.* at 2.

[112] *Id.*

[113] *See, e.g.*, U.S. GOV'T ACCOUNTABILITY OFF., LARGE CONSTELLATIONS OF SATELLITES: MITIGATING ENVIRONMENTAL AND OTHER EFFECTS 6 (2022), https://www.gao.gov/products/gao-23-105005 [https://perma.cc/75SW-PDTA].

[114] *See* SATELLITE LICENSING, *supra* note 110, at 29.

[115] *See* West Virgina v. EPA, 142 S. Ct. 2587, 2609 (2022).

[116] The Court wrote that: "[p]recedent teaches that there are 'extraordinary cases' . . . in which the 'history and the breadth of the authority that [the agency] has asserted,' and the 'economic and political significance' of that assertion, provide a "reason to hesitate before concluding that Congress' meant to confer such authority." *Id.* at 2608 (citing FDA v. Brown & Williamson Tobacco Corp., 529 U.S. 120, 159–160 (2000)). *See, e.g.*, Alabama Assn. of Realtors v. Dep't of Health and Hum. Servs., 141 S. Ct. 2485, 2489; Util. Air Regul. Grp. v. EPA, 573 U. S. 302, 324; Gonzales v. Oregon, 546 U.S. 243, 267; Nat'l Fed'n of Indep. Bus. v. OSHA, 142 S. Ct. 661, 664–65 (2022). Under this body of law, known as the

Court explained that when "agencies [assert] highly consequential power beyond what Congress could reasonably be understood to have granted,"[117] or "discover in a long-extant statute an unheralded power representing a 'transformative expansion in its regulatory authority,'"[118] "there is every reason to 'hesitate before concluding that Congress' meant to confer"[119] the power claimed. By a vote of 6–3, Chief Justice John Roberts, writing for the Court in its reversal of the EPA's carbon dioxide regulations, argued that the Clean Air Act does not explicitly authorize the EPA to regulate carbon dioxide emissions in a manner that triggers a nationwide transition away from the use of coal and that Congress must speak clearly on this subject.[120] In its defanging of the EPA's authority to regulate carbon dioxide emissions, Chief Justice Roberts wrote that, while "[c]apping carbon dioxide emissions at a level that will force a nationwide transition away from the use of coal to generate electricity may be a sensible solution to the crisis of the day,"[121] [a] decision of such magnitude and consequence rests with Congress itself, or an agency acting pursuant to a clear delegation from that representative body,"[122] and "[t]o convince us otherwise, something more than a merely plausible textual basis for the agency action is necessary. The agency instead must point to 'clear congressional authorization' for the power it claims."[123]

Chief Justice Roberts's unambiguous embrace of the major questions doctrine, which is "a judicially created approach to statutory interpretation in challenges to agency authority[,] likely [has] ripple effects far beyond the EPA[, as this] reason-

---

major questions doctrine, given both separation of powers principles and a practical understanding of legislative intent, the agency must point to "clear congressional authorization" for the authority it claims. *Util. Air*, 573 U.S. at 324. "This is a major questions case." *EPA*, 142 S. Ct. at 2595.

[117] *EPA*, 142 S. Ct. at 2620.

[118] *Id.* at 2610.

[119] *Id.*; *See also* Thomas B. Griffith & Haley N. Proctor, *Deference, Delegation, and Divination: Justice Breyer and the Future of the Major Questions Doctrine*, 132 YALE L.J. 693, 694 (2022) (explaining that the "major questions doctrine instructs courts to presume that Congress does not delegate policy decisions of great economic and political magnitude to [federal] agencies.").

[120] *EPA*, 142 S. Ct. at 2616.

[121] *Id.*

[122] *Id.*

[123] *Id.* at 2609 (citing Util. Air Regul. Grp. v. EPA, 573 U.S. 302, 324 (2014)).

ing applies to any major policymaking effort by federal agencies," including the FCC.[124]

Indeed, the Clean Air Act, which the EPA used in its rulemaking,[125] was passed in 1970 when global warming was lesser known.[126] Similarly, NEPA was passed in 1969 when orbital debris was also a lesser known phenomenon.[127] Notably, independent of the FCC's oversight and authorization of satellite operations, 47 C.F.R. § 1.1307 does not reference satellites, the LEO orbits in which they operate, or orbital debris.[128] Moreover, this regulation has not been significantly amended since 1986.[129] Accordingly, while the Supreme Court may view the mitigation of orbital debris to be a "sensible solution to the crisis of the day,"[130] the Court may view FCC rulemaking in this area as "representing a transformative expansion in its regulatory authority"[131] and, therefore, unconstitutional.

VI. RECOMMENDATIONS TO INCLUDE THE EARTH'S ORBITAL ENVIRONMENT UNDER THE SCOPE OF NEPA

This Part recommends language to amend two sections of the U.S. Code to include Earth's orbital environment under the scope of NEPA, which will then enable the FCC to regulate orbital debris in a manner that is responsive to the Supreme Court's requirement that federal agencies have "clear congressional authorization"[132] to exercise any power not explicitly provided by Congress.[133] While these regulations may be seen as an unrea-

---

[124] Amy Howe, *Supreme Court Curtails EPA's Authority to Fight Climate Change*, SCOTUSBLOG (June 30, 2022, 12:57 PM), https://www.scotusblog.com/2022/06/supreme-court-curtails-epas-authority-to-fight-climate-change/ [https://perma.cc/9FW8-LFJL].

[125] *See EPA*, 142 S. Ct. at 2599.

[126] *See* Coral Davenport, *What Is the Clean Air Act?*, N.Y. TIMES (June 20, 2022), https://www.nytimes.com/2022/06/30/climate/clean-air-act-epa.html [https://perma.cc/3GM5-SVCZ].

[127] *See* Jim Kershner, *NEPA, the National Environmental Policy Act*, HISTORYLINK.ORG (Aug. 27, 2011), https://www.historylink.org/File/9903 [https://perma.cc/XD3A-QJGP].

[128] *See* 47 C.F.R. § 1.1307 (1990).

[129] *Id.*

[130] *EPA*, 142 S. Ct. at 2616.

[131] *Id.* at 2595.

[132] *Id.* at 2616 (citing Util. Air Regul. Grp. v. EPA, 573 U.S. 302, 324 (2014)).

[133] *Id.* at 2595; *see* Matthew Daly, *What the Supreme Court's EPA Ruling Means for the Climate Change Fight*, PBS NEWSHOUR (June 30, 2022, 6:41 PM), https://www.pbs.org/newshour/politics/what-the-supreme-courts-epa-ruling-means-for-

sonable restraint on the growth of new space industries, a Pew study found that, in the case of nearly a dozen industries, the costs of implementing new regulations were less than estimated while the economic benefits were greater than estimated.[134] Furthermore, these regulations did not significantly impede the economic competitiveness of the industries.[135]

A. Amend Title 42 of the U.S. Code to Include Earth's Orbital Environment Under the Scope of NEPA

Consistent with the FCC's mandate to enhance the safety of space traffic management,[136] the public interest goals of the FCC,[137] the notion that LEO orbits potentially satisfy the CEQ's definition of a "human environment,"[138] the U.S. Supreme Court's recent ruling that federal agencies must point to "clear

---

the-climate-change-fight [https://perma.cc/42MX-A2P9] (detailing the implications for federal agencies in the wake of this ruling, Daly quotes Georgetown University Law Professor Lisa Heinzerling, a former EPA official: "It's almost as if the [C]ourt needs Congress to make a new law every time a new problem emerges, which is ridiculous and dangerous.").

134 *See Government Regulation: Costs Lower, Benefits Greater than Industry Estimates*, Pew (May 26, 2015), https://www.pewtrusts.org/-/media/assets/2015/05/industry/government_regulation_costs
_lower_benefits_greater_than_industry_estimates.pdf [https://perma.cc/7WWV-KLH8].

135 The report found that

> [r]egulatory requirements to protect the environment . . . often lead to innovation, increased productivity, and new businesses and jobs. Although an argument is sometimes made that the cost of complying with regulations is too high, that the societal benefits do not justify the investment, or that job losses will result, a review of past regulations reveals just the opposite. Historically, compliance costs have been less and benefits greater than industry predictions, and regulation typically poses little challenge to economic competitiveness.

Id. at 1.

136 *See generally* National Space Traffic Management Policy, 83 Fed. Reg. 28969 (June 21, 2018) (outlining the policy of the United States towards the management of traffic in space); *Mitigation of Orbital Debris in the New Space Age*, 35 FCC Rcd. 4156 (2020) (regarding the FCC's vote to adopt additional debris mitigation rules while also seeking public comment on additional proposed rules).

137 *See* FCC v. Nat'l Citizens Comm. for Broad., 436 U.S. 775, 795 (1978) (holding that the scarcity of the broadcast spectrum justified consideration of monopolistic ownership practices in granting licenses to promote diversification of media in furtherance of the public interest); 47 U.S.C. § 307(a); Deep S. Broad. Co. v. FCC, 278 F.2d 264, 267 (D.C. Cir. 1960); Simmons v. FCC, 145 F.2d 578, 579 (D.C. Cir. 1944).

138 *See supra* note 78.

congressional authorization"[139] for any power not explicitly provided by Congress, and responsiveness to the GAO's recommendations to the FCC,[140] this Article's proposed amendment to Title 42 of the U.S. Code is as follows:

Title 42, of the U.S. Code, is amended by adding to § 4331 the following bolded and italicized language:

Subchapter I – Congressional Declaration of National Environmental Policy

(a) The Congress, recognizing the profound impact of man's activity on the interrelations of all components of the natural environment, *including Earth's orbital environment,* particularly the profound influences of population growth, high-density urbanization, industrial expansion, resource exploitation, and new and expanding technological advances and recognizing further the critical importance of restoring and maintaining environmental quality to the overall welfare and development of man, declares that it is the continuing policy of the Federal Government, in cooperation with State and local governments, and other concerned public and private organizations, 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.[141]

B. Amend Title 47 of the U.S. Code to Require that Commercial Satellite Operators Prepare an Environmental Assessment on LEO Orbits

If NEPA is amended in a manner similar to the above recommendation, the FCC's broad CE practices[142] must also be amended. Accordingly, this Article's proposed amendments to Title 47 of the U.S. Code narrow the FCC's broad CE practices through the following:

Title 47, of the U.S. Code, is amended by adding to § 1.1307 the following bolded and italicized language:

---

[139] *See* West Virginia v. EPA, 142 S. Ct. 2587, 2595 (2022).

[140] *See* Satellite Licensing, *supra* note 110.

[141] *See* 42 U.S.C. § 4331 (1970).

[142] *See* discussion *supra* Part III.

Subpart I – Procedures Implementing the National Environmental Policy Act of 1969

§ 1.1307 Actions that may have a significant environmental effect, for which Environmental Assessments (EAs) must be prepared.[143]

(c) **Commission actions with respect to satellite operations may significantly affect the environment and thus require the preparation of EAs or further Commission environmental processing where:**[144]

(1) **Satellite operations in LEO may affect the terrestrial human environment including, but not limited to: weather forecasting, remote sensing,**[145] electronic commerce, GPS, internet connectivity, and news reporting.

VII. CONCLUSION

"Over the next decade, commercial operators plan to launch tens of thousands of new satellites into orbit. A veritable Cambrian explosion of commercial space operations is just over the horizon. We had better be ready when it arrives."[146]

The recommendations provided in this Article are not only designed to survive judicial scrutiny in the wake of the Supreme Court's recent *EPA* ruling,[147] but they are also consistent with the Orbital Debris Plan, as they "focus on addressing the safety and sustainability of the space environment due to intended and unintended orbital debris events."[148] Moreover, these recommendations help further the FCC's current effort to address "the new space age with modernized regulations to match the

---

[143] The existing (c) in the statute would become (d), (d) would become (e), and (e) would become (f).

[144] For reference, the language of CFR § 1.1307(a) reads: "Commission actions with respect to the following types of facilities may significantly affect the environment and thus require the preparation of EAs by the applicant (*see* 47 §§ 1.1308 and 1.1311) and may require further Commission environmental processing. (*see* §§ 1.1314, 1.1315, and 1.1317)." *See* 47 C.F.R. § 1.1307(a).

[145] *See* WHAT IS REMOTE SENSING AND WHAT IS IT USED FOR?, U.S. GEOLOGICAL SURV., https://www.usgs.gov/faqs/what-remote-sensing-and-what-it-used [https://perma.cc/F5ZH-DN66] (defining remote sensing as "the process of detecting and monitoring the physical characteristics of an area by measuring its reflected and emitted radiation at a distance").

[146] Statement of Commissioner Nathan Simington; Re: Space Innovation, IB Docket No. 22-271; Mitigation of Orbital Debris in the New Space Age, IB Docket No. 18-313.

[147] *See* West Virginia v. EPA, 142 S. Ct. 2587, 2587 (2022).

[148] *See* NAT'L SCI. & TECH. COUNCIL, *supra* note 10, at ii.

new realities . . . and taking seriously the space sustainability questions that come with rapidly growing and changing public and private space endeavors."[149] Indeed, as the satellite industry is now estimated to be a $279 billion-a-year sector,[150] proactive regulations are needed to ensure that satellite operators clean up after themselves and consider the environmental impacts of their operations in LEO.

---

[149] *See* Press Release, Federal Communications Commission, *supra* note 4.
[150] *Id.*