Before the
Federal Communications Commission
Washington, DC 20554

In the Matter of Mitigation of Orbital Debris in the New Space Age	IB Docket No. 18-313

COMMENTS OF
THE SATELLITE INDUSTRY ASSOCIATION

The Satellite Industry Association

Tom Stroup
President
Satellite Industry Association
1200 18th Street NW, Suite 975
Washington, DC 20036
(202) 503-1560

October 9, 2020

TABLE OF CONTENTS

Before the
Federal Communications Commission
Washington, DC 20554

In the Matter of Mitigation of Orbital Debris in the New Space Age	IB Docket No. 18-313

COMMENTS OF
THE SATELLITE INDUSTRY ASSOCIATION

The Satellite Industry Association ("SIA")[1] provides the following comments in response to the Federal Communications Commission's ("FCC" or "Commission") Further Notice of Proposed Rulemaking ("*Further Notice*")[2] addressing the mitigation of orbital debris in the New Space Age.[3]

[1] SIA Executive Members include: Amazon; AT&T Services, Inc.; The Boeing Company; EchoStar Corporation; Intelsat S.A.; Iridium Communications Inc.; Kratos Defense & Security Solutions; Ligado Networks; Lockheed Martin Corporation; OneWeb; SES Americom, Inc.; Space Exploration Technologies Corp.; Spire Global Inc.; and Viasat Inc. SIA Associate Members include: ABS US Corp.; AIRBUS U.S. Space & Defense, Inc.; Amazon Web Services; Analytical Graphics, Inc.; Artel, LLC; Astranis Space Technologies Corp; Blue Origin; Eutelsat America Corp.; ExoAnalytic Solutions; HawkEye 360; Hughes; Inmarsat, Inc.; Kymeta Corporation; Leonardo DRS; Lynk; Omnispace; OneWeb Satellites; Panasonic Avionics Corporation; Peraton; Planet; Telesat Canada; and XTAR, LLC. For more information on SIA, see www.sia.org.

[2] *Mitigation of Orbital Debris in the New Space Age*, Report and Order and Further Notice of Proposed Rulemaking, 35 FCC Rcd 4156 (2020) ("*Further Notice*").

[3] SIA member, Viasat Inc. is not joining in these comments. Other SIA members are not joining these comments with respect to the following sections: Iridium Communications Inc. is not joining with respect to Section III (post-mission performance bond) and Oneweb Satellites is not joining with respect to Section VI (design for demise and targeted reentry).

I. INTRODUCTION AND SUMMARY

The Satellite Industry Association ("SIA") greatly appreciates the Commission's decision to extend its orbital debris proceeding through the adoption of the *Further Notice* and the invitation for additional comment on certain proposals that were initially included in the draft order, but would benefit from further discussion and analysis. Since the Commission commenced this proceeding in November 2018, SIA members have met regularly in large and small discussion groups in an effort to reach consensus on detailed measures that should be adopted to mitigate orbital debris.

Throughout this deliberative process, SIA's members have been clearly aligned on the most important issue—the preservation of a safe and sustainable orbital environment that can continue to support scientific research and the rapidly growing space commerce industry. For SIA members, space sustainability is vital to protect existing and future on-orbit investments and to ensure the continued availability of critically-important satellite communications and Earth imaging services that touch literally every point on the globe and ensure universal availability of Internet access to all populations.

Consistent with these commitments, SIA created a Space Sustainability Working Group to develop industry recommendations related to the Administration's Space Policy Directive 3 ("SPD-3") addressing space traffic management and space situational awareness. On October 22, 2019, SIA announced the adoption of its Principles of Space Safety promoting collaboration, best practices, the minimization of debris, registration and tracking of space objects, the sharing of Space Situational Awareness information and other important measures.

SIA also released a White Paper on September 24, 2020 entitled *The Future of Space and Space Traffic Coordination and Management ("STCM")*, which addresses the importance of a

long-term sustainable and safe space environment for commercial satellites and spacecraft. The recommendations included:

- Federal funding to develop and implement a more modern STCM environment to support space-based innovation, including leveraging both commercial and government capabilities to yield a U.S.-developed cutting-edge space sustainability model.

- The use of technology neutral requirements, recognizing that the U.S. space industry is fully capable of developing and employing cost-efficient and effective technologies to achieve sustainability objectives.

- The encouragement of best practices that reflect the lengthy track record of the commercial space industry of responsible operations in space and the importance of maintaining a safe space environment to undertake ongoing and future space business.

- The need for "whole of space" solutions that serve global needs by addressing all types of space activities and involving all space-faring nations and industries.

SIA and its members also participated in the federal interagency meeting that was held virtually on August 28, 2020 to explore the shared needs of the U.S. government and commercial industry with respect to a sustainable space environment. The interagency meeting was productive and merits a recurring schedule.

With respect to the *Further Notice*, SIA's deliberations on these issues are reflected in these comments and in previous filings submitted by SIA in this docket. SIA strongly agrees that the Commission's orbital debris rules need to be updated in some important areas. In certain cases, SIA has reached consensus on a new specific standard for debris mitigation. In other cases, SIA recognizes the need for a new standard, but has not yet reached consensus on the details of that approach. To this end, SIA is continuing to identify consensus on additional issues that will be reflected in SIA's reply comments and in subsequent *ex parte* filings.

As explained herein, SIA supports adoption of the 0.001 probability metric for accidental explosions, which would provide objectivity and transparency in the Commission's approach to

the issue and align Commission policy with the standards of other U.S. agencies. The Commission should also work to identify a replacement for the existing 25-year standard for post-mission disposal lifetime and encourage wide industry participation in these efforts.

The Commission, however, should refrain from adopting proposals that have not been demonstrated to be effective in deterring orbital debris and would unduly increase the regulatory burden on satellite companies and deter industry investment. First, the Commission should abandon its indemnification proposal, which would exceed the Commission's legal authority under Title III. Such a requirement is unnecessary given the extremely low likelihood of government liability that can be dealt with using the Commission's existing regulatory authority, and the proposal would impose serious costs on an industry that already carries significant financial risks.

Second, the Commission should not place additional financial obligations on licensees through a post-mission disposal performance bond. Space station licensees are currently incentivized to protect space safety through prompt and effective post-mission disposal and, absent technical malfunction, already reliably do so today. Bonds would not improve space safety and would instead deter innovation and participation in the U.S. space industry by creating excessive and long-term financial burdens.

Finally, it is premature for the Commission to mandate that all spacecraft disposed of via atmospheric reentry be designed for demise. Although SIA strongly supports a long-term goal that would lower casualty risk to zero, the current standard is consistent with both other U.S. government agencies and international agencies, and in fact significantly overstates the actual threat to human life. Until the industry identifies appropriate substitutes for spacecraft materials that can survive atmospheric reentry, the Commission should retain the internationally accepted

threshold of 1 in 10,000 and refrain from requiring detailed information in defense of meeting such a threshold.

II. THE COMMISSION SHOULD ABANDON ITS INDEMNIFICATION PROPOSAL, WHICH IS LEGALLY SUSPECT, UNNECESSARY, AND BURDENSOME

There is no support for the Commission's proposal, first raised in its 2018 orbital debris Notice of Proposed Rulemaking, to require satellite operators to indemnify the United States against "any costs associated with a claim" brought under the Outer Space Treaty or the Liability Convention (together, the "Space Treaties").[4] SIA, its members, and academics dispute the Commission's proffered legal authority to impose an indemnification requirement on its licensees.[5] Moreover, the Commission both overestimates its Title III authority, and underestimates the industry's incentive to operate safely. The Commission, in doing so,

[4] *Further Notice*, Appendix D (proposing adoption of 47 C.F.R. §§ 5.64(c), 25.114(d)(14)(viii), 97.207(h)). *See generally id.*, ¶¶ 176-92; *Mitigation of Orbital Debris in the New Space Age*, Notice of Proposed Rulemaking, 33 FCC Rcd 11352, ¶ 78 (2018).

[5] More than a dozen satellite industry parties stated that the Commission lacks authority or questioned the justification and public interest reasoning for adopting an indemnification requirement. *See e.g.*, Comments of AT&T Services, Inc. at 5-6; Comments of The Boeing Company at 37-39 ("Boeing Comments"); Comments of The Commercial Smallsat Spectrum Management Association at 20-21; Comments of Eutelsat S.A. at 12; Comments of Intelsat License LLC ("Intelsat Comments") at 12-15; Comments of Leosat MA, Inc. at 9; Comments of Lockheed Martin Corporation at 18-19; Comments of WorldVu Satellites Limited at 29-32; Comments of ORBCOMM Inc. ("ORBCOMM Comments") at 18-20; Reply Comments of SES Americom, Inc. and O3b Limited at 8; Comments of the Satellite Industry Association at 8-10; Comments of Sirius XM Radio Inc. at 9-10; Comments of Space Logistics, LLC at 9-13; Comments of Spaceflight, Inc. at 6; Comments of Telesat Canada at 11; Comments of Viasat, Inc. at 4; *see also* Laura Montgomery, *FCC Continuing to Push for Satellite Industry to Indemnify U.S. Government Despite Lack of Authority*, Ground Based Space Matters (Sep. 11, 2020), https://groundbasedspacematters.com/index.php/2020/09/11/fcc-continuing-to-push-for-satellite-industry-to-indemnify-u-s-government-despite-lack-of-authority/.

specifically fails to consider less burdensome options that would be legally permissible to incentivize its licensees to continue to operate satellites in a safe manner.

A. The Commission Lacks Authority to Compel Satellite Operators to Indemnify the U.S. Government for Claims Arising Under the Space Treaties

The Commission lacks authority under the Communications Act to adopt an indemnification requirement. Title III authorizes the Commission to license radio communications, including satellite communications, in service of the public interest.[6] The Commission's strained reading of the Act must be dismissed as contrary to the plain language of the statute and its intent. As the record in this proceeding demonstrates, Title III fails to provide sufficient authority for the Commission to impose a new financial obligation in the form of indemnification, let alone require licensees to fund U.S. treaty obligations.

First, the Commission's Title III public interest authority, although expansive, is not limitless. The statute grants the Commission authority over "radio transmission" in the United States.[7] To the extent the Commission has authority over matters of orbital debris, its authority must be connected to its mandate to "encourage the larger and more effective use of radio in the public interest."[8] An obligation to indemnify the U.S. government for any claims that it may be liable for under its treaty commitments to State Parties in order to limit taxpayer liability is not proximately connected to the Commission's mandate to oversee U.S. radio communications.

Second, absent express delegation of authority by Congress, the Commission cannot seek to fulfill the United States' liability obligations by requiring satellite operators to fund these

---

[6] 47 U.S.C. § 307(a).

[7] 47 U.S.C. § 301.

[8] *NBC v. United States*, 319 U.S. 190, 219 (1943) (*quoting* 47 U.S.C. § 303(g)).

obligations by indemnifying the government. As a signatory to the Space Treaties, the United States itself is liable for any damage caused to another State Party, its citizens, territory, or property by an object that it launches or for which it procures the launch of.[9] These liability provisions in the Space Treaties are non-self-executing, as they would accomplish what is exclusively within Congress' lawmaking power—to raise revenue.[10] Unless a treaty provision is "self-executing" and thus has domestic effect as federal law upon ratification, only Congress can administer the treaty provision through implementing legislation.[11] There is no statute to authorize the Commission's proposed indemnification requirement. Ratification of the treaties alone does not delegate authority to the Commission to administer the non-self-executing liability provisions of these treaties.

Third, even if the Commission's authority under Title III could be interpreted to permit an indemnification requirement, doing so would run counter to Congress's long-standing practice of supporting the growth of certain industries deemed critical to national security by *limiting* private sector liability. For example, the Commercial Space Launch Act of 1984, as amended, provides for indemnification by the U.S. government to commercial space launch companies against certain

[9] Treaty on Principles Governing the Activities of States in the Exploration and Uses of Outer Space, including the Moon and Other Celestial Bodies, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205, Art. VII (entered into force Oct. 10, 1967) ("Outer Space Treaty"); Convention on International Liability for Damage Caused by Space Objects, Mar. 29, 1972, 24 U.S.T. 2389, T.I.A.S. No. 7762 (entered into force Sep. 1972) ("Liability Convention").

[10] *See* Carlos Manuel Vázquez, *The Four Doctrines of Self-Executing Treaties*, 89 Am. J. Int'l L. 695-723, at 718 (1995) ("The types of treaties that have been considered non-self-executing for constitutional reasons include treaties that purport to raise revenue, treaties that purport to make conduct criminal, and treaties that purport to appropriate money.") (internal citations omitted).

[11] *Medellin v. Texas*, 552 U.S. 491, 525-26 (2008) (holding that only Congress can make "non-self-executing" treaties enforceable).

third-party claims.[12] This statute arose from a public-private effort to mitigate potential cost burdens and thereby ensure the growth of the commercial launch industry. Similarly, Congress requires the Nuclear Regulatory Commission to "indemnify and hold harmless" licensees from public liability arising from nuclear incidents.[13] Consistent with this approach, the Commission should seek to mitigate—not add to—burdens that chill the development of satellite communications, particularly given the Commission's own mandate to "encourage the larger and more effective use of radio."

B. The Commission's Justification for Imposing Indemnification Overestimates the Risk of U.S. Government Liability and Underestimates its Own Authority to Regulate Licensees to Mitigate that Limited Risk

The Commission's indemnification proposal is also wholly unnecessary. The Commission already has oversight and enforcement authority over its licensees without obligating satellite operators to assume the government's liability under the Space Treaties. The Commission can deny authorizations to applicants with spacecraft that pose an unacceptable risk to other operators (or another country).[14] It can exercise its enforcement authority to assess forfeitures against any licensee that willfully or repeatedly fails to comply substantially with the terms and conditions of its license, the Commission's rules, or the Communications Act.[15] Such mechanisms are more

---

[12] 51 U.S.C. § 50915.

[13] 42 U.S.C. § 2210(c) (providing for indemnification of licensees by the Nuclear Regulatory Commission for amounts in excess of financial protection requirements but not to exceed $500 million excluding certain legal costs); *see also id.* § 2210(d) (providing for indemnification of contractors by the Department of Energy against certain claims).

[14] 47 U.S.C. § 307(a). *See also* 47 C.F.R. § 25.114(d)(6), (14) (requiring satellite applicants to demonstrate "public interest considerations in support of grant" and to identify "the design and operational strategies that will be used to mitigate orbital debris").

[15] 47 U.S.C. § 503(b). *See also* 47 C.F.R. § 1.80.

than sufficient to ensure satellite operators take all reasonable precautions to ensure safe space operations, further mitigating the already negligible risk of liability claims against the United States.

Moreover, the Commission was correct in acknowledging in the *Further Notice* that an "indemnification requirement may be an unnecessary formal step to acknowledge an existing legal obligation of licensees engaged in space activities,"[16] and cites The Boeing Company's initial comments,[17] which state that the U.S. government has ample authority to seek reimbursement from a satellite operator for liability resulting from a space-related accident using such legal doctrines as a Claim of Contribution,[18] Claim of Equitable Apportionment,[19] or a Claim of Equitable Tort

[16] *Further Notice*, ¶ 179.

[17] Boeing Comments at 37-38.

[18] *See, e.g.*, *Barrett v. United States*, 853 F.2d 124, 130-31 (2d Cir. 1988) (United States permitted to maintain a tort claim of contribution against the State of New York for its liability in the death of a patient in 1953 at the New York State Psychiatric Institute who was injected with chemicals without his consent in the course of a chemical warfare experiment conducted with the U.S. Army); *United States v. Hawaii*, 832 F.2d 1116, 1118 (9th Cir. 1987) (permitting the United States to maintain a contribution claim against the State of Hawaii for its contributory role in third party injuries caused by a jeep driven by a sergeant in the Hawaii National Guard); *Bradford v. United States*, 2018 U.S. Dist. LEXIS 51263 (W.D. KY, 2018) (United States permitted to maintain tort claim of contribution against a boat operator for its share of liability for the loss of three passengers when the boat capsized); *United States v. St. Louis Univ.*, 2007 U.S. Dist. LEXIS 84915 (S.D. IL, 2007) (United States permitted to sue defendant university for contribution resulting from its liability in a medical malpractice and wrongful death action); *Danz v. United States*, 1976 U.S. Dist. LEXIS 11823 (S.D. FL, 1976) (United States permitted to maintain a claim of contribution from the estate of a pilot following a plane crash that was deemed partially the fault of air traffic controllers and partially the fault of the deceased pilot); *Portel v. United States*, 85 F. Supp. 458 (S.D. NY, 1949) (United States permitted to maintain a claim of contribution against the employer of an individual who was injured while servicing a U.S.-owned vessel for its share of the liability).

[19] *See, e.g., Bethel Native Corp. v. DOI*, 208 F.3d 1171 (9th Cir. 2000) (United States permitted to maintain a third-party claim for equitable apportionment of tort liability against the State of Alaska for its role in the burn injuries to an individual resulting from an oil spill).

Indemnification.[20]

While the *Further Notice* acknowledges these legal options, it raises a question about their application to liability claims resulting from treaty obligations entered into by the U.S. government, such as the Space Treaties.[21] SIA has been unable to identify any tort claim cases that address the Space Treaties, as the U.S. government has never faced a civil liability claim under these treaties. In an analogous case, however, the U.S. Court of Appeals for the Second Circuit upheld the U.S. government's authority to seek recovery from a barge company for cleanup costs that the government paid to Canada resulting from an oil spill in the St. Lawrence Seaway in 1976.[22] The U.S. and Canada were parties to a bilateral treaty agreement that required the governments to reimburse each other for such spill related damages.[23] The Second Circuit concluded that the U.S. government's claim of recovery from the barge company was permissible. This ruling is consistent with an earlier decision by the U.S. Supreme Court, which addressed the broader question of whether the U.S. government has the legal authority to demand contribution, apportionment, or indemnification from third parties. The Supreme Court explained:

> Of course there is no immunity from suit by the Government to collect claims for contribution due it from its joint tort-feasors. The Government should be able to enforce this right in a federal court not only in a separate

[20] *See, e.g., Williams v. United States*, 469 F. Supp. 2d 339 (E.D. VA, 2007) (United States was able to maintain a claim for equitable tort indemnification against a bus service transporting Navy sailors regarding injuries to a sailor).

[21] *Further Notice*, ¶ 179.

[22] *See Complaint of Oswego Barge Corp.*, 664 F.2d 327 (2d Cir. 1981).

[23] *See* Agreement Between the United States of America and Canada on Great Lakes Water Quality, 23 U.S.T. 301 (1972). The Agreement provides that "the costs of operations of both Parties under the (Joint Contingency Plan for oil and hazardous spills in boundary waters) shall be borne by the Party in whose waters the pollution incident occurred." *Id.*, Annex 8, at 4; 23 U.S.T. at 341.

action but by impleading the joint tort-feasor as a third-party defendant.[24]

The major treatise on Federal Practice and Procedure reflects this view, explaining that "it seems logical that the United States, as a defendant, should have the same right to implead a third party as would a private litigant."[25] The primary test appears to be whether the U.S. government has waived its sovereign immunity so that it can be sued, in which case the government has a reciprocal right to seek contribution from third parties.[26] As the *Further Notice* acknowledges, the government's ratification of the Space Treaties clearly provides its consent to be subject to liability for space-related accidents.[27] Therefore, the U.S. government has the authority to seek contribution from liable third parties for claims involving the Space Treaties using the impleader procedures in Section 14 of the Federal Rules of Civil Procedure,[28] and no reason exists to duplicate that authority through an indemnification requirement, particularly one, as noted below, that would harm the U.S. space industry.

C. The Commission Would Disserve the Public Interest by Imposing an Unnecessary and Costly Regulatory Burden on Licensees

The proposed indemnification requirement would be unduly burdensome to satellite operators, resulting in a disservice to U.S. satellite customers. The Commission proposes to hold

---

[24] *United States v. Yellow Cab Co.*, 340 U.S. 543, 551-52 (1951).

[25] Charles A. Wright, Arthur R. Miller & Mary K. Kane, Federal Practice and Procedure § 1450 at 467 (1990).

[26] The only exception is that the Government cannot recover indemnification from its employees. *See id.* (*citing U.S. v. Gilman*, 347 U.S. 507, 74 S. Ct. 695, 98 L. Ed. 898 (1954)).

[27] Outer Space Treaty, Article VI. (explaining that "State Parties to the Treaty shall bear international responsibility for national activities in outer space . . . whether such activities are carried on by governmental agencies or by non-governmental entities").

[28] *United States v. Yellow Cab Co.*, 340 U.S. at 553.

licensees responsible for "any costs" associated with "a claim" brought against the U.S. under the Space Treaties, regardless of fault.[29] The unlimited, unpredictable, and perpetual financial liability that the Commission's proposal would place on licensees would deter innovation, investment, and participation in the U.S. space industry. Further, insurance broad enough to offset this financial liability, unlimited coverage against *any contingency* while on-orbit,[30] does not appear to exist.[31] Even if an entirely new insurance policy that accounts for unknowable and unavoidable risks over an indefinite period of time was created, third-party liability and on-orbit insurance policies are already prohibitively expensive for many satellite companies and would-be satellite companies.[32] The imposition of such a huge burden of unlimited indemnification would also encourage satellite

[29] *Further Notice*, Appendix D (proposing adoption of 47 C.F.R. §§ 5.64(c), 25.114(d)(14)(viii), 97.207(h)).

[30] As proposed, the Commission's indemnification requirement could even compel licensees to indemnify the government for claims associated with satellites that have previously been decommissioned safely in a disposal orbit. Yet, satellite operators are no longer capable of controlling the satellite after de-orbit procedures, *see* 47 C.F.R. § 25.283(c) (requiring all satellite operators to "ensure, unless prevented by technical failures beyond its control, that stored energy sources on board the satellite are discharged, by venting excess propellant, discharging batteries, relieving pressure vessels, or other appropriate measures"), nor do they have legal authority to do so. *See* 47 C.F.R. § 25.161(c) (providing for automatic license termination upon removal or modification of facilities rendering the space station not operational for more than 90 days, unless specific authority is requested).

[31] *See, e.g.*, Intelsat Comments at 19, n.34 ("Intelsat is unaware of an existing insurance policy that would provide limitless coverage," and if "such a policy existed, it would likely [be] prohibitively expensive."); Reply Comments of AT&T Services, Inc. at 8-9 ("It is not clear whether it will be possible for satellite system operators to obtain insurance at reasonable rates, and as such it is very likely that defaults on such obligations could easily occur, rendering such a requirement ineffective and unenforceable.") (*quoting* ORBCOMM Comments at 19 (*internal quotations omitted*).

[32] *See Reply Comments of The Boeing Company* at 44 ("Given the fact that few operators currently secure insurance covering the entire lifetime of their satellites, it is unclear whether such insurance could be obtained on reasonable terms."); In fact, few operators currently secure insurance for the lifetime of their satellites. *See* Comments of Global NewSpace Operators at 19 (observing that only five percent of low-Earth orbit satellites are subject to on-orbit insurance).

operators to seek licensing from foreign jurisdictions.

Moreover, the Commission's costly proposal offers no meaningful, countervailing benefits. As discussed above, operators already actively cooperate with industry, the Commission, and the U.S. government and other stakeholders to ensure and preserve a safe space operating environment. The indemnification proposal is made further unnecessary by the Commission's existing mechanisms to incentivize space safety and judicial remedies available to the U.S. government to seek reimbursement for damages paid as a result of claims brought under the Space Treaties. It is thus precisely the type of overly burdensome regulation that the Commission should not adopt.

III. THE COMMISSION SHOULD NOT ADOPT A PERFORMANCE BOND FOR POST-MISSION DISPOSAL

The Commission's proposal to require all space station licensees to "post a surety bond specific to successful post-mission disposal within 30 days of the grant of its license" would add material costs to satellite operators without advancing the agency's orbital debris mitigation goals.[33] Satellite operators are self-motivated to mitigate orbital debris and, absent technical anomaly, reliably de-orbited their spacecraft after mission life consistent with Commission rules. As explained above, the Commission's existing oversight and enforcement authorities provide additional incentives to reduce the probability of anomalous events through system testing, design redundancies, and other best practices.[34] The agency's enforcement authority allows it to penalize

[33] *Further Notice*, Appendix D (proposing adoption of 47 C.F.R. § 25.166(a)).

[34] *Supra* Section I.A. (describing the Commission's authority to deny authorizations to applicants with spacecraft that pose an unacceptable orbital debris risk under Title III of the Act, 47 U.S.C. § 307(a), and its enforcement authority under Section 503(b) of the Act, 47 U.S.C. § 503(b), to assess forfeitures against any licensee that willfully or repeatedly fails to comply substantially with the terms and conditions of its license, the Commission's rules, or the Communications Act).

licensees that nevertheless violate the end-of-life disposal rules. A post-mission bond requirement would not further incentivize an industry that is already driven to safeguard the space environment.

Instead, the Commission's bond proposal would place additional, excessive, and long-term financial burdens on satellite operators to the detriment of the U.S. space industry. Satellite startups and smaller companies would generally be unable to secure a traditional bond (one that requires the grantee to pay carrying costs) of the proposed size and would thus be required to place capital equivalent to the full bond amount into escrow for each license in order to comply with the proposed rule. Geostationary satellite orbit ("GSO") network operators with large U.S. licensed fleets authorized under numerous licenses would be compelled to carry an incredibly high cumulative bond amount.[35] Operators of non-geostationary satellite orbit ("NGSO") systems with multiple licenses authorizing separate frequency bands could, in addition to carrying large bond amounts, risk forfeiting amounts under multiple bonds.[36] These significant, upfront expenditures would be compounded by tens of thousands of dollars in bond maintenance and administrative fees each year.

For similar reasons, the Commission should abandon its proposal to require a GSO licensee extending the length of its license term to increase its surety bond, including by doubling the bond amount for a 5-year extension.[37] Not only would such an escalating bond requirement be

[35] For example, a GSO satellite operator with 50 licenses could be required to secure and carry bonds for up to $250 million. *See Further Notice*, Appendix D (proposing adoption of 47 C.F.R. § 25.166(a)(2)).

[36] For example, an NGSO operator with separate licenses for Ku/Ka-band spectrum and V-band spectrum supporting a single constellation could be required to secure and carry bonds for up to $200 million. *See id.*, Appendix D (proposing adoption of 47 C.F.R. § 25.166(a)(1)).

[37] *See id.*, Appendix D (proposing adoption of 47 C.F.R. § 25.166(a)(2)(A)) ("If the licensee is granted a modification to extend the length of its license by up to five years, the surety bond on

prohibitively costly and unduly burdensome, it would be inappropriate considering that older GSO satellites are even less likely than younger satellites to experience an anomaly preventing full and complete de-orbit. Moreover, the proposed escalating bond requirement would undermine the Commission's efforts to reduce orbital debris because it would create incentives for operators to launch new satellites rather than extend the mission life of fully functional, on-orbit space stations.

The agency's surety bond requirement for milestone completion is already burdensome on U.S. satellite operators, but is only in effect for up to 5 years for a GSO licensee or 6 years for an NGSO licensee.[38] The lifetime for a post-mission disposal bond would generally run for at least 15 years, and likely even longer. Capital would thus be tied up for much longer, with 15 years or more of bond fees that would never be recovered.

Finally, regardless of precautions taken in the design and operation of a satellite, factors beyond an operator's control can prevent timely or complete de-orbit. Such anomalies are typically caused by unanticipated events that occur notwithstanding an operator's adherence to orbital debris mitigation best practices. Posting a bond would not prevent such unexpected anomalies and instead would punish operators for events outside their control. The Commission should therefore not require post-mission disposal bonds.

IV. THE COMMISSION SHOULD ADOPT THE OBJECTIVE 0.001 PROBABILITY METRIC FOR ACCIDENTAL EXPLOSIONS

SIA supports the Commission's proposal to adopt a requirement that satellite applicants demonstrate that the integrated probability of debris-generating explosions (excluding small

file must be increased by $5,000,000, and by an additional $5,000,000 for a subsequent extension of up to five years.").

[38] *See* 47 C.F.R. §§ 25.164, 165; *see also Further Notice*, ¶ 193 (comparing its post-mission disposal bond proposal to the agency's milestone and surety bond requirements).

particle impacts) is less than 0.001 during deployment and mission operations.[39] SIA previously expressed support for the adoption of this rule.[40] The 0.001 metric would provide an objective and transparent alternative to the Commission's current approach of requiring that satellite license applicants explain in their applications that they have assessed and limited the probability of accidental explosion without specifying in the rules the outcome of such assessments that may be deemed acceptable by Commission staff.

As the *Further Notice* observes, the updated Orbital Debris Mitigation Standard Practices ("*ODMSP*")[41] instructs that compliance demonstrations addressing accidental explosions should be developed using "commonly accepted engineering and probability assessment methods."[42] The *Further Notice* requests comment on how the Commission should implement this guidance.[43] The Commission's rules already include numerous instances where applicants for satellite authorizations are required to "demonstrate" compliance with technical requirements, which are subject to Section 1.17 of the rules with respect to truthful and accurate submissions. Consistent with this, the Commission should continue to review such showings for accuracy and to verify the use of commonly accepted engineering practices and probability assessment methods. If this review raises significant questions, an inquiry can be submitted to the applicant. Otherwise, the

[39] *See Further Notice*, ¶ 154.

[40] *See Ex Parte Notice of the Satellite Industry Association*, IB Docket No. 18-313, Attachment 1 at 4 (April 15, 2020).

[41] *See* U.S. Government, *Orbital Debris Mitigation Standard Practices*, Nov. 2019 Update, § 2.1 ("*ODMSP*") *available at:* https://orbitaldebris.jsc.nasa.gov/library/usg_orbital_debris_mitigation_standard_practices_november_2019.pdf (*last visited* Oct. 2, 2020).

[42] *Further Notice,* ¶ 154 & n.525 (*quoting ODMSP*, § 2-1).

[43] *Id.*, ¶ 154.

technical demonstrations that are filed by satellite system applicants should be accepted as accurate and should justify the grant of an application as long as they show compliance with the 0.001 probability metric.

V. SIA SUPPORTS CHANGES TO THE COMMISSION'S LIMITS ON THE POST-MISSION DISPOSAL LIFETIME OF RETIRED SATELLITES

SIA agrees that the permissible post-mission disposal lifetime for satellites needs to be revised through modification of the 25-year rule. The need to update the 25-year rule was one of the most significant focuses of discussion during a recent interagency meeting on orbital debris that was held on August 28, 2020 and included participation by SIA members. Given the central focus of the 25-year rule in the interagency deliberations, the Commission should identify an appropriate replacement for the 25-year standard. SIA continues to work with its members to support this effort.

VI. IT IS PREMATURE FOR THE COMMISSION TO MANDATE DESIGN FOR DEMISE OR TARGETED REENTRY REQUIREMENTS FOR SATELLITES

SIA strongly supports the Commission's long-term goal of implementing a design for demise requirement applicable to all space objects that employ atmospheric reentry at the conclusion of their missions.[44] It is premature, however, to adopt such a requirement at this time. Currently, the internationally accepted standard for spacecraft reentry casualty risk is 1 in 10,000. The standard was first adopted by NASA in 1995[45] and has repeatedly been affirmed by other U.S.

[44] *See Further Notice*, ¶ 174.

[45] *See Guidelines and Assessment Procedures for Limiting Orbital Debris*, NASA Safety Standard ("NSS") 1740.14 (1995).

government agencies through its inclusion in each version of the *ODMSP*.[46] It was also adopted by the European Space Agency and is consistent with the international Space Debris Mitigation Guidelines adopted by the Inter-Agency Space Debris Cooperation Committee ("IADC"), which state that "reentering debris should not pose an *undue* risk to people or property."[47]

A design for demise requirement is relevant to the human casualty risk limit because the risk threshold is determined using the anticipated size of the debris field that would result from an object surviving atmospheric reentry with kinetic energy in excess of 15 joules and calculated against the relevant population. As such, the existing 1 in 10,000 threshold greatly overstates the actual risk to human life since an object with a kinetic energy of around 15 joules could not harm people who are indoors or in cars, neither of which is considered in the calculation.

Refraining from the adoption of a design for demise requirement is justified because not all materials that are optimal for use in spacecraft and satellite manufacturing are guaranteed to incinerate sufficiently during atmospheric reentry. For example, the Hubble space telescope presents a human casualty reentry risk of 1 in 240 due to its composition, which includes a large Pyrex mirror and significant amounts of titanium.[48]

Fortunately, commercial satellites do not present such risks, routinely complying with the internationally accepted threshold of 1 in 10,000. Further, the atmospheric reentry of a commercial

---

[46] *See ODMSP*, § 4-1(a).

[47] *IADC Space Debris Mitigation Guidelines*, Inter-Agency Space Debris Coordination Committee, IADC Action Item number 22.4 (Sept. 2007) (*emphasis added*), *available at* https://www.unoosa.org/documents/pdf/spacelaw/sd/IADC-2002-01-IADC-Space_Debris-Guidelines-Revision1.pdf (*last visited* Sept. 25, 2020).

[48] *See Hubble Space Telescope Disposal Study Closeout Report*, National Aeronautics and Space Administration, at 1-2 (Nov. 2012) *available at:* https://cor.gsfc.nasa.gov/studies/HSTD_18DecRev1.pdf (*last visited* Sept. 17, 2020).

satellite has never resulted in a human casualty. It is therefore unwarranted for the Commission to propose a near-term requirement that FCC licensees must achieve a zero-risk mandate through a fully demisable requirement. Although all industries, including the satellite industry, strive for zero risk of human casualty, no industry is required by U.S. laws or regulation to achieve such a requirement.

A design for demise requirement would impose significant harm on the U.S. space industry because some materials that are known to partially survive atmospheric reentry remain the best choice in the manufacture of safe and reliable satellites. As examples, the use of titanium remains desirable for some components—such as for pressurized propellant vessels—because it is nearly as strong as steel, but with the weight of aluminum. Titanium has a melting temperature of 3,034º Fahrenheit, significantly reducing its potential to incinerate during atmospheric reentry.

Gallium arsenide is optimal as a semiconductor for space-based solar cells because of its much higher conversion efficiencies. Gallium arsenide has a melting point of 2,260º Fahrenheit, also making it susceptible to reentry survival. Aluminum is used abundantly in satellite manufacturing because of its light weight. Although its melting temperature is a relatively low 1,221º Fahrenheit, its use for relatively dense components, such as batteries, makes it susceptible to reentry survival. Finally, steel remains preferable for certain mechanical components, such as wheels, and with a melting temperature in the range of 2,500º to 2,800º Fahrenheit, it is susceptible to survival on atmospheric reentry.

The satellite manufacturing industry continues to strive to identify appropriate substitutes for these materials. For example, carbon-wrapped pressure vessels are now available as a potential substitute for titanium or other materials. This transition, however, is far from complete. Satellite manufacturers also routinely minimize the use of high-melting point materials, particularly in

configurations that make them susceptible to reentry survival. As a result, U.S. commercial satellites routinely comply with the international requirement of limiting casualty risk to 1 in 10,000. The Commission should not arbitrarily mandate a reduction in this risk to zero.

It would be equally inappropriate to require applicants that comply with the 1 in 10,000 requirement, but do not achieve zero risk, to provide additional information to the Commission, such as "a detailed discussion of the need for use of high melting point material" and a "demonstration that mission objectives cannot be met with an alternative spacecraft design."[49] The *Further Notice* suggests that such a requirement "could help to ensure that applicants are considering strategies such as design for demise and targeted re-entry."[50] This rationalization disregards the fact that satisfying the existing 1 in 10,000 requirement already requires very detailed engineering and tradeoffs. Thus, a further reminder of these requirements and the importance of achieving them is not necessary.

It would also be entirely inappropriate for Commission staff to attempt to second guess the engineering decisions and tradeoffs made by satellite designers. Such a process would lack transparency and objectivity. Instead, consistent with U.S. and international standards, the Commission should continue to adhere to the 1 in 10,000 risk threshold, which has remained successful in ensuring that no individual has ever been harmed by the atmospheric reentry of a manmade space object.

The *Further Notice* also raises questions about the use of targeted reentry to ensure that satellite debris lands in uninhabited areas.[51] Although such measures can be encouraged, they are

[49] *Further Notice*, ¶ 173, n.583.

[50] *Id.*, ¶ 174.

[51] *Id.*

not technically neutral and are not economically achievable on a sufficiently reliable basis using existing technologies. Therefore, the Commission should not attempt to mandate the use of unproven technologies or techniques in an effort to achieve a targeted reentry approach to atmospheric disposal of space objects.

VII. CONCLUSION

For the foregoing reasons, the Commission should adopt an objective 0.001 probability metric for accidental explosions and develop a replacement for the 25-year rule. Taking these steps will improve space safety while continuing to support innovation and participation in the satellite industry. The Commission, however, should refrain from adopting its proposals regarding treaty indemnification, post-mission disposal performance bonds, or a zero-risk human casualty probability requirement.

Respectfully submitted,

SATELLITE INDUSTRY ASSOCIATION

By: /s/ Tom Stroup

Tom Stroup
President
Satellite Industry Association
1200 18th Street N.W., Suite 1001
Washington, D.C. 20036

October 9, 2020