

Nos. 21-1123, -1125, -1128

---

---

IN THE UNITED STATES COURT OF APPEALS  
FOR THE DISTRICT OF COLUMBIA CIRCUIT

---

---

VIASAT, INC.,

*Appellant,*

v.

FEDERAL COMMUNICATIONS COMMISSION,

*Appellee,*

SPACE EXPLORATION HOLDINGS, LLC,

*Intervenor for Respondent.*

-----  
THE BALANCE GROUP,

*Appellant,*

v.

FEDERAL COMMUNICATIONS COMMISSION,

*Appellee,*

SPACE EXPLORATION HOLDINGS, LLC,

*Intervenor for Respondent.*

---

On Appeal from the Federal Communications Commission  
IBFS File No. SAT-MOD-20200417-00037

---

**ADDENDUM TO OPENING BRIEF OF  
APPELLANTS VIASAT, INC. AND THE BALANCE GROUP**

---

*(Counsel listed on inside cover)*

August 6, 2021

Colin L. Ward  
VIASAT, INC.  
6155 El Camino Real  
Carlsbad, CA 92009

William M. Jay  
GOODWIN PROCTER LLP  
1900 N Street, NW  
Washington, DC 20036  
(202) 346-4000

OF COUNSEL:

John P. Janka  
Jarrett S. Taubman  
VIASAT, INC.  
901 K Street, NW, Suite 400  
Washington, DC 20001

David J. Zimmer  
Gerard J. Cedrone  
Jordan Bock  
GOODWIN PROCTER LLP  
100 Northern Avenue  
Boston, MA 02210  
(617) 570-1000

*Counsel for Viasat, Inc.*

Michael F. Smith  
THE SMITH APPELLATE LAW FIRM  
1717 Pennsylvania Avenue, NW  
Suite 1025  
Washington, DC 20006  
(202) 454-2860

Stephen L. Goodman  
STEPHEN L. GOODMAN, PLLC  
532 North Pitt Street  
Alexandria, VA 22314  
(202) 607-6756

*Counsel for The Balance Group*

## TABLE OF CONTENTS

### Declarations

Declaration of Dr. Christopher Baddiley .....	Add1
Declaration of Mark Dankberg .....	Add6
Declaration of Dr. Roger F. Malina.....	Add32
Declaration of Joseph Sandri .....	Add36

### Statutory Provisions

42 U.S.C. § 4321 .....	Add42
42 U.S.C. § 4331 .....	Add43
42 U.S.C. § 4332 .....	Add45

### Regulatory Provisions

40 C.F.R. § 1501.3 .....	Add46
40 C.F.R. § 1501.4 .....	Add47
40 C.F.R. § 1501.5 .....	Add48
40 C.F.R. § 1507.3.....	Add49
40 C.F.R. § 1508.1 .....	Add50
47 C.F.R. § 1.1306 .....	Add52
47 C.F.R. § 1.1307 .....	Add54

**UNITED STATES COURT OF APPEALS  
FOR THE DISTRICT OF COLUMBIA CIRCUIT**

VIASAT, INC.,	)	
	)	
Appellant,	)	No. 21-1123
	)	
v.	)	Consolidated with Nos.
	)	21-1125, 21-1127 & 21-
1128		
FEDERAL COMMUNICATIONS	)	
COMMISSION,	)	FCC IBFS File No. SAT-
MOD-		
	)	20200417-00037
Appellee,	)	
	)	
SPACE EXPLORATION	)	
HOLDINGS, LLC,	)	
	)	
Intervenor for Respondent.	)	
	)	

---

**DECLARATION OF CHRISTOPHER BADDILEY**

1. My name is Christopher Baddiley, and I make these statements pursuant to 28 U.S.C. § 1746 and based upon my own personal knowledge. I am over 18 years of age, and if called to do so, am competent to testify that the contents of this Declaration are accurate and true.

2. I am a retired physicist and a member of The Balance Group, and I reside in Mathon, Near Malvern, England, United Kingdom. I earned a Ph.D. in astrophysics from University College London (UCL) in 1973, and a B.S. with Honors in Physics from

Newcastle University in 1969. Currently I teach a U3A course in astrophysics and am a Fellow with the Royal Astronomical Society (RAS) and a member of the International Astronomical Union (IAU).

3. I research light pollution, and have presented findings at the National Astronomy Meeting, an annual scientific conference of astronomers that is sponsored and coordinated by the Royal Astronomical Society. I have measured sky brightness every 2 minutes for 10 years, and imaged the sky every 30 seconds on the darkest of nights and prepared related statistics, and have analyzed and written papers and presented at various conferences. Previously, I have been awarded the IDA Galileo award.

4. The current and worsening situation with the launch of satellite mega-constellations has limited my Astro imaging work to increasingly short exposures. I create and store night sky images (via observatory) on all clear nights, and have created a voluminous archive of sequential sky brightness measures and of all sky imaging which is the basis of many projects and statistical analysis.

5. I image dark sky objects continually on the few UK darkest and clearest of nights using a long focal length lens and standard DSLR camera auto-guided by the main telescope, which is also imaging with multi band filters and a high sensitivity detector. I am now getting with the standard DSLR camera and long focal length lens 2.5-degree fov, typically 1 to 2 Low Earth Orbit satellite crossings in at least one of the sequential 2-minute exposures over any 30-minute period, away from midnight. I also run an all-sky camera at the same time and have sequential images of these SpaceX Starlink satellite constellations. This already has significant impact on my Astro imaging projects.

6. The situation is getting worse and will be far worse as more satellite are launched; also, by other companies. There are papers reporting modelling of the overall increase in sky brightness from mega constellations; this significantly adding to the natural sky glow background comparative to the artificial light at night light pollution in rural areas.

This is yet another example of commercial nighttime activity using new technology having significant impact on the natural environment.

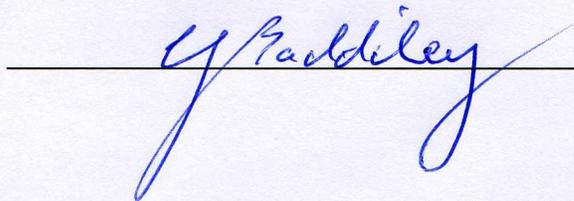
7. Mitigation measures on the satellites have only reduced the brightness slightly, and consequently increased the infrared emissions. With respect to the future and large professional telescope facilities; there is significant interference to radio telescopes. The effect on the new large optical survey facilities and radio facilities coming on line has been modelled to be extremely significant; limiting their ability detect potentially hazardous asteroids as just one example.

8. If these launches continue then there will be many other competitors doing the same. There already have been near collision misses with other satellites of which any could be disastrous. We are heavily littering our immediate space environment without control. The United Nations Office for Outer Space Affairs has already had conferences and made strong statements about this, as have many academic institutions, including the International Astronomical Union.

9. The cessation of the continued deployment of the SpaceX system, and ideally significant changes to its satellites (and/or removal of those satellites from their current, low orbital slots) would put a limit on this environmental pollution.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Executed on August 05, 2021 at Mathon, England, United Kingdom.



Christopher Baddiley

Nos. 21-1123, -1125

---

---

IN THE UNITED STATES COURT OF APPEALS  
FOR THE DISTRICT OF COLUMBIA CIRCUIT

---

---

VIASAT, INC.,  
*Appellant,*

v.

FEDERAL COMMUNICATIONS COMMISSION,  
*Appellee,*

SPACE EXPLORATION HOLDINGS, LLC,  
*Intervenor for Respondent.*

---

On Appeal from the Federal Communications Commission  
IBFS File No. SAT-MOD-20200417-00037

---

**DECLARATION OF MARK DANKBERG**

I, Mark Dankberg, hereby declare as follows:

1. I am the Chairman of the Board and Executive Chairman of Viasat, Inc. I co-founded the company in 1986, and served as its CEO from 1986 until assuming my current role in November 2020. As Executive Chairman, I focus on advancing Viasat's strategic technology and business direction, as well as shaping the national and international space and broadband regulatory environments that are critical to Viasat's execution of its global strategy.

2. I earned a Bachelor of Science in Electrical Engineering and a Master

of Electrical Engineering from Rice University, and am a member of the Rice University Electrical and Computer Engineering Hall of Fame. In 2017, I was elected to the National Academy of Engineering for my contributions to broadband internet communications via satellite. Membership in the National Academy of Engineering is one of the highest professional honors that can be accorded an engineer.

3. I have co-authored several military standards on satellite networking, and am a named inventor on over one hundred patents concerning communications and satellite networking technologies. I have participated in Department of Defense advisory panels and was invited to testify before Congress on the promises of next-generation commercial satellite technology, national broadband expansion plans, and high technology growth companies and IPOs.

4. I have received a number of other awards in recognition of my industry and business leadership, including:

- 2000 San Diego Entrepreneur of the Year
- 2003 Satellite Industry Executive of the Year
- 2008 American Institute of Aeronautics and Astronautics (AIAA) Aerospace International Communications Award
- 2012 Visionary Executive of the Year, Satellite Markets and Research
- 2013 Arthur C. Clarke Foundation Industry Innovator
- 2013 San Diego Business Journal Most Admired CEO Founders Award
- 2015 Society of Satellite Professionals Hall of Fame

5. Viasat has a long history and extensive expertise in developing and providing satellite communications technologies for both military and commercial uses. It is a leading provider of satellite-based broadband services to consumers, businesses, and government users throughout the United States and the world, including to over 1,400 aircraft and more than 14 airlines (American Airlines, Delta Airlines, JetBlue, KLM, Qantas, and United Airlines, among others). Viasat also develops state-of-the-art technologies for other satellite operators and for government entities. Viasat has been a leading provider of satellite payload and ground technologies for satellite operators and government entities across narrowband low-earth orbit (“LEO”), broadband LEO, earth sensing non-geosynchronous orbit (“NGSO”), broadband medium-earth orbit (“MEO”), and broadband geosynchronous orbit (“GSO”).

6. Viasat’s broadband service has received various accolades. For example:

- Last year, *U.S. News & World Report* named Viasat to its list of top internet service providers (ISPs) in the United States.<sup>1</sup>
- In 2019, *Fortune* included one of Viasat’s satellite broadband solutions on its “Change the World” list, which identifies commercial initiatives that are having measurable social impact around the world.<sup>2</sup>

<sup>1</sup> Sarah Shelton, *Best Internet Service Providers of 2021*, U.S. News & World Report (Apr. 28, 2021), <https://www.usnews.com/360-reviews/internet-providers>.

<sup>2</sup> *Change the World*, FORTUNE, <https://fortune.com/change-the-world/2019/> (last visited June 1, 2021).

- In April, CNET named Viasat as the best satellite provider of 2021 for rural connectivity in the United States.<sup>3</sup>
- *Fast Company* included Viasat in its 2020 World Changing Ideas list.<sup>4</sup>

7. Viasat's existing fleet of satellites has set records over the years.

ViaSat-1, for example, became the highest capacity satellite in the world upon its launch in 2011, at the time providing greater capacity than all other communications satellites over North America combined.<sup>5</sup>

8. In addition to its consumer and business services, Viasat has been a leading provider of satellite broadband connectivity to allied governments and a number of U.S. Department of Defense organizations, serving a broad range of airborne platforms and missions, including providing satellite-based internet connectivity for Air Force One and other high-value government aircraft. Viasat is currently operating a satellite for a U.S. Government customer in LEO at an orbit of

<sup>3</sup> David Anders, *The Best Rural Internet Providers of 2021*, CNET (Apr. 7, 2021), <https://www.cnet.com/home/internet/best-rural-internet/>.

<sup>4</sup> Kristin Toussaint, *Here's how one company is delivering the internet to remote villages*, *Fast Company* (Apr. 28, 2020), <https://www.fastcompany.com/90490840/heres-how-one-company-is-delivering-the-internet-to-remote-villages>; *see also World Changing Ideas Awards 2020: Developing-World Technology Finalists and Honorable Mentions* (Apr. 28, 2020), <https://www.fastcompany.com/90492106/world-changing-ideas-awards-2020-developing-world-technology-finalists-and-honorable-mentions>.

<sup>5</sup> Veronica Magan, *ViaSat-1 Sets Guinness World Record*, *VIA SATELLITE* (Mar. 6, 2013), <https://www.satellitetoday.com/telecom/2013/03/06/viasat-1-sets-guinness-world-record/>.

575 km (within the 510-580 km orbital altitude range of SpaceX's Starlink satellites).<sup>6</sup>

9. Viasat has active plans to expand its fleet with additional satellites and satellite constellations. On April 23, 2020, the FCC authorized Viasat to serve the United States market with a NGSO satellite system consisting of 20 satellites operating in MEO (at ~8,200 km).<sup>7</sup> On May 26, 2020, Viasat requested a modification of that authorization to expand the number of active satellites from 20 to 288 and to lower the orbital altitude to LEO (at ~1,300 km). In addition, Viasat is under contract with the Department of Defense to launch a high value LEO satellite into an orbit that also is within the altitude range of SpaceX's Starlink satellites, and intends to do so within the next six to twelve months. That satellite will demonstrate Tactical Data Links from space in support of the Department of Defense and Space Force. The satellite will be jointly operated by Viasat and the Department of Defense. Many more such satellites are contemplated.

10. In addition, Viasat has spent years and over one billion dollars

<sup>6</sup> Mike Gruss, *ViaSat Wins \$73 Million for Air Force One Satellite Communications Contract*, SPACE NEWS (June 3, 2016), <https://spacenews.com/viasat-wins-73-million-for-air-force-one-satellite-communications-contract/>.

<sup>7</sup> *In the Matter of Viasat, Inc. Petition for Declaratory Ruling Granting Access for a Non-U.S. Licensed Non-Geostationary Orbit Satellite Network*, Order and Declaratory Ruling, 35 FCC Rcd. 4224 (Apr. 23, 2020).

researching, designing, and building its latest generation of broadband satellites, dubbed ViaSat-3. Each of the three ViaSat-3 satellites under construction will cover one-third of the earth's surface, and each will have a communications capacity of over 1 terabit of data per second.<sup>8</sup> Upon deployment, each ViaSat-3 satellite will be the highest-capacity communications satellite ever launched, with more than twice the per-satellite capacity of its nearest competitor.

11. The first ViaSat-3 is expected to be launched through LEO into geosynchronous orbit (which is at a higher altitude than LEO or MEO) within the next twelve months, followed shortly thereafter by the next two ViaSat-3 satellites.

12. I am familiar with (a) SpaceX's plans to deploy a LEO satellite constellation (dubbed "Starlink") consisting of: (i) two initial groups of satellites that would be operated together as a single network—including a group of approximately 4,408 operating satellites, and another group of approximately 7,518 operating satellites (with the two groups operating in different frequency combinations and altitudes), and (ii) a follow-on network with approximately 30,000 additional operating satellites; (b) SpaceX's FCC licenses and license applications that underlie the foregoing; (c) SpaceX's "Third Modification Application," in which it sought final authorization from the FCC to deploy 2,824 operating satellites into

<sup>8</sup> *ViaSat-3 Satellite Constellation*, ViaSat, Inc., <https://www.viasat.com/space-innovation/satellite-fleet/viasat-3/> (last accessed June 1, 2021).

LEO; (d) the FCC's Order approving the Third Modification Application; and (e) Viasat's efforts to secure environmental review by the FCC of the Third Modification Application (including through this appeal). I also am familiar with the scientific research that has been conducted, and is ongoing, regarding both the threats to the orbital environment and the safety thereof posed by the growing amount of orbital debris, as well as the threats to the continued use of shared orbital resources in space as a consequence of the deployment of unprecedentedly large numbers of satellites in LEO, like the Starlink constellation.

13. I submit this declaration to explain the injury to Viasat that will result from SpaceX's environmentally reckless satellite deployments and operations authorized by the Order.

14. A large number of academics and other researchers have expressed concern about the potential impact of launching large numbers of satellites into LEO.

By way of example:

- a. Dr. Jonathan McDowell of the Harvard-Smithsonian Center for Astrophysics has warned that SpaceX will operate so many satellites that even a low failure rate would mean a relatively high threat to orbital safety because of the potential for collisions, and that it is "not clear that [SpaceX] will be able to manage the final constellation."<sup>9</sup>

<sup>9</sup> Bojan Pancevski, *Elon Musk's Satellite Internet Project Is Too Risky, Rivals Say*, THE WALL STREET JOURNAL (Apr. 19, 2021), <https://www.wsj.com/articles/elon-musks-satellite-internet-project-is-too-risky-rivals-say-11618827368>. Dr. McDowell has similarly noted that the "impacts [of Starlink] will be significant for certain types of [astronomical] observation, certain observatories and at certain

Dr. McDowell has recommended that satellite companies pause launches once there are 1,000 satellites in orbit to monitor for design flaws or other issues.<sup>10</sup>

- b. Dr. Moriba K. Jah, a leading expert on managing the risks of debris at the Aerospace Engineering and Engineering Mechanics Department at the University of Texas at Austin, testified to Congress that “[t]here are no standard ‘rules of the road’ for space operations and activities, and we should avoid creating these in a vacuum, absent informed science and technology.” He testified further: “I have personally found an absence of space operations expertise amongst the workforce driving some of these ‘New Space’ ventures, causing me further concern regarding orbital safety and long-term sustainability of space activities. There is a mentality of ‘take risks and fail often.’ While this worked well for software companies in Silicon Valley, we can’t afford to have this exact mentality in space.”<sup>11</sup>
- c. Dr. William Ailor, Technical Fellow for the Center for Orbital and Reentry Debris Studies at the Aerospace Corporation, a federally funded research and development center committed exclusively to the space enterprise, has written that the “environmental impacts of rocket emissions, space debris and re-entry plumes warrant attention given the significant increase in space activity in recent years.” Moreover, “[m]ore analysis is warranted to appropriately quantify and account for environmental impacts along the entire space supply chain to

times of year.” A. Tarantola, *We’re Entombing the Earth in an Impenetrable Shell of Dead Satellites*, ENGADGET (Apr. 8, 2021), <https://www.engadget.com/were-entombing-the-earth-in-an-impenetrable-shell-of-dead-satellites-163002560.html>

<sup>10</sup> Kate Duffy, *SpaceX is dominating orbit with its Starlink satellites, making the risk of space-traffic collision a serious hazard, industry experts say*, BUSINESS INSIDER (Mar. 28, 2021), <https://www.businessinsider.com/elon-musk-spacex-starlink-satellites-dominate-orbit-industry-experts-2021-3>

<sup>11</sup> *Reopening the American Frontier: Promoting Partnerships Between Commercial Space and the U.S. Government to Advance Exploration and Settlement: Hearing Before the Subcomm. on Space, Science, and Competitiveness of the S. Comm. on Commerce, Science & Transportation*, 115th Cong. 38 (2017) (Statement of Moriba K. Jah), <https://www.govinfo.gov/content/pkg/CHRG-115shrg30770/pdf/CHRG-115shrg30770.pdf>.

ensure both terrestrial and space sustainability.”<sup>12</sup>

15. The FCC has identified and acknowledged two critical aspects of the problem that is created by the rush to fill space with mega-constellations like SpaceX’s:

- a. LEO resources are limited, such that an unlimited number of satellites cannot coexist in LEO.
- b. Economic incentives for individual commercial actors may not be sufficient to encourage them to adopt responsible and socially optimal practices designed to ensure that the shared orbital environment remains available for all to use safely. Instead, individual commercial actors may be incented to adopt practices that force other space users to bear significant negative externalities, raising their economic costs and ultimately jeopardizing the viability of certain parts of space—*i.e.*, the Tragedy of the Commons.<sup>13</sup>

16. SpaceX’s authorizations from the FCC allow it to deploy an unlimited number of technically identical replacement satellites over the applicable 15-year license term. Given the stated 5-year design life of its satellites, and the expectation (based on experience to date) that many of its satellites will fail or be deorbited before the end of their design lives (as over 100 of its first ~1,700 satellites already have), it is reasonable to expect that over 15 years, SpaceX will launch at least two-

<sup>12</sup> Debra Werner, *Aerospace Corp. raises questions about pollutants produced during satellite and rocket reentry*, SPACE NEWS (Dec. 11, 2020), <https://spacenews.com/aerospace-agu-reentry-pollution/>

<sup>13</sup> See *Mitigation of Orbital Debris in the New Space Age*, Notice of Proposed Rulemaking and Order on Reconsideration, 33 FCC Rcd 11352, at ¶¶ 88-89 (2018); *Mitigation of Orbital Debris in the New Space Age*, Report and Order and Further Notice of Proposed Rulemaking, 35 FCC Rcd 4156, at ¶ 25 (2020).

to-three times more Starlink satellites than it is permitted to operate at any one time. Indeed, the Commission's Order estimated that SpaceX could launch close to 10,000 satellites under the authority provided by the FCC's Order alone.<sup>14</sup>

17. SpaceX's planned deployment of many thousands of satellites into LEO—including those covered by the FCC's grant of the Third Modification Application—will significantly increase the risk of in-orbit collisions, including (a) collisions between two SpaceX satellites, (b) collisions between a SpaceX satellite and a satellite operated by a third party, such as Viasat, and (c) collisions between a SpaceX satellite and orbital debris. Viasat and other parties presented extensive technical analysis of this increased collision risk, which is included in the FCC's administrative record.<sup>15</sup>

18. With respect to a given satellite constellation, there are two particularly significant sources of overall collision risk: (i) risks related to satellites that fail and lose the ability to maneuver—and thus avoid potential collisions, and (ii) “residual risks” that remain even when collision avoidance maneuvers are attempted. Example residual risks include:

- a. Most orbital debris objects cannot be tracked at all, and even that which can be tracked cannot always be tracked precisely, making it difficult to predict collisions with such objects or initiate appropriate avoidance

<sup>14</sup> Order ¶ 63.

<sup>15</sup> See, e.g., Letter from Viasat to FCC, IBFS File No. SAT-MOD-20200417-00037, Attachment (Jan. 15, 2021).

maneuvers to avoid such collisions;

- b. Maneuvering to avoid one collision risks may cause a different collision; and
- c. Avoidance maneuvers are *not* initiated in every instance where a collision is possible (*e.g.*, because the predicted collision probability is deemed too low to warrant a maneuver).

The impact of each of these factors generally scales with constellation size, with constellations containing many thousands of satellites presenting exponentially greater collision risk than the much smaller satellite constellations that previously have been deployed. And, as discussed below, any such collisions will have long-lasting repercussions in space, for the operator involved in the collision, for other operators in nearby orbits, and for those in orbits hundreds of kilometers away. The effects of space debris, such as that caused by satellite collisions is further compounded in a chain reaction when debris objects randomly collide with other debris objects – causing even more fragmentation, and increasing the risks of colliding with, and fragmenting even more satellites.

19. Two basic principles are very important in understanding the growing problem of pollution in space: (i) satellites that cannot maneuver cannot avoid collisions, and (ii) not all potential collisions can be predicted, and even when a potential collision is predicted with a satellite that is maneuverable, not all of those potential collisions can actually be avoided.

20. A satellite that cannot maneuver is unable to avoid a potential collision

regardless of whether that collision is with another non-maneuverable satellite in the same constellation, a third party's satellite that is non-maneuverable, or with orbital debris of any shape or size. Even where a satellite is designed to be maneuverable, that maneuverability can be lost in whole or in part if any one of several sub-systems fails or is damaged by a collision with even a tiny piece of orbital debris. Thus, the loss of satellite maneuverability has a direct bearing on collision risk. So does the number of total satellites in the constellation, as discussed below.

21. Collisions can occur when one of the over 100 million pieces of uncontrolled orbital debris strikes a satellite and disables it or renders it non-maneuverable, or entirely destroys the satellite, fragmenting it into thousands of pieces of new orbital debris. Collisions also can occur when two satellites are on a collision path and the collision is not successfully avoided.

22. NASA explains that orbital debris in LEO travels at speeds up to 17,500 mph,<sup>16</sup> fast enough for even a very small piece of orbital debris to damage a satellite. Indeed, every piece of orbital debris larger than 1-2 cm has the potential to either cause a catastrophic collision in space or render a satellite non-maneuverable.<sup>17</sup> The

<sup>16</sup> Mark Garcia, *Space Debris and Human Spacecraft*, NASA, [https://www.nasa.gov/mission\\_pages/station/news/orbital\\_debris.html](https://www.nasa.gov/mission_pages/station/news/orbital_debris.html) (last updated May 27, 2021).

<sup>17</sup> Roger Thompson, *A Space Debris Primer*, CROSSLINK 5 (Fall 2015), <https://aerospace.org/sites/default/files/2019-04/Crosslink%20Fall%202015%20V16N1%20.pdf>.

following table helps demonstrate the magnitude of the threat posed by even very small pieces of orbital debris:<sup>18</sup>

Debris size	Mass (g) aluminum sphere	Kinetic Energy (J)	Equivalent TNT (kg)	Energy similar to
1 mm	0.0014	71	0.0003	Baseball
3 mm	0.038	1910	0.008	Bullets
1 cm	1.41	70,700	0.3	Falling anvil
5 cm	176.7	8,840,000	37	Hit by bus
10 cm	1413.7	70,700,000	300	Large bomb

23. NASA estimates that there are approximately (i) 23,000 pieces of uncontrolled orbital debris larger than a softball (*i.e.*, 10 cm) orbiting the Earth, (ii) half a million pieces of debris the size of a marble (up to 1 cm) and larger, and (iii) approximately 100 million pieces of debris about 1 mm and larger.<sup>19</sup>

24. NASA also explains that certain techniques can be effective in avoiding the larger pieces of orbital debris that can be tracked by the Department of Defense's Space Surveillance Network. These techniques include conjunction assessments (*i.e.*, predicting expected "close calls" when the orbital paths of the debris and an

<sup>18</sup> *Id.* at 5-6.

<sup>19</sup> Mark Garcia, *Space Debris and Human Spacecraft*, *supra* n. 14.

active satellite intersect with or approach each other) and collision avoidance maneuvers (*i.e.*, activating the propulsion sub-system on the satellite to try to get out of the way of the oncoming debris or satellite). NASA further explains that orbital debris smaller than 10 cm usually is too small to track with current technology for conjunction assessments and collision avoidance. In other words, techniques exist to try to avoid collisions with only a very small fraction of the over 100 million pieces of existing debris.<sup>20</sup>

25. As to the potential collisions with large orbital debris (or other satellites) that theoretically can be avoided, experts calculate that a constellation of thousands of satellites (like SpaceX's) should expect to receive millions or tens of millions of conjunction warnings each year, depending on the number of other satellites in nearby orbits (*i.e.*, warnings about possible close calls with uncontrollable debris or with other satellites).<sup>21</sup> Satellite operators typically maneuver to avoid such close calls only when the probability of a collision is expected to exceed a certain threshold (*e.g.*, 1 in 10,000, or 1 in 100,000).

26. Every time an operator does not maneuver a satellite in response to a

<sup>20</sup> *Id.*

<sup>21</sup> Salvatore Alfano, Daniel L. Oltrogge, & Ryan Shepperd, *LEO Constellation Encounter and Collision Rate Estimation: An Update*, 2ND IAA CONFERENCE ON SPACE SITUATIONAL AWARENESS, Washington D.C. (Jan. 2020), <https://bit.ly/3tk9VCc>.

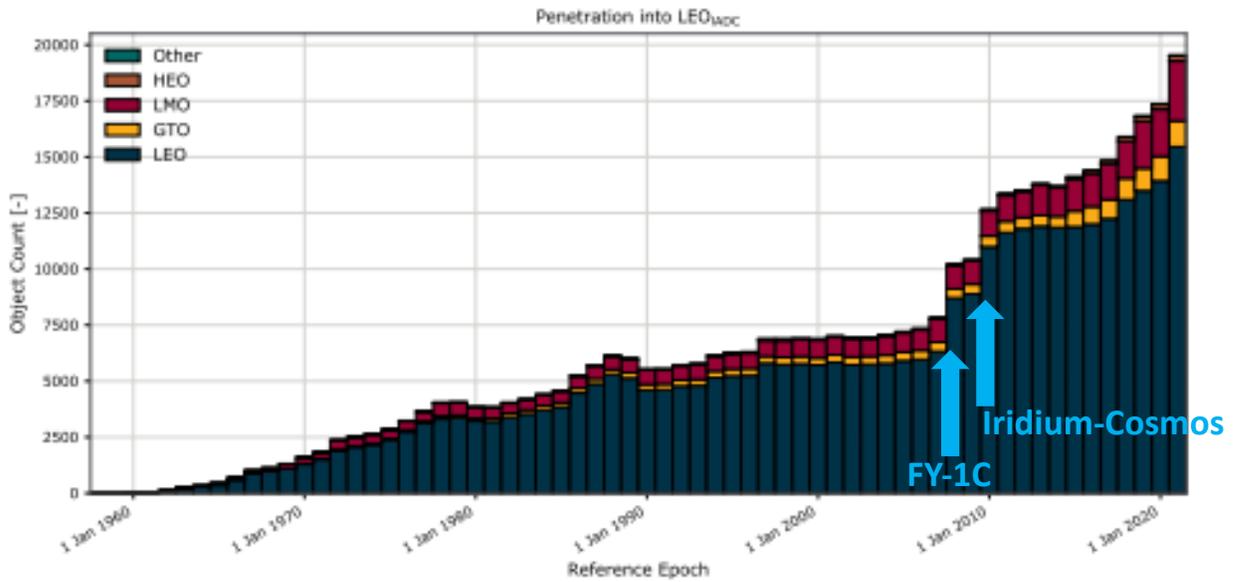
low-probability conjunction warning, there is a non-zero collision risk. Additionally, every time an operator does maneuver in an attempt to avoid a collision, there is another non-zero probability that the maneuver will not be effective and a collision will still occur. In both cases, with millions, or tens of millions, of conjunction warnings each year, even events that are individually very *unlikely* to occur can quickly become *highly likely*, or *virtually certain* when all those individual risks are aggregated.

27. A collision in space has the potential to create a large debris field that can spread to surrounding orbits—including to altitudes hundreds of kilometers away from the collision. By way of illustration, the 2009 collision between the active Iridium 33 satellite and the passive Cosmos 2251 satellite just below 800 km fragmented these two satellites into an estimated 200,000 pieces, and spread dangerous debris widely into numerous orbits<sup>22</sup>—including where the International Space Station operates.<sup>23</sup> This collision and the intentional destruction of just one

<sup>22</sup> Felix Hoots, *Keeping Track: Space Surveillance for Operational Support*, CROSSLINK 26 (Fall 2015), <https://aerospace.org/sites/default/files/2019-04/Crosslink%20Fall%202015%20V16N1%20.pdf>.

<sup>23</sup> Debris poses a particular danger to the International Space Station (ISS), and recently required the conduct of emergency maneuvers when there was a particularly close approach of orbital debris. See Adam Smith, *International Space Station Forced to Carry Out Emergency Manoeuvre to Dodge Debris*, INDEPENDENT (Sep. 23, 2020), <https://www.independent.co.uk/life-style/gadgets-and-tech/international-space-station-space-debris-nasa-iss-b549114.html>. Notably, this is not the first time astronauts from the ISS have needed to evacuate to an

other satellite (a Chinese weather satellite named FY-1C satellite that fragmented into an estimated 300,000 objects 1 cm or larger) resulted in substantial step-increases in the amount of trackable objects (including debris objects) in LEO, as depicted in Figure 1.



(a) Evolution of absolute number of objects.

Figure 1 – Step Increases in Absolute Number of Objects in the Low Earth Orbit (LEO) Region, Including Objects in Geostationary Transfer Orbit (GTO), Low and Medium Earth Crossing Orbits (LMO), and Highly Eccentric Earth Orbit (HEO).<sup>24</sup>

28. As can be seen in the below graphic, the debris from the Iridium-

emergency capsule because debris threatened to impact the ISS—such incidents have occurred at least seventeen times between 2009 and 2017. See Organisation for Economic Co-operation and Development, *Space Sustainability: The Economics of Space Debris in Perspective* 24 (Apr. 2020).

<sup>24</sup> See *ESA's Annual Space Environment Report*, EUROPEAN SPACE AGENCY, § 2.2 (May 27, 2021) (arrows added), [https://www.sdo.esoc.esa.int/environment\\_report/Space\\_Environment\\_Report\\_latest.pdf](https://www.sdo.esoc.esa.int/environment_report/Space_Environment_Report_latest.pdf).

Cosmos collision spread to orbits many hundreds of kilometers above and below the point of impact.

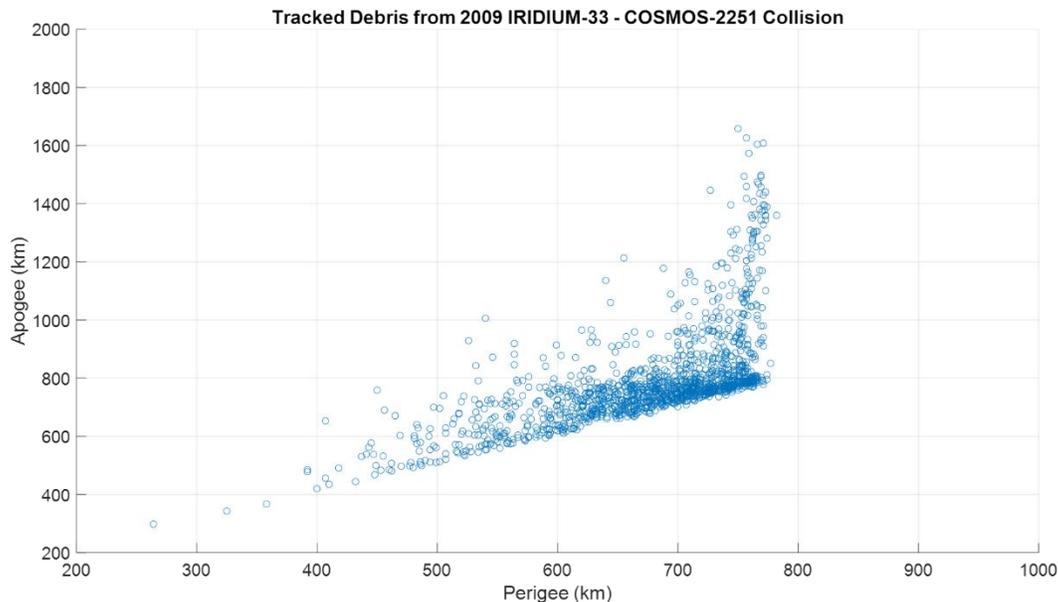


Figure 2 – Iridium-33–Cosmos 2251 Debris Cloud, 12 Years Later (2021-06-03)<sup>25</sup>

29. This debris still persists as an ongoing threat *more than a decade later*.

Indeed, when such a collision occurs and debris spreads to other orbital altitudes, that debris can remain in space for a very long period of time.

30. In fact, earlier this year scientists from the Canadian Space Agency and NASA noticed that Canadarm2—the Canadian robotic arm on the International Space Station—had been hit by a piece of debris. As the statement from the

<sup>25</sup> This graph was plotted from the June 3, 2021 data available through Space-Track.org, which “promotes space flight safety [and] protection of the space environment.” See <https://www.space-track.org/#catalog>. The apogee is the farthest distance the object gets from Earth in its orbit. The perigee is the closest distance the object gets to the Earth in its orbit.

Canadian Space Agency noted, “[w]hile the utmost precautions are taken to reduce the potential for collisions with the” International Space Station, collisions can still occur.<sup>26</sup>

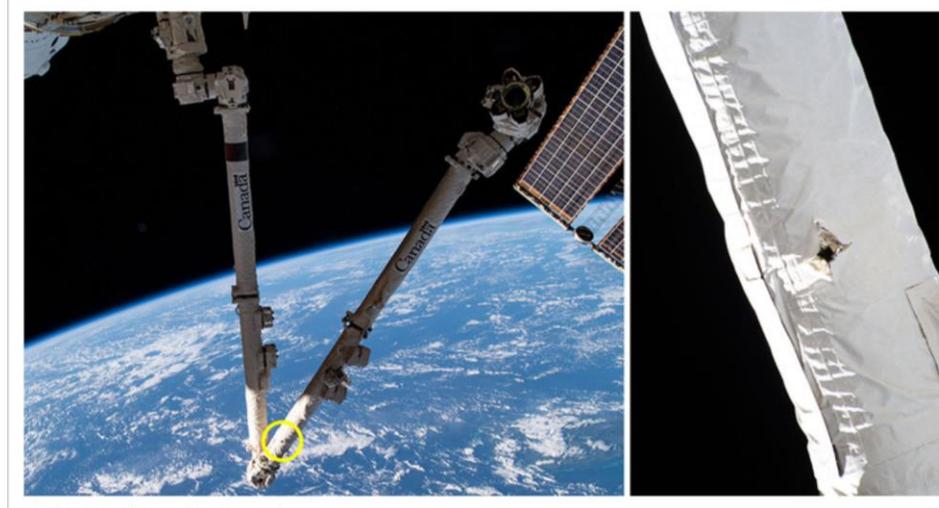


Figure 3 – Damage from space debris colliding with Canadarm2<sup>27</sup>

31. The orbital debris created from a collision of a SpaceX satellite at ~550 km could similarly spread across a wide range of orbits and would remain an ongoing threat in those orbits. As depicted below, such debris would not be expected to passively decay and reenter the Earth’s atmosphere for anywhere from over a decade to more than 100 years.

<sup>26</sup> *Lucky Strike: Canadarm2 stays the course after an orbital debris hit*, Canadian Space Agency (May 28, 2021), <https://www.asc-csa.gc.ca/eng/iss/news.asp#20210528>.

<sup>27</sup> *Id.*

Apogee (km)	Decay Time
550	13.7 years
650	17.8 years
750	28.6 years
850	42.9 years
950	59.9 years
1050	79.7 years
1150	96.5 years
1250	> 100 years
1350	> 100 years

Table 1 – Passive Decay Times for Collision Fragments in Various LEO Orbits with 550 km Perigee<sup>28</sup>

Moreover, recent research indicates that these calculations—which undergird most debris models, including those used by the Commission—may actually understate the amount of time that debris will remain in orbit because increasing levels of carbon dioxide in the atmosphere may materially reduce the rate of passive decay of debris.<sup>29</sup>

32. For these reasons, a catastrophic collision in space can create a considerable number of additional debris objects, which immediately make the orbital environment more dangerous and make access to space more costly and risky

<sup>28</sup> The decay times in this table were computed using the Orbit Lifetime/Dwell Time utility in NASA’s Debris Assessment Software (DAS). See <https://software.nasa.gov/software/MSC-26690-1>. Values were computed assuming a 550-km perigee and 0.01 m<sup>2</sup>/kg area-to-mass ratio for fragmentation debris created in 2020. Debris with smaller area-to-mass ratios take longer to decay than the passive decay time for an intact spacecraft.

<sup>29</sup> Jonathan O’Callaghan, *What if Space Junk and Climate Change Become the Same Problem?*, NY TIMES (May 12, 2021), <https://www.nytimes.com/2021/05/12/science/space-junk-climate-change.html>.

as well.<sup>30</sup> Furthermore, the considerable debris created by an in-orbit collision can lead to further collisions, with each one exponentially increasing the pre-existing level of in-orbit collision risk, including the expected number of conjunctions. These threats could have a significant impact on our ability to use LEO, and pose a substantial risk of catastrophic harm to Viasat (and other satellite operators).

33. Parties commenting at the FCC, along with leading academics,<sup>31</sup> have expressed concern that SpaceX's demonstrated approach to space is inherently risky. Specifically, SpaceX intends to launch large numbers of economically-expendable and replaceable satellites (i.e., achieving system-wide redundancy through large numbers of satellites, many of which are *expected* to fail) instead of deploying smaller numbers of more capable, reliable, and safer satellites.<sup>32</sup> Indeed, SpaceX

<sup>30</sup> Zachary Grzelka and Jeffrey Wagner, *Managing Satellite Debris in Low-Earth Orbit: Incentivizing Ex Ante Satellite Quality and Ex Post Take-Back Programs*, 74 ENV'T & RES. ECONS. 321-22 (2019).

<sup>31</sup> See Aaron C. Boley and Michael Byers, *Satellite mega-constellations create risks in Low Earth Orbit, the atmosphere and on Earth*, SCIENTIFIC REPORTS (May 20, 2021), <https://www.nature.com/articles/s41598-021-89909-7> (noting that the “consumer electronic model [adopted by SpaceX] allows for short upgrade cycles and rapid expansion of capabilities, but also considerable discarded equipment”).

<sup>32</sup> Instead, the likely goal should be the deployment of maximally efficient satellite constellations across all domains that impact or otherwise create risks for the environment, including (a) the total numbers of satellites in each constellation, (b) the total mass of each constellation in space, (c) the total cross-sectional area of each constellation in space, (d) the total conjunction risk of each constellation in space, and (e) the composition of a constellation's satellites (e.g., whether made of aluminum or other materials).

itself has noted that “[l]aunching more satellites is our core competency, so we generally use that kind of fault tolerance wherever we can[.]”<sup>33</sup>

34. As Viasat has previously argued to the Commission, one of the results of this commercial decision is to shift onto other users of space, like Viasat, the increased costs and risks—including those resulting from the satellite failures, collisions, creation of additional debris, and risks and delays associated with launching satellites into a more crowded and dangerous space environment, as discussed above.

35. In SpaceX’s case, the risk of an in-orbit collision is elevated because SpaceX’s satellites have failed at a high rate. In its Order, the FCC acknowledged that SpaceX’s experiential failure rate suggests that *hundreds* of SpaceX satellites could fail over its 15-year license term.<sup>34</sup> As discussed above, failed satellites that cannot maneuver cannot avoid collisions, thereby significantly increasing the risk of

<sup>33</sup> See *We are the SpaceX software team, ask us anything!*, REDDIT (June 6, 2020), [https://www.reddit.com/r/spacex/comments/gxb7j1/we\\_are\\_the\\_spacex\\_software\\_team\\_ask\\_us\\_anything/](https://www.reddit.com/r/spacex/comments/gxb7j1/we_are_the_spacex_software_team_ask_us_anything/) (“On Starlink, we’ve designed the system so that satellites will quickly passively deorbit due to atmospheric drag in the case of failure (though we fight hard to actively deorbit them if possible). We still have some redundancy inside the vehicle, where it is easy and makes sense, but we primarily trust in having system-level fault tolerance: multiple satellites in view that can serve a user. Launching more satellites is our core competency, so we generally use that kind of fault tolerance wherever we can . . .”).

<sup>34</sup> See *Space Exploration Holdings, LLC*, Order and Authorization and Order on Reconsideration, IBFS File No. SAT-MOD-20200417-00037, FCC 21-48, at ¶ 63 (rel. Apr. 27, 2021).

an in-orbit collision and consequent fragmentation. Moreover, failed satellites remain a collision risk until they passively decay into the Earth's atmosphere, which Viasat's analysis before the Commission demonstrated would take anywhere from 3.2 to 6.1 years (based on a failure occurring in 2020, and depending on the precise orbit at which the failure occurs and whether the failure causes the satellite to tumble). Recent research indicates that these calculations may actually understate the problem, as discussed in paragraph 31 above.

36. Leading experts have expressed concern about the development of a devastating “positive feedback loop” within existing fields of orbital debris that leads to an exponential and self-sustaining growth in the density of debris. Within this loop, debris density increases after each collision, causing additional collisions to occur, which further increases debris density—and so on under until the collision rate becomes so high that all satellites are consumed. This is the so-called Kessler syndrome first posited by noted NASA researcher Dr. Donald Kessler.

37. The Organisation for Economic Co-operation and Development explains that the socio-economic impacts of such an event could be “severe” and that “[s]everal important space applications could be affected or lost, in particular space-based observations for weather forecasting, climate monitoring, earth sciences, and potentially, satellite communications. Certain geographic areas and social groups would be disproportionately affected, in particular in rural areas with

limited existing ground infrastructures and large reliance on space infrastructure.”<sup>35</sup>

38. At a minimum, orbital debris and non-maneuverable satellites pollute orbits and impede the ability of Viasat and other users of space to traverse and operate in those orbits. SpaceX satellites are likely to fail and lose maneuverability on an ongoing basis, and will pose immediate risks to other operators—including Viasat—when they do. For example, the debris created by a collision involving a SpaceX satellite could damage, disable, or destroy Viasat satellites traversing or operating in LEO. Indeed, as I discussed above, Viasat is currently operating a satellite in LEO at 575km (within the 510-580 km orbital altitude range of SpaceX’s satellites), and is under contract with the Department of Defense to launch a high-value LEO satellite into that same range, and plans to do so within the next six to twelve months. And over the 15-year term of SpaceX’s license, Viasat also plans to deploy additional LEO satellites at altitudes within hundreds of kilometers of SpaceX’s satellites. Moreover, an intact SpaceX satellite that has failed and is no longer maneuverable will pose risks to all Viasat satellites that are being launched *through* the orbits in which SpaceX operates.

39. The orbital debris created by the fragmentation of a SpaceX satellite after a collision, and failed SpaceX satellites that are not maneuverable, would both

<sup>35</sup> See *Space Sustainability: The Economics of Space Debris in Perspective*, Organisation for Economic Co-operation and Development 7 (Apr. 2020), <https://www.oecd.org/environment/space-sustainability-a339de43-en.htm>.

frustrate Viasat's efforts to deploy its own constellation in LEO—and, at a minimum, significantly increase the costs and complexity of doing so. Indeed, the Organisation for Economic Co-operation and Development and leading academics have studied and commented on the increased economic costs borne by operators like Viasat from an increase in both debris and collision risk, noting that debris “reduces the realized value of space activities by increasing the probability of damaging existing satellites or other space vehicles.”<sup>36</sup>

40. Moreover, SpaceX's deployment of thousands of additional satellites into LEO pursuant to the FCC's Order would in and of itself create a more crowded orbital environment—and in and of itself harm Viasat's operations. As crowding increases, Viasat will need to expend time and resources ensuring that its own satellites—including LEO satellites currently in orbit—avoid collisions or physical interference caused by SpaceX.<sup>37</sup>

41. For example, viable launch windows are inherently limited, and will become even more scarce as SpaceX deploys thousands of additional satellites into LEO. And the debris created by a collision involving a SpaceX satellite, or even the

<sup>36</sup> See, e.g., Nodir Adilov et al., *An Economic Analysis of Earth Orbit Pollution*, 60 ENV'T & RES. ECON., 95 (2015).

<sup>37</sup> It is even conceivable that the rapid launch of new Starlink satellites could require other operators to pause their own launches into LEO until the safety risk of co-existing in LEO decreases to responsible levels.

mere presence in orbit of failed SpaceX satellites that are no longer maneuverable, will further impede the ability of Viasat and other operators to launch their own satellites into orbit. At a minimum, the increased scarcity caused by SpaceX's planned deployment and operations, collisions involving SpaceX satellites and the resulting orbital debris, and the presence of additional failed SpaceX satellites will increase the costs, risks, and delay associated with launching satellites into space. This problem was recently recognized by the CEO of satellite launch provider RocketLab, who explained that while he could previously pick a 30-minute timeframe and expect to reach orbit safely, the company now has to pick "half a dozen separate launch windows because we've got to shoot up in between a train of" satellites.<sup>38</sup> Put simply, SpaceX's planned deployment would reduce the number of viable launch windows available to Viasat and other operators, and thus increase the costs and delay associated with launch activities, including launches Viasat has planned in the next six to twelve months as well as launches throughout the remainder of SpaceX's license term.

42. SpaceX intends to use its constellation to compete directly with Viasat

<sup>38</sup> Jackie Wattles, *Space is becoming too crowded, Rocket Lab CEO Warns*, CNN (Oct. 8, 2020), <https://www.cnn.com/2020/10/07/business/rocket-lab-debris-launch-traffic-scn/index.html> ("Satellite constellations can be particularly problematic, he said, because the satellites can fly fairly close together, forming a sort of blockade that can prevent rockets from squeezing through.").

in the market for satellite broadband services,<sup>39</sup> and in that competition SpaceX benefits commercially from the Commission's having skipped a legally required environmental review. Viasat must now internalize costs that the Commission's Order shifts onto other operators. The negative externalities created by the Commission's having authorized SpaceX to deploy thousands of satellites into LEO without proper environmental review directly harms Viasat, including inflicting unwarranted competitive injury.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on August 6<sup>th</sup> 2021.

  
Mark Dankberg

---

<sup>39</sup> Kate Duffy, *Here are the 7 big space companies in the race to build a global satellite-internet network*, Business Insider (April 17, 2021), <https://www.businessinsider.com/spacex-starlink-amazon-oneweb-companies-compete-satellite-internet-2021-4> (quoting SpaceX's CEO's assertion that "Starlink 'poses a hazard' to Viasat's profits").

UNITED STATES COURT OF APPEALS  
FOR THE DISTRICT OF COLUMBIA CIRCUIT

VIASAT, INC.,	)	
	)	
Appellant,	)	No. 21-1123
	)	
v.	)	Consolidated with Nos.
	)	21-1125, 21-1127 & 21-1128
FEDERAL COMMUNICATIONS	)	
COMMISSION,	)	FCC IBFS File No. SAT-MOD-
	)	20200417-00037
Appellee,	)	
	)	
SPACE EXPLORATION	)	
HOLDINGS, LLC,	)	
	)	
Intervenor for Respondent.	)	
<hr/>		

**DECLARATION OF ROGER F. MALINA**

1. My name is Roger F. Malina, and I make these statements pursuant to 28 U.S.C. § 1746 and based upon my own personal knowledge. I am over 18 years of age, and if called to do so, am competent to testify that the contents of this Declaration are accurate and true.

2. I am an astronomer, physicist, and technologist and a member of The Balance Group, and I reside in Texas. I earned a Bachelor of Science in physics from Massachusetts Institute of

Technology in 1972, and a Ph.D. in Astronomy from the University of California, Berkeley, in 1979.

3. I was formerly the Principal Investigator for the NASA Extreme Ultraviolet Explorer Satellite at the University of California, Berkeley, and the former director of the Observatoire Astronomique de Marseille Provence (OAMP) and of the Laboratoire d'Astrophysique de Marseille in Marseille, France, and member of its observational cosmology group, which investigates the nature of dark matter and dark energy. I am currently distinguished professor of arts and technology, and professor of physics at the University of Texas at Dallas, and a Directeur de Recherche in the CNRS at the University of Aix Mareseille. I am also President of the Association Leonardo in France, which fosters connections between the arts, sciences, and technology, and since 1982 I have been the Editor in Chief of Leonardo Journal at MIT Press. I am a co-founder and member of the Institut Mediterranen de Recherches Avancees ("IMERA") (Mediterranean Institute for Advanced Study), which aims at contributing to interdisciplinarity and places emphasis on the human dimensions of the sciences.

4. The current and worsening situation with the launch of satellite mega-constellations has limited my ability to conduct earth-based astronomy work, and the SpaceX system, with its extreme number of low earth orbit satellites, directly clouds and interferes with my instrumentation and data observation and data gathering protocols. It significantly inhibits my work in my chosen profession and my ability to study dark matter, dark energy and numerous other phenomena.

5. My profession and ability to obtain planetary, meteor, star, and other natural night-sky phenomena data, images and photographs are directly frustrated and injured by SpaceX satellites, and the issue is getting worse. The impact is especially harmful on clear nights when attempts to obtain astronomy images and data are marred by several satellite crossings across my instrumentation's view fields.

6. The cessation of the continued deployment of the SpaceX system, and ideally, significant changes to its satellites (and/or removal of those satellites from their current, low orbital slots) would mitigate or cease the damage to my work in studying dark matter and dark energy, and obtaining data, imagery and photographs of planets,

meteors, comets, stars and other natural night sky phenomena upon which my projects depend.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on August 5, 2021 at Richardson, Dallas County, Texas.



---

Roger F. Malina

UNITED STATES COURT OF APPEALS  
FOR THE DISTRICT OF COLUMBIA CIRCUIT

VIASAT, INC.,	)	
	)	
Appellant,	)	No. 21-1123
	)	
v.	)	Consolidated with Nos.
	)	21-1125, 21-1127 & 21-1128
FEDERAL COMMUNICATIONS	)	
COMMISSION,	)	FCC IBFS File No. SAT-MOD-
	)	20200417-00037
Appellee,	)	
	)	
SPACE EXPLORATION	)	
HOLDINGS, LLC,	)	
	)	
Intervenor for Respondent.	)	

---

**DECLARATION OF JOSEPH M. SANDRI**

1. My name is Joseph M. Sandri, and I make these statements pursuant to 28 U.S.C. § 1746 and based upon my own personal knowledge. I am over 18 years of age, and if called to do so, am competent to testify that the contents of this Declaration are accurate and true.

2. I am a co-founder of Appellant, The Balance Group, and currently its operating officer. I also am Chief Executive Officer of Thought Delivery Systems, Inc., a privately held technology

conglomerate based in Silver Spring, Md.; president of the National Spectrum Management Association (NSMA) ([www.nsma.org](http://www.nsma.org)); and a board member of the Archangel Ancient Tree Archive ([www.AncientTreeArchive.org](http://www.AncientTreeArchive.org)).

3. The Balance Group exists to provide a balanced approach to solving large, systemic issues concerning existing and proposed man-made systems and their impact on the human condition and the environment at large. Its members include astronomers, physicists, scientists, environmentalists, technologists, telecommunications experts, and medical professionals, among others. Technology and large-scale networks provide certain benefits that we all rely upon, yet the same existing or proposed networks and systems can degrade the human condition and surrounding environment.

4. As the forum for balanced research and advocacy for respecting the need for technology while also improving the human and environmental condition, The Balance Group is designed to provide counsel and technical systems and solutions to individuals, non-profits, corporations, and governments. The technical solutions include and are not limited to, professional-grade spectrum management techniques,

health care solution research and development, radio-astronomy best practices, and other measurement and mitigation reporting systems. They are designed to protect industry, humans, flora, fauna, and the environment from harmful-yet-preventable pollution (including light pollution), uninsured material risk, and other measurable and addressable environmental harms. It is in the interest of network providers, customers, regulators, environmentalists, scientists, academics, and healthcare providers to persistently seek balanced solutions to these risks that benefit all parties (see: [www.TheBalanceGroup.net](http://www.TheBalanceGroup.net)). Our technology and advocacy seeks to ensure that such networks are subjected to proven, peer-reviewed science, in order to reduce to manageable levels systemic risks to industry, human beings and the environment.

5. The FCC's modification of SpaceX's license for its "Starlink" system, a non-geostationary orbit fixed-satellite service constellation using Ku- and Ka-band spectrum, is imposing and will continue to impose significant financial and other costs on The Balance Group unless it is reversed. The Balance Group's work on analyzing other large-scale wireless networks has been materially disrupted by the

exigent need to address the unprecedented SpaceX network as the FCC has allowed it to be modified. The Balance Group has been forced to, among other things: (i) redeploy personnel and divert other resources that it had previously assigned to analyses of other networks, (ii) build a related web portal, and (iii) analyze the SpaceX network as modified by the FCC ruling. Specifically, The Balance Group has had to re-deploy equipment and personnel to measure the impacts of the SpaceX system (as modified) on spectrum interference, human health, environmental health, cyber-security and other matters. Further, we have had to engage spectrum managers and spectrum analyzers, at significant expense, to assess the modified SpaceX system to determine the extent to which the changed parameters affect potential interference and increase the risk of harmful effects on human and environmental health. In other words, the Balance Group is spending precious and extensive resources on personnel, and is staging equipment deployments, to try to determine the scientific impacts of the SpaceX system as modified from its original ~1100-1300km orbit to its radically changed ~550km orbit.

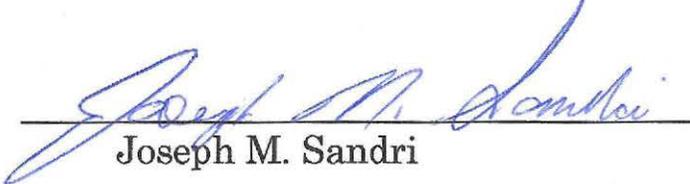
6. If not for the proposed modification of the SpaceX system and the resources The Balance Group has had to devote to analyzing it, we could deploy these badly needed personnel and related equipment to other mission-critical projects related to, among other things, (i) obtaining spectrum emission data on the impacts of terrestrial networks (wireless, electrical, and other) upon humans, flora, and fauna, (ii) researching cyber-security impacts on terrestrial networks, and (iii) researching the lack of systemic insurance coverage for certain terrestrial networks and the devices tied to those networks. Further, if we were not deploying resources to analyze the modified SpaceX system, we could obtain necessary data from terrestrial networks at a much greater rate, so as to more effectively *develop solutions* and advocate in the areas of environmental science, health care, and cyber security that are at the center of The Balance Group's mission.

7. In my estimation, The Balance Group since release of the FCC's Order in April 2021 has spent at least \$10,000 on activities related to Starlink (excluding costs related to these proceedings) that it otherwise could have spent on these other efforts. That number will likely be much higher once fully accounted.

8. Starlink *as now modified* is imposing costs on The Balance Group that would not have been imposed had SpaceX never sought the modification – and The Balance Group would have fewer costs and critical resource diversions analyzing the original system.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on August <sup>5</sup>4, 2021 at Silver Spring, Montgomery County, Maryland.

  
\_\_\_\_\_  
Joseph M. Sandri

**42 U.S.C. § 4321. Congressional declaration of purpose**

The purposes of this chapter are: To declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality.

## **42 U.S.C. § 4331. 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, 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.

(b) In order to carry out the policy set forth in this chapter, it is the continuing responsibility of the Federal Government to use all practicable means, consistent with other essential considerations of national policy, to improve and coordinate Federal plans, functions, programs, and resources to the end that the Nation may—

- (1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
- (2) assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings;
- (3) attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;
- (4) preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice;
- (5) achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and

(6) enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

(c) The Congress recognizes that each person should enjoy a healthful environment and that each person has a responsibility to contribute to the preservation and enhancement of the environment.

**42 U.S.C. § 4332. Cooperation of agencies; reports; availability of information; recommendations; international and national coordination of efforts**

The Congress authorizes and directs that, to the fullest extent possible: (1) the policies, regulations, and public laws of the United States shall be interpreted and administered in accordance with the policies set forth in this chapter, and (2) all agencies of the Federal Government shall—

...

(C) include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on—

- (i) the environmental impact of the proposed action,
- (ii) any adverse environmental effects which cannot be avoided should the proposal be implemented,
- (iii) alternatives to the proposed action,
- (iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and
- (v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

Prior to making any detailed statement, the responsible Federal official shall consult with and obtain the comments of any Federal agency which has jurisdiction by law or special expertise with respect to any environmental impact involved. Copies of such statement and the comments and views of the appropriate Federal, State, and local agencies, which are authorized to develop and enforce environmental standards, shall be made available to the President, the Council on Environmental Quality and to the public as provided by section 552 of Title 5, and shall accompany the proposal through the existing agency review processes;

...

### **40 C.F.R. § 1501.3. Determine the appropriate level of NEPA review**

**(a)** In assessing the appropriate level of NEPA review, Federal agencies should determine whether the proposed action:

- (1)** Normally does not have significant effects and is categorically excluded (§ 1501.4);
- (2)** Is not likely to have significant effects or the significance of the effects is unknown and is therefore appropriate for an environmental assessment (§ 1501.5); or
- (3)** Is likely to have significant effects and is therefore appropriate for an environmental impact statement (part 1502 of this chapter).

**(b)** In considering whether the effects of the proposed action are significant, agencies shall analyze the potentially affected environment and degree of the effects of the action. Agencies should consider connected actions consistent with § 1501.9(e)(1).

**(1)** In considering the potentially affected environment, agencies should consider, as appropriate to the specific action, the affected area (national, regional, or local) and its resources, such as listed species and designated critical habitat under the Endangered Species Act. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend only upon the effects in the local area.

**(2)** In considering the degree of the effects, agencies should consider the following, as appropriate to the specific action:

- (i)** Both short- and long-term effects.
- (ii)** Both beneficial and adverse effects.
- (iii)** Effects on public health and safety.
- (iv)** Effects that would violate Federal, State, Tribal, or local law protecting the environment.

#### **40 C.F.R. § 1501.4. Categorical exclusions**

**(a)** For efficiency, agencies shall identify in their agency NEPA procedures (§ 1507.3(e)(2)(ii) of this chapter) categories of actions that normally do not have a significant effect on the human environment, and therefore do not require preparation of an environmental assessment or environmental impact statement.

**(b)** If an agency determines that a categorical exclusion identified in its agency NEPA procedures covers a proposed action, the agency shall evaluate the action for extraordinary circumstances in which a normally excluded action may have a significant effect.

**(1)** If an extraordinary circumstance is present, the agency nevertheless may categorically exclude the proposed action if the agency determines that there are circumstances that lessen the impacts or other conditions sufficient to avoid significant effects.

**(2)** If the agency cannot categorically exclude the proposed action, the agency shall prepare an environmental assessment or environmental impact statement, as appropriate.

**40 C.F.R. § 1501.5. Environmental assessments**

(a) An agency shall prepare an environmental assessment for a proposed action that is not likely to have significant effects or when the significance of the effects is unknown unless the agency finds that a categorical exclusion (§ 1501.4) is applicable or has decided to prepare an environmental impact statement.

(b) An agency may prepare an environmental assessment on any action in order to assist agency planning and decision making.

(c) An environmental assessment shall:

(1) Briefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact; and

(2) Briefly discuss the purpose and need for the proposed action, alternatives as required by section 102(2)(E) of NEPA, and the environmental impacts of the proposed action and alternatives, and include a listing of agencies and persons consulted.

...

### **40 C.F.R. § 1507.3. Agency NEPA procedures**

...

(e) Agency procedures shall comply with the regulations in this subchapter except where compliance would be inconsistent with statutory requirements and shall include:

(1) Those procedures required by §§ 1501.2(b)(4) (assistance to applicants) and 1506.6(e) of this chapter (status information).

(2) Specific criteria for and identification of those typical classes of action:

(i) Which normally do require environmental impact statements.

(ii) Which normally do not require either an environmental impact statement or an environmental assessment and do not have a significant effect on the human environment (categorical exclusions (§ 1501.4 of this chapter)). Any procedures under this section shall provide for extraordinary circumstances in which a normally excluded action may have a significant environmental effect. Agency NEPA procedures shall identify when documentation of a categorical exclusion determination is required.

(iii) Which normally require environmental assessments but not necessarily environmental impact statements.

(3) Procedures for introducing a supplement to an environmental assessment or environmental impact statement into its formal administrative record, if such a record exists.

...

## **40 C.F.R. § 1508.1. Definitions**

**(a)** Act or NEPA means the National Environmental Policy Act, as amended (42 U.S.C. 4321, et seq.).

...

**(d)** Categorical exclusion means a category of actions that the agency has determined, in its agency NEPA procedures (§ 1507.3 of this chapter), normally do not have a significant effect on the human environment.

...

**(g)** Effects or impacts means changes to the human environment from the proposed action or alternatives that are reasonably foreseeable and have a reasonably close causal relationship to the proposed action or alternatives, including those effects that occur at the same time and place as the proposed action or alternatives and may include effects that are later in time or farther removed in distance from the proposed action or alternatives.

**(1)** Effects include ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic (such as the effects on employment), social, or health effects. Effects may also include those resulting from actions that may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial.

**(2)** A “but for” causal relationship is insufficient to make an agency responsible for a particular effect under NEPA. Effects should generally not be considered if they are remote in time, geographically remote, or the product of a lengthy causal chain. Effects do not include those effects that the agency has no ability to prevent due to its limited statutory authority or would occur regardless of the proposed action.

**(3)** An agency’s analysis of effects shall be consistent with this paragraph

...

**(q)** Major Federal action or action means an activity or decision subject to Federal control and responsibility subject to the following:

...

**(3)** Major Federal actions tend to fall within one of the following categories:

**(i)** Adoption of official policy, such as rules, regulations, and interpretations adopted under the Administrative Procedure Act, 5 U.S.C. 551 et seq. or other statutes; implementation of treaties and international conventions or agreements, including those implemented pursuant to statute or regulation; formal documents establishing an agency's policies which will result in or substantially alter agency programs.

**(ii)** Adoption of formal plans, such as official documents prepared or approved by Federal agencies, which prescribe alternative uses of Federal resources, upon which future agency actions will be based.

**(iii)** Adoption of programs, such as a group of concerted actions to implement a specific policy or plan; systematic and connected agency decisions allocating agency resources to implement a specific statutory program or executive directive.

**(iv)** Approval of specific projects, such as construction or management activities located in a defined geographic area. Projects include actions approved by permit or other regulatory decision as well as Federal and federally assisted activities.

**47 C.F.R. § 1.1306. Actions which are categorically excluded from environmental processing**

**(a)** Except as provided in § 1.1307 (c) and (d), Commission actions not covered by § 1.1307 (a) and (b) are deemed individually and cumulatively to have no significant effect on the quality of the human environment and are categorically excluded from environmental processing.

**(b)** Specifically, any Commission action with respect to any new application, or minor or major modifications of existing or authorized facilities or equipment, will be categorically excluded, provided such proposals do not:

- (1)** Involve a site location specified under § 1.1307(a) (1)–(7), or
- (2)** Involve high intensity lighting under § 1.1307(a)(8).
- (3)** Result in human exposure to radiofrequency radiation in excess of the applicable safety standards specified in § 1.1307(b).

**(c)**

**(1)** Unless § 1.1307(a)(4) is applicable, the provisions of § 1.1307(a) requiring the preparation of EAs do not encompass the construction of wireless facilities, including deployments on new or replacement poles, if:

**(i)** The facilities will be located in a right-of-way that is designated by a Federal, State, local, or Tribal government for communications towers, above-ground utility transmission or distribution lines, or any associated structures and equipment;

**(ii)** The right-of-way is in active use for such designated purposes; and

**(iii)** The facilities would not

**(A)** Increase the height of the tower or non-tower structure by more than 10% or twenty feet, whichever is greater, over existing support structures that are located in the right-of-way within the vicinity of the proposed construction;

**(B)** Involve the installation of more than four new equipment cabinets or more than one new equipment shelter;

**(C)** Add an appurtenance to the body of the structure that would protrude from the edge of the structure more than twenty feet, or more than the width of the structure at the level of the appurtenance, whichever is greater (except that the deployment may exceed this size limit if necessary to shelter the antenna from inclement weather or to connect the antenna to the tower via cable); or

**(D)** Involve excavation outside the current site, defined as the area that is within the boundaries of the leased or owned property surrounding the deployment or that is in proximity to the structure and within the boundaries of the utility easement on which the facility is to be deployed, whichever is more restrictive.

**(2)** Such wireless facilities are subject to § 1.1307(b) and require EAs if their construction would result in human exposure to radiofrequency radiation in excess of the applicable health and safety guidelines cited in § 1.1307(b).

**47 C.F.R. § 1.1307. Actions that may have a significant environmental effect, for which Environmental Assessments (EAs) must be prepared**

...

(c) If an interested person alleges that a particular action, otherwise categorically excluded, will have a significant environmental effect, the person shall electronically submit to the Bureau responsible for processing that action a written petition setting forth in detail the reasons justifying or circumstances necessitating environmental consideration in the decision-making process. If an interested person is unable to submit electronically or if filing electronically would be unreasonably burdensome, such person may submit the petition by mail, with a request for waiver under § 1.1304(b). (See § 1.1313). The Bureau shall review the petition and consider the environmental concerns that have been raised. If the Bureau determines that the action may have a significant environmental impact, the Bureau will require the applicant to prepare an EA (see §§ 1.1308 and 1.1311), which will serve as the basis for the determination to proceed with or terminate environmental processing.

...