

**Before the  
Federal Communications Commission  
Washington, D.C.**

In the Matter of:

**Mitigation of Orbital Debris in the  
New Space Age**

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IB Docket No. 18-313

**Reply Comments of Academic Small Satellite Researchers**

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## Summary

The above-listed academic researchers in the areas of aerospace engineering, space sciences, and other related fields respectfully reply to comments on the Commission's Further Notice of Proposed Rulemaking concerning the mitigation of orbital debris. We urge the Commission not to adopt the proposed rules regarding the maneuverability, indemnification, and bond requirements, most especially for academic and experimental researchers. The record as a whole strongly disapproves of the indemnity and bond requirements and shares our concerns that maneuverability requirements for university and research missions will harm the public good.

Our research is necessary to observe and understand climate change, predict weather patterns, and track pollutant distribution, among other critical public interest research. Our institutions also serve as springboards for graduates to embark on careers in national defense and the satellite industry. The proposed rules would stifle our research to the detriment of the American public and close off a critical avenue for new entrants into the space industry.

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## Discussion

The above-signed Academic Small Satellite Researchers respectfully reply to the comments submitted in response to the Commission’s Further Notice of Proposed Rulemaking (“FNPRM”) regarding proposed new requirements for small satellites.<sup>1</sup> We strongly disagree with the need for the Commission’s maneuverability, indemnification, and bond requirements. Many commenters share our concerns that financially burdensome maneuverability requirements on new small satellites will have a chilling effect on research and harm the ability of US institutions to continue innovating space technologies. An overwhelming majority of commenters agree that an indemnification requirement puts an unreasonable burden on satellite operators that neither furthers the public interest nor addresses significant legal hurdles in its implementation.

### **I. The record underscores that maneuverability requirements for university and research missions will harm the public good. (¶¶ 53, 164-167)**

Many commenters agree that the maneuverability requirement proposed in the FNPRM<sup>2</sup> is economically infeasible for the many small satellite operators with smaller budgets and would effectively lock many operators out entirely, including universities and researchers.<sup>3</sup> As the Commercial Picosatellite and Nanosatellite Developers explain, “[r]equiring maneuverability from pico- and nano-satellites above 400km eliminates nearly all launch opportunities” and would “painfully constrict innovation of

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<sup>1</sup> Mitigation of Orbital Debris in the New Space Age, Report and Order and Further Notice of Proposed Rulemaking, IB Docket No. 18-313, FCC 20-54, 35 FCC Rcd. 4156 (2020) (“FNPRM”), <https://www.fcc.gov/document/fcc-updates-orbital-debris-mitigation-rules-new-space-age-0>.

<sup>2</sup> *Id.* at 4180, ¶ 53.

<sup>3</sup> Comments of The Commercial Picosatellite and Nanosatellite Developers Group (CPNDG) at 1-2 (Oct. 9, 2020), <https://www.fcc.gov/ecfs/filing/1010211012354>; see also Comments of Open Research Institute at 2-3 (Oct. 9, 2020), <https://www.fcc.gov/ecfs/filing/100998217277>; Comments of The Astrodynamics, Space Robotics, and Controls Laboratory (ARCLab) at 14-15 (October 8, 2020) <https://www.fcc.gov/ecfs/filing/100968628105>.



nanotechnologies for satellite applications in the United States.”<sup>4</sup> The Open Research Institute (ORI) similarly predicts that putting space out of reach to so many operators without extensive funding will severely reduce the number of people in the United States who seek careers in space and space technology.<sup>5</sup>

This same chilling effect will be felt by academic programs as well when students are unable to gain practical experience in space-oriented education. Even the large corporations will eventually feel these negative effects as the number and abilities of future engineers and scientists shrink.

Even commenters that are not entirely opposed to maneuverability requirements agree that a maneuverability requirement for small satellite operators with few numbers of low-mass satellites will do little to mitigate the overall risk of small-operator missions relative to the overwhelming risk created by megaconstellations in the same orbit.<sup>6</sup> For example, Viasat points out that risk to the overall LEO environment is directly proportional to the size of constellations currently deployed or planned for deployment soon.<sup>7</sup>

Because experimental operators are among the smallest of operators with the fewest number of satellites per mission, the overall risk posed by academic and research missions has historically been low and will continue to be low in the future. As Spire Global notes, “[s]mall satellite systems have been operating at altitudes below 600 km for many years without issue,” and “[m]aneuverability should not be a requirement for

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<sup>4</sup> CPNDG Comments at 1-2.

<sup>5</sup> Open Research Comments at 2-3.

<sup>6</sup> Comments of Viasat at 19-20 (Oct. 9, 2020), <https://www.fcc.gov/ecfs/filing/101021941342>; *see also* Comments of Spire Global at 7-10 (Oct. 9, 2020), <https://www.fcc.gov/ecfs/filing/1009247736882>; Comments of Telesat Canada at 3-4 (Oct. 9, 2020), <https://www.fcc.gov/ecfs/filing/100969719106>; Comments of Boeing at 8-14 (Oct. 9, 2020), <https://www.fcc.gov/ecfs/filing/1009646113893>.

<sup>7</sup> Viasat Comments at 17, 25.

small satellite systems operating below 600 km given the low severity and environmental impact if there were to be a collision.”<sup>8</sup>

The record also strongly underscores the important contributions of experimental satellite operators to the industry and the public good and finds wide support for small-operator exemptions from maneuverability requirements.<sup>9</sup> We agree with Boeing that “[e]xceptions should exist in the rules for small experimental spacecraft that are injected into orbit between 400 and 600 kilometers for research and educational purposes.”<sup>10</sup> We likewise agree with the Aerospace Industries Association that an exception should be made for experimental spacecraft in orbit between 400 and 600 kilometers for research and educational purposes for systems less than 180 kg or fleet mass of less than 1800 kg.<sup>11</sup> Such a system requirement provides sufficient operating room for experimental missions to contribute to research and education without unduly taxing already strained financial considerations.

Finally, we agree with the comments of the Astrodynamics, Space Robots, and Controls Laboratory (“ARCLAB”) that the Commission must consider the public benefit of missions and applicants when deciding the thresholds for acceptable risk in a given orbital region.<sup>12</sup> While we do not currently favor one assessment formula over another, by adopting a system to include public benefit in risk assessments the Commission sends a clear and unambiguous message that by taking these steps to preserve the orbital environment the Commission is not only safeguarding space for commercial ventures but for everyone involved in technology, research, and scientific advancement.

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<sup>8</sup> Spire Global Comments at 12.

<sup>9</sup> Comments of the Aerospace Industries Association (AIA) (Oct. 9, 2020), <https://www.fcc.gov/ecfs/filing/100908396821>; Boeing Comments at 14-16; Open Research Comments at 4-5.

<sup>10</sup> Boeing Comments at 14-16.

<sup>11</sup> AIA Comments at 1.

<sup>12</sup> ARCLab Comments at 5-6.

## **II. The record does not support adopting the proposed indemnification requirements, at least for entities affiliated with, or operating under, state governments. (¶¶ 135, 176)**

As we have noted in our previous filings, the indemnification requirement would almost certainly be fatal to our research mission.<sup>13</sup> As the last round of comments shows, the FCC record continues to overwhelmingly disapprove of the proposed indemnification requirements.<sup>14</sup> Of the twenty-two comments mentioning the indemnification proposals by the Commission, twenty-one of them opposed indemnity provisions in whole or in part<sup>15</sup>, including a wide range of stakeholders such as Boeing, SIA, WorldVu, Echostar, AT&T, Spire Global, Intelsat, and Eutelsat.<sup>16</sup> SIA, Boeing, and Spire Global express that this proposal is unnecessary as there is currently adequate civil recourse available to allow for recovery in case of accidents.<sup>17</sup> AT&T and Spire Global argue that imposing this

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<sup>13</sup> Comments of Academic Small Satellite Researchers at 15 (Oct. 9, 2020), <https://www.fcc.gov/ecfs/filing/10092555323758>.

<sup>14</sup> FNPRM, 35 FCC Rcd. at 4218, ¶ 135 & n.475; *see also* Boeing Comments at 18-21; Comments of WorldVu Satellites (OneWeb) at 12-14 (Oct. 9, 2020), <https://www.fcc.gov/ecfs/filing/1010455913201>; Comments of the Satellite Industry Association (SIA) at 5-13 (Oct. 9, 2020), <https://www.fcc.gov/ecfs/filing/1009664601911>; Comments of Echostar Satellite Services and Hughes Network Systems at 2-4 (Oct. 9, 2020), <https://www.fcc.gov/ecfs/filing/100992769732> (“Echostar Comments”).

<sup>15</sup> Comments of Association of Space Explorers (ASE) at 5 (Oct. 9, 2020), <https://www.fcc.gov/ecfs/filing/1007104826869>. ASE strongly supported the insurance and bond concepts because they want owners of spacecraft to take responsibility for their debris. This support is from the view of persons who are most concerned with preventing collisions with the International Space Station. It is our view that our small, experimental spacecraft are extraordinarily low-risk, which is outweighed by the public good they create.

<sup>16</sup> *See* Boeing Comments at 18-21; SIA Comments at 5-16; WorldVu Comments at 12-14; Echostar Comments at 2-4; Comments of AT&T at 8-11 (Oct. 9, 2020), <https://www.fcc.gov/ecfs/filing/1009130293503>; Spire Global Comments at 13-14; Comments of Intelsat License at 3-18 (Oct. 9, 2020), <https://www.fcc.gov/ecfs/filing/1009549207981>; Comments of Eutelsat at 8-10 (Oct. 9, 2020), <https://www.fcc.gov/ecfs/filing/10092634626280>.

<sup>17</sup> SIA Comments at 11-13; Boeing Comments at 17-21; Spire Global Comments at 13.

requirement would be contrary to the public interest, as it would disallow innovation and forward-thinking to flourish within this constantly changing field.<sup>18</sup>

As academic researchers, our work is geared towards furthering the public interest at large. We agree with AT&T and Spire Global that an indemnity requirement would damage public interest missions at universities across the country. Such a rule would lead to a future of fewer and fewer graduates within these research fields, causing a decline in U.S. preeminence in the industry.

Moreover, even the few commenters not wholly opposed to indemnity requirements generally supported a carve-out for experimental operators and small-scale academic research missions was usually offered.<sup>19</sup> As The Aerospace Corporation (TAC) notes, “[i]t is likely that requiring indemnification will disproportionately affects smaller operators and academic institutions that cannot afford the potential risk or any associated legal costs.”<sup>20</sup> We agree with TAC that the Commission should, at a minimum, “exempt small experimental operators and academic institutions” from any indemnity requirement.<sup>21</sup>

### **III. The record strongly opposes the bond requirement. (¶¶ 137, 193, 195)**

A wide range of commenters also voiced strong opposition for the proposed bond requirement, and for many of the same reasons that they opposed an indemnity requirement. Of the twenty-four commenters remarking on the bond, more than twenty were opposed to a bond requirement. We agree; a bond requirement, if not carefully

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<sup>18</sup> Spire Global Comments at 13-14; AT&T Comments at 9.

<sup>19</sup> Comments of The Aerospace Corporation (TAC) at 3-4 (Oct. 9, 2020), <https://www.fcc.gov/ecfs/filing/100837059769>; Open Research Comments at 3-4. Both Astroscale and CSSMA support a capped indemnification, modeled after the UK indemnification structure. See Comments of Astroscale U.S. at 26-28 (Oct. 9, 2020), <https://www.fcc.gov/ecfs/filing/10093022414224> (“Astroscale Comments”); Comments of Commercial Smallsat Spectrum Management Association (CSSMA) at 18-19 (Oct. 9, 2020), <https://www.fcc.gov/ecfs/filing/1009262429713>.

<sup>20</sup> TAC Comments at 14.

<sup>21</sup> *Id.* at 15.

considered and tailored for those who could do the most harm to the special environment, would risk the same kind of economic harm to academic small satellite research as the indemnity requirement.

The FNPRM queries whether “a performance bond tied to successful post-mission disposal”<sup>22</sup> would be in the public interest. This requirement, if instituted for small satellite researchers, would significantly diminish or completely erase the budgets for their research. Bond carriers expect reimbursement after they pay out a claim. This means that an insured person or group must have the amount of the bond set aside, or readily available for access. University researchers often must operate on small budgets and would be unable to continue necessary work if forced to set aside most or all of the yearly budgets for a bond requirement.

There is no clarity on how the bond requirements would apply to university research missions. Similar to the indemnity requirement, the bond requirement would be difficult to implement and would likely add to the financial stress that our academic research missions already face. As ORI observed, it is inaccurate to say that amateur payloads would “only ever target LEO[,] . . . projects will never attempt . . . constellations[, or] . . . [that] bond costs will be low or zero because amateurs will only ever use single payload LEO missions.”<sup>23</sup> We agree with ORI that there is a real risk of shutting out “ambitious non-commercial work”<sup>24</sup> with these burdensome economic requirements.

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<sup>22</sup> FNPRM, 35 FCC Rcd. at 4245, ¶ 193.

<sup>23</sup> Open Research Comments at 2-3.

<sup>24</sup> *Id.* at 2; *see also* Astranis Comments at 3; Comments of ARRL, the National Association of Amateur Radio at 2-4 (Oct. 9, 2020), <https://www.fcc.gov/ecfs/filing/1010380726514>; Comments of Radio Amateur Satellite Corporation at 5 (Oct. 9, 2020), <https://www.fcc.gov/ecfs/filing/100998217277>.