

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of )
Streamlining Licensing Procedures for Small ) IB Docket No. 18-86
Satellites )

REPORT AND ORDER

Adopted: August 1, 2019

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By the Commission: Chairman Pai and Commissioners O’Rielly, Carr, Rosenworcel, and Starks issuing separate statements.

TABLE OF CONTENTS

Heading Paragraph #
I. INTRODUCTION..... 1
II. BACKGROUND..... 3
III. REPORT AND ORDER ..... 9
A. Adoption of a Streamlined Small Satellite and Small Spacecraft Process..... 9
B. Characteristics of a Satellite or System Qualifying for Streamlined Processing ..... 17
1. Number of Satellites ..... 21
2. Planned In-Orbit Lifetime ..... 31
3. License Term ..... 36
4. Deployment Orbit and Maneuverability..... 42
5. Maximum Spacecraft Size..... 49
6. Trackability ..... 53
7. Casualty Risk..... 59
8. Cessation of Emissions..... 61
9. Streamlined Small Spacecraft Process ..... 65
10. Operational Debris and Collision Risk..... 68
11. Other Characteristics ..... 72
C. Application Requirements ..... 76
D. Application Processing ..... 80
E. Interference Protection Status ..... 90
F. Revised Bond Requirement ..... 93
G. Technical Rules..... 98
H. Fees ..... 99
I. Frequency Considerations for Small Satellites ..... 107
1. Compatibility and Sharing with Federal Users..... 107
2. Spectrum Assignments for Streamlined Small Satellites ..... 111
J. Other Issues..... 117
IV. PROCEDURAL MATTERS..... 119
V. ORDERING CLAUSES..... 124
APPENDIX A – Final Rules
APPENDIX B – Final Regulatory Flexibility Analysis
APPENDIX C – List of Commenters

## I. INTRODUCTION

1. Recent technological innovation has spurred an increasing use of what have been colloquially termed “small satellites” or “small sats” for a wide variety of missions, ranging from short-term experimental missions conducting scientific experiments to longer term commercial communications and remote sensing missions.<sup>1</sup> There are a number of ways of defining small satellites, but they are most often associated with small size (some based on the “CubeSat” standard<sup>2</sup>), short duration missions, and relatively low cost. Many small satellites have been part of government missions, but an ever-increasing number of non-governmental missions by companies, academic institutions, and others have used small satellites. The Communications Act of 1934, as amended, requires the issuance of a license for communications to and from the United States or from any U.S. satellite,<sup>3</sup> and applications requesting a license or authorization to operate with small satellites represent a growing percentage of the number of satellite applications received by the Commission.

2. Today, we take action to make available a new, optional licensing process for these small satellites. This will enable small satellite applicants to choose a streamlined licensing procedure and thereby take advantage of an easier application process, a lower application fee, and a shorter timeline for review than currently exists for applicants. We will refer to this alternative as the “part 25 streamlined small satellite process.” In so doing, we limit the regulatory burdens borne by applicants and offer potential radiofrequency interference protection for critical communication links, while promoting orbital debris mitigation and efficient use of spectrum. This action will support and encourage the increasing innovation in the small satellite sector and will help preserve U.S. leadership in space-based services and operations.

## II. BACKGROUND

3. The Commission’s part 25 satellite licensing rules, primarily used by commercial systems, group satellites into two general categories—geostationary-satellite orbit (GSO) systems and non-geostationary-satellite orbit (NGSO) systems—for purposes of application processing.<sup>4</sup> This categorization is similarly reflected in the Commission’s fee structure.<sup>5</sup> As a result, an application for a

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<sup>1</sup> These changes are largely the result of improvements in miniaturization, but the rise of smaller, nimbler launch providers underscores the importance of reducing wait times for licensing and regulatory approval. It is uneconomical to waste the payload capacity of a medium-to-heavy lift launch vehicle on a single small sat, so these satellites have until now tended to launch to space on “rideshare” missions, with multiple small sats packed into one large rocket fairing. This leads to long wait times between launches. However, new companies are beginning to offer launches for single small sats on demand, using smaller rockets. As a result, the licensing and approval process represents an increasingly significant component of total wait time between satellite construction and start of operations. See, e.g., Loren Gush, *Later this year, a SpaceX Falcon 9 rocket will launch its biggest batch of satellites yet* (Aug. 6, 2018), available at <https://www.theverge.com/2018/8/6/17654372/spacex-falcon-9-spaceflight-industries-small-satellite-rideshare>.

<sup>2</sup> The “CubeSat” design is a standardized interface consisting of approximately 10 cm x 10 cm x 10 cm units. The scalable standard unit specification enables CubeSats to be fully enclosed in specifically developed deployment mechanisms and helps to provide greater access to launch services.

<sup>3</sup> 47 U.S.C. §§ 301(d), (f). See also *FCC Enforcement Advisory: Compliance with Satellite Communications Licensing Requirements is Mandatory and Failure to Comply Can Result in Enforcement Action*, Public Notice, DA 18-368, 33 FCC Rcd 3592 (EB, IB, OET, WTB April 12, 2018) (*FCC Satellite Licensing Enforcement Advisory*).

<sup>4</sup> Under part 25 of the Commission’s rules, applications for satellites and satellite systems are filed either as GSO space station applications or NGSO space station or constellation applications. See, e.g., 47 CFR § 25.114(a).

<sup>5</sup> See, e.g., Federal Communications Commission, *International and Satellite Services Application Fee Filing Guide, Fact Sheet*, at 15-16 (Sept. 4, 2018), available at <https://www.fcc.gov/document/ib-application-fee-filing-guide-0>; *Regulatory Fees Fact Sheet, What You Owe – International and Satellite Services Licensees for FY 2018*, at 5 (Aug. 30, 2018), available at <https://www.fcc.gov/document/fy-2018-international-and-satellite-services-fact-sheet>.

single commercial NGSO small satellite with a planned two-year mission would be subject to the same application process and fee as an application for an NGSO communications system consisting of hundreds or more satellites to be replenished on a regular basis.

4. On April 17, 2018, the Commission released a *Notice of Proposed Rulemaking (NPRM)* proposing to modify the Commission's part 25 satellite licensing rules to create a new category of application specific to small satellites.<sup>6</sup> The Commission sought comment on criteria that would define this new category and proposed that applicants meeting the criteria could take advantage of a simplified application, faster processing, and lower fees, among other things.<sup>7</sup> The proposed streamlined licensing process was developed based on the features and characteristics that typically distinguish small satellite operations from other types of satellite operations, such as shorter orbital lifetime and less intensive frequency use.<sup>8</sup> The *NPRM* detailed this small satellite procedure, which would serve as an optional alternative to existing procedures for authorization of small satellites. The *NPRM* also provided background information on the Commission's other processes for licensing and authorizing small satellites, including under the experimental (part 5)<sup>9</sup> and amateur (part 97)<sup>10</sup> rules, although no changes were proposed to either of those parts.<sup>11</sup>

5. The *NPRM* also sought comment on topics related to spectrum use by small satellites. The Commission asked for comment on typical small satellite frequency use characteristics,<sup>12</sup> how to facilitate compatibility with Federal operations,<sup>13</sup> use of particular spectrum for inter-satellite links by small satellites,<sup>14</sup> and other issues related to operations by small satellites in frequency bands including the 137-138 MHz, 148-150.05 MHz, and 1610.6-1613.8 MHz bands.<sup>15</sup>

6. Finally, the *NPRM* sought comment on the appropriate application fee that would apply to the proposed optional part 25 streamlined process.<sup>16</sup> The Commission proposed a \$30,000 application fee.<sup>17</sup> It noted that any changes to the annual regulatory fees applicable to the small satellites authorized under the streamlined process would be addressed through the separate annual proceeding for review of regulatory fees.<sup>18</sup>

7. On May 21, 2018, the Commission adopted its fiscal year (FY) 2018 *Notice of Proposed Rulemaking* addressing regulatory fees,<sup>19</sup> which sought comment on whether to adopt a new regulatory fee category for small satellites authorized under the proposed streamlined part 25 process, and if a new

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<sup>6</sup> *Streamlining Licensing Procedures for Small Satellites*, IB Docket No. 18-86, Notice of Proposed Rulemaking, 33 FCC Rcd 4152 (2018) (*Small Satellite NPRM* or *NPRM*).

<sup>7</sup> *See id.* at 4163, para. 21.

<sup>8</sup> *See id.* at 4165, para. 26.

<sup>9</sup> *Id.* at 4158-60, paras. 14-15.

<sup>10</sup> *Id.* at 4160-61, para. 16.

<sup>11</sup> *See, e.g., id.* at 4186-4190, Appendix A.

<sup>12</sup> *Id.* at 4175-76, paras. 56-59.

<sup>13</sup> 33 FCC Rcd at 4176-77, paras. 60-61.

<sup>14</sup> *Id.* at 4181-82, paras. 70-73.

<sup>15</sup> *See id.* at 4177-81, paras. 62-73.

<sup>16</sup> *See id.* at 4182-83, paras. 75-76.

<sup>17</sup> *Id.* at 4183, para. 76.

<sup>18</sup> *Id.* at 4183, para. 77.

<sup>19</sup> *Assessment and Collection of Regulatory Fees for Fiscal Year 2018*, MD Docket 18-175, Report and Order and Notice of Proposed Rulemaking, 33 FCC Rcd 5091 (2018) (*2018 Regulatory Fee NPRM*).

fee category were to be adopted, what the regulatory fee should be.<sup>20</sup> The Commission adopted its FY 2018 schedule of regulatory fees in a *Report and Order* on August 28, 2018,<sup>21</sup> in which the Commission noted that it was deferring consideration of a new regulatory fee category and the appropriate regulatory fee for small satellites until the Commission adopted a definition of “small satellites” in the instant proceeding.<sup>22</sup>

8. Comments on the *NPRM* were due July 9, 2018, and reply comments were due August 7, 2018.<sup>23</sup> We received 23 comments and 17 reply comments. A list of commenters, reply commenters, and *ex parte* filings is contained in Appendix C.

### III. REPORT AND ORDER

#### A. Adoption of a Streamlined Small Satellite and Small Spacecraft Process

9. Commenters to the *NPRM* overwhelmingly support the adoption of a new streamlined licensing process for small satellites within part 25 of the Commission’s rules. Commenters agree that the current part 25 process can be overly burdensome for some companies seeking to launch small satellites into space.<sup>24</sup>

10. We adopt here a streamlined version of part 25 for small satellite licensing. Applicants seeking authorization of small satellites can choose to take advantage of this streamlined small satellite process,<sup>25</sup> rather than using the other existing applicable licensing procedures. The goal of this small satellite process is to enable satellites that have shorter missions, less intensive spectrum use, and lower risk of producing orbital debris to be licensed on a streamlined basis.

11. Under the existing regime, some applicants may seek to operate a commercial system under the Commission’s experimental licensing program because of the large cost difference between the experimental application fee and part 25 application fee, notwithstanding the fact that the experimental licensing regime is limited to non-commercial uses.<sup>26</sup> The streamlined process adopted here avoids this issue, and is not limited to commercial or non-commercial applications. At the same time, applicants for experimental satellites whose planned operations fall within the scope of part 5 may continue to apply under the part 5 experimental licensing process.<sup>27</sup>

12. Part 25 licenses and authorizations are typically applied for by commercial systems, and the adoption of this streamlined part 25 process provides increased opportunity for commercial small satellite systems to apply for a part 25 license. In addition, other operators may apply for a streamlined

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<sup>20</sup> *Id.* at 5103, paras. 32-33.

<sup>21</sup> *Assessment and Collection of Regulatory Fees for Fiscal Year 2018*, MD Docket 18-175, Report and Order and Order, 33 FCC Rcd 8497 (2018) (*2018 Regulatory Fee R&O*).

<sup>22</sup> *Id.* at 8499, para. 6, n.21.

<sup>23</sup> *See Streamlining Licensing Procedures for Small Satellites*, Proposed Rules, 83 FR 24064 (May 24, 2018).

<sup>24</sup> *See, e.g.*, Satellite Industry Association Comments at 1-2 (rec. July 9, 2018) (SIA Comments) (stating that the ability to provide services and prove technology viability by “smallsat” companies has been hindered by the time-consuming and financially burdensome licensing processes). *See also NPRM*, 33 FCC Rcd at 4154, para. 3 (noting that, for example, in some instances application and regulatory fees could even exceed the total cost of a small satellite mission).

<sup>25</sup> Wherever the context is clear, we may simply refer to this process as the “small satellite process.”

<sup>26</sup> ORBCOMM Inc. (ORBCOMM) states, for example, its view that “a growing number of applicants are improperly attempting to shoe-horn a commercial satellite system into the Commission’s experimental licensing program.” ORBCOMM Inc. Comments at 3 (rec. July 9, 2018) (ORBCOMM Comments).

<sup>27</sup> *See* 47 CFR § 5.3 (describing the types of permitted operations for stations operating in the experimental radio service under the Commission’s rules).

part 25 small satellite license should they choose to do so.<sup>28</sup> For example, an operator with a planned mission to test new technology would have the choice of applying under either part 5 or part 25. If protection of communications links from harmful interference is important to the mission, that operator may choose to apply under part 25.<sup>29</sup> Part 25 also offers the opportunity to provide commercial operations.<sup>30</sup>

13. Commenters suggest that the Commission clarify how the proposed rules relate to other existing licensing and authorization processes, particularly those under parts 5 and 97 of the rules. For example, several commenters questioned whether satellite applicants would be prevented from applying for an experimental license under part 5 once the new part 25 rules are adopted.<sup>31</sup> We emphasize that all of the existing options for satellite authorization will remain available, including the existing part 25, part 5 experimental, and part 97 amateur processes.<sup>32</sup> No changes to those existing processes were proposed in the *NPRM*, and none are adopted here.<sup>33</sup>

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<sup>28</sup> The Samuel-Glushko Technology Clinic also suggests that the Commission make the new streamlined part 25 small satellite process more usable for university and non-profit missions. Samuelson-Glushko Clinic Sept. 13, 2018 *Ex Parte* Letter at 2-3.

<sup>29</sup> Operations under an experimental license are on a non-interference basis. 47 CFR § 4.83. *See also, e.g.*, University Small-Satellite Researchers Reply at 2 (noting that there are circumstances where the increased protections of part 25, including standing against interference, will be helpful to university researchers).

<sup>30</sup> Part 5 experimental licensees generally cannot market devices or services to customers except under limited circumstances for Commission-approved market trials. *See* 47 CFR part 5, subpart H (setting forth rules for product trials and market trials); 47 CFR § 2.803 (rules related to marketing of radiofrequency devices prior to equipment authorization, cross-referencing part 5, subpart H). Additionally, the standard license term for an experimental license is two years. 47 CFR § 5.71(a). An applicant may request a longer license term, up to 5 years, but must provide justification. *Id.* We do note that the Commission recently adopted a “Spectrum Horizons” experimental radio license, which is issued under part 5 for the purpose of testing and marketing devices on frequencies above 95 GHz, where there are no existing service rules, and which permits licensees to be able to market experimental equipment more widely than currently permitted under the Commission’s experimental market trial rules. *See Spectrum Horizons*, Report and Order, ET Docket No. 18-21, FCC 19-19 at para. 9 (March 21, 2019). The term for these licenses is 10 years. *Id.* at para. 20.

<sup>31</sup> *See* The Commercial Spaceflight Federation Comments at 2 (rec. July 9, 2018) (Commercial Spaceflight Federation Comments); The Commercial Spaceflight Federation Reply Comments at 2 (rec. Aug. 7, 2018) (Commercial Spaceflight Federation Reply); *see also* Dr. Scott Palo, et al. Comments at 4 (rec. June 21, 2018) (filed on behalf of University Small-Satellite Researchers) (University Small-Satellite Researchers Comments) (expressing concern that the proposed part 25 application fee as well as the part 25 regulatory fee would necessarily apply to educational and research small satellites); Open Research Institute, Inc. Comments at 2, 3-4 (rec. July 9, 2018) (Open Research Comments) (arguing that “the proposed licensing costs” will push university researchers to license their experimental satellites in the Amateur Satellite Service); Dr. Scott Palo, et al. Reply Comments at 1, 2 (rec. Aug. 8, 2018) (filed on behalf of University Small-Satellite Researchers) (University Small-Satellite Researchers Reply) (requesting that the Commission ensure the continuing viability of parts 5 and 97); The Boeing Company Comments at i (filed July 9, 2018) (Boeing Comments) (requesting that the Commission preserve the availability of its experimental licensing process for satellites that are not used for commercial purposes, including experimental satellites that are used for the various activities that are specified in section 5.3 of the experimental licensing rules).

<sup>32</sup> *See* Letter from Blake E. Reid, Director, Samuelson-Glushko Technology Law & Policy Clinic at the University of Colorado School of Law, and counsel to Dr. Scott Palo, to Marlene H. Dortch, Secretary, FCC, IB Docket No. 18-86, at 2 (filed Sept. 13, 2018) (Samuelson-Glushko Clinic Sept. 13, 2018 *Ex Parte* Letter) (suggesting that the new streamlined process should be an addition to, rather than a replacement for, the currently existing part 5 and part 97 satellite authorization processes).

<sup>33</sup> *See, e.g.*, 33 FCC Rcd at 4186-4190, Appendix A. The Samuelson-Glushko Clinic suggests that the streamlined process should also provide a workable path for educational and scientific missions. Samuelson-Glushko Clinic Sept. 13, 2018 *Ex Parte* Letter at 1-2.

14. We adopt the *NPRM* proposal to make streamlined processing available to entities seeking access to the United States market using a non-U.S.-licensed space station, through a petition for declaratory ruling.<sup>34</sup> SIA and CSSMA express support for this proposal, provided that the foreign-licensed satellite or system is subject to the same requirements as U.S. applicants under the streamlined process and applicable reciprocity market-access requirements under the part 25 process.<sup>35</sup> No commenters disagreed with the proposal. Although we use the term “license” at various points in this *Order*, the streamlined part 25 process will also be made available to applicants seeking U.S. market access, and conclude that such applicants will be subject to the small satellite streamlined process rules, application and regulatory fees under the new fee categories adopted for small satellites,<sup>36</sup> and the part 25 rules currently applicable to entities requesting to access the United States market using a non-U.S.-licensed space station.<sup>37</sup> We adopt minor revisions to section 25.137 of our rules, addressing non-U.S.-licensed space station application procedures, to add references to the streamlined small satellite process.<sup>38</sup>

15. Some commenters requested that the Commission use terminology other than “small satellite” if the streamlined process includes criteria other than just satellite size.<sup>39</sup> Given the number of criteria described below, it is unclear how all of these criteria could be reflected in a single title for the new streamlined process. As proposed, the rule section specifying the application procedures for the streamlined process, section 25.122, is titled “Applications for streamlined small satellite authorization.”<sup>40</sup> We also adopt a definition of “small satellite” referencing the application rule section.<sup>41</sup> Since all satellites authorized under this process will be small compared to the satellites historically licensed under part 25, we see no need to alter this title. To help avoid any confusion, however, we have referred to this process as the part 25 streamlined small satellite process, to make it clear that this new process is within part 25 of the Commission’s rules.

16. As discussed below, we also make streamlined processing available to spacecraft with non-Earth orbit missions. Moon Express, Inc., the Commercial Spaceflight Federation, and the Commercial Smallsat Spectrum Management Association (CSSMA) suggest that if the streamlined process is made available to missions beyond Earth orbit, the Commission consider using the term “spacecraft” or “small spacecraft,”<sup>42</sup> instead of or in addition to the term small satellite.<sup>43</sup> We agree with

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<sup>34</sup> See *NPRM*, 33 FCC Rcd at 4164, para. 23. Entities seeking streamlined treatment would file a petition for declaratory ruling, rather than seeking to communicate with a non-U.S.-licensed space station through an earth station application.

<sup>35</sup> SIA Comments at 6; Commercial Smallsat Spectrum Management Association Reply Comments at 23-24 (rec. August 7, 2018) (CSSMA Reply).

<sup>36</sup> As discussed in further detail *infra*, we are adopting here a new application fee category for small satellites as part of the Commission’s schedule of application fees, and this fee will be applicable to streamlined applicants petitioning for U.S. market access, in order to recover the costs of Commission processing of such applications. Similarly, we are adopting a new regulatory fee category for small satellites, which will include market access grantees.

<sup>37</sup> See, e.g., 47 CFR § 25.137.

<sup>38</sup> See Appendix A, Final Rules.

<sup>39</sup> Analytical Space, Inc. Comments at 5 (rec. July 9, 2018) (Analytical Space Comments); Commercial Spaceflight Federation Comments at 2.

<sup>40</sup> See Appendix A, Final Rules.

<sup>41</sup> See Appendix A, Final Rules, § 25.103.

<sup>42</sup> Section 25.103 of the Commission’s rules defines “spacecraft” as “[a] man-made vehicle which is intended to go beyond the major portion of the Earth’s atmosphere.” 47 CFR § 25.103.

using the term “small spacecraft” to refer to the space stations that will operate beyond Earth’s orbit, and adopt a corresponding definition.<sup>44</sup>

**B. Characteristics of a Satellite or System Qualifying for Streamlined Processing**

17. In the *NPRM*, the Commission proposed a series of criteria that would define the types of operations that qualify for the small satellite process.<sup>45</sup> The *NPRM* sought comment on these proposed eligibility criteria as well as any additional criteria that should be considered.<sup>46</sup>

18. We received numerous comments on specific eligibility criteria, but almost all commenters agreed with the general proposal to establish a set of criteria to categorize part 25 small satellites for processing. The Boeing Company (Boeing), however, recommends that small commercial satellites, for purposes of the streamlined licensing process, be defined by a “single, controlling characteristic, the nature of their orbital and spectrum sharing rights and obligations.”<sup>47</sup> Boeing believes that so long as the underlying principle that small commercial satellite licensees must, to the extent technically feasible, share orbital and spectrum resources with all other small commercial satellites, the Commission is unlikely to need to adopt many additional regulations governing the characteristics of such satellites.<sup>48</sup> In a later section, we discuss Boeing’s specific comments on the rights and sharing obligations of small satellites licensed under the streamlined process. We do not believe, however, that having a single characteristic regarding orbital and spectrum sharing rights is sufficient to establish the category of systems that may apply under the streamlined process. While the ability to share with other operations is a characteristic that the Commission will review, and an important one from an application processing perspective, the other characteristics proposed in the *NPRM* and discussed below are also important to ensure that the applications can be reviewed in a timely manner and support some of the benefits of the streamlined process to operators.<sup>49</sup>

19. We summarize below the characteristics of satellites/systems that we have concluded may be eligible for streamlined processing.<sup>50</sup> These characteristics support processing on a streamlined basis. For example, the demonstration that the requested small satellite operations are compatible with existing operations and do not materially constrain future satellite operations supports exempting these satellites from the Commission’s processing round procedures. In the text that follows, we address each of these characteristics/criteria in turn, including the specific rationale for each.

- Ten or fewer satellites under a single license. No limitation on the number of

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<sup>43</sup> Commercial Spaceflight Federation Comments at 9; Moon Express, Inc. Comments at 2 (rec. July 9, 2018) (Moon Express Comments); Commercial Smallsat Spectrum Management Association Comments at 15 (rec. July 9, 2018) (CSSMA Comments).

<sup>44</sup> See Appendix A, Final Rules, § 25.103; see also Appendix A, Final Rules § 25.123 (rules applicable to applicants for streamlined small spacecraft authorization). We therefore will refer to the process as the “streamlined small spacecraft process” when discussing an aspect of the streamlined process that would apply uniquely to these missions. Except as specified, see, e.g., section III.B.10, the rules adopted will apply to both streamlined small satellites and streamlined small spacecraft.

<sup>45</sup> *NPRM*, 33 FCC Rcd at 4165, para. 25.

<sup>46</sup> *Id.* at 4165, para. 26.

<sup>47</sup> Boeing Comments at 3.

<sup>48</sup> *Id.* at 9.

<sup>49</sup> Accordingly, in some instances we anticipate that granting individualized waiver requests of the qualifying criteria would require too much individualized analysis and slow the regulatory process, thereby undermining the purpose of the rule(s).

<sup>50</sup> As described *infra* in section III.B.10, for streamlined small spacecraft, i.e., non-Earth-orbiting missions, we provide several modifications to these criteria; see also Appendix A, Final Rules, § 25.123.

applications that may be filed.

- Maximum in-orbit lifetime of any individual satellite is six years, including time to de-orbit the satellite.
- All operations under a license will be completed within six years.
- Maximum mass of any individual satellite will be 180 kg, including propellant (“wet mass”).
- Satellite(s) will be deployed below 600 km altitude or have the capability to perform collision avoidance and de-orbit maneuvers using propulsion.
- Satellite(s) will release no planned debris.
- Satellite operator has assessed and limited the probability of debris being generated due to an accidental explosion resulting from the conversion of energy sources on board the satellite into energy that fragments the spacecraft.
- Probability of in-orbit collision between any satellite and large objects is 0.001 or less as calculated using current NASA software or other higher fidelity model.
- Any individual satellite is 10 cm or larger in its smallest dimension.
- Satellite(s) will have a unique telemetry marker.
- Probability of casualty resulting from uncontrolled atmospheric re-entry of any satellite is zero, as calculated using current NASA software or other higher fidelity model.
- Licensees must have the capability to eliminate harmful interference when necessary under the terms of the license or other applicable regulations. In particular, satellites must have the capability for immediate cessation of emissions on telecommand.
- Radiofrequency operations will be compatible with existing operations in the requested frequency bands and not materially constrain future operations of other satellites in those frequency bands.

20. We note that several of these qualifying characteristics overlap with issues discussed in a separate proceeding addressing the Commission’s rules on orbital debris mitigation generally—*Mitigation of Orbital Debris in the New Space Age*.<sup>51</sup> The Commission adopted a *Notice of Proposed Rulemaking* in that proceeding in November 2018 and comments and reply comments were recently filed.<sup>52</sup> The criteria we adopt here are based upon the record developed specifically in the docket for this proceeding.<sup>53</sup> In the event that we reassess certain orbital debris risks as part of the separate, dedicated orbital debris proceeding, these criteria will be modified as necessary or appropriate to conform to rules that would be generally applicable to Commission-authorized space stations, to ensure regulatory congruity.<sup>54</sup>

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<sup>51</sup> *Mitigation of Orbital Debris in the New Space Age*, Notice of Proposed Rulemaking, IB Docket 18-313, 33 FCC Rcd 11352 (2018) (*Orbital Debris Mitigation NPRM*).

<sup>52</sup> See Federal Communications Commission, Electronic Comment Filing System (ECFS), IB Docket No. 18-313.

<sup>53</sup> See ECFS, IB Docket No. 18-86.

<sup>54</sup> See, e.g., Iridium Communications Inc. Comments at 7 (rec. July 9, 2018) (Iridium Comments) (asking us to clarify that the criteria used to determine eligibility for the streamlined procedure could change in the future depending on the outcome of a proceeding focused more comprehensively on orbital debris). Since the streamlined process is intended for those operations generally associated with relatively low orbital debris risk, it would not make sense for us to maintain lower orbital debris mitigation standards for small satellites than for other types of satellites authorized under part 25.



### 1. Number of Satellites

21. We adopt the proposal in the *NPRM* to limit the number of satellites that can be authorized under an individual streamlined part 25 license to 10.<sup>55</sup> This number has broad support among commenters as a limit on the number of small satellites under a single license.<sup>56</sup> And though Boeing argues we should allow up to 30 satellites in a single application,<sup>57</sup> that would allow a substantially larger constellation (and require a more intensive review) than what most small satellite applicants appear to desire—and in any event could be functionally achieved by applicants by applying for multiple licenses at the same time.

22. We also conclude that it is not necessary to place a limitation on the number of streamlined licenses that may be obtained by a single entity because of the other criteria that must be met for an applicant to qualify for streamlined processing.<sup>58</sup> If multiple licenses are sought by the same entity, or an entity and affiliated entities, the Commission will have the opportunity to review each application to see if the proposed operations continue to meet the qualifications for streamlined processing, including, as described below, not materially constraining other operations in the requested frequency band. The grant of one application does not guarantee that subsequent applications will also be granted. We adopt here a requirement that applicants for the streamlined process identify related applications or grants, to help assist the Commission's understanding of a particular system or series of satellites or systems.<sup>59</sup>

23. CSSMA, Audacy Corporation (Audacy), Analytical Space, the Commercial Spaceflight Federation, and other commenters argue that a limit on the number of streamlined process applications is unnecessary and may stifle innovation.<sup>60</sup> CSSMA, for example, states that ten satellites may not be sufficient for all operators that are developing their technology while engaging commercially with customers, and notes that CSSMA has members that build and/or operate satellites for others and might seek several licenses, one for each system, under the streamlined process.<sup>61</sup> We agree and believe the approach we adopt here—which does not place a limitation on the number of licenses that can be granted to a single entity—will accommodate innovative small satellite system concepts and business models.

24. Some commenters such as ORBCOMM and SpaceX express concern that applicants

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<sup>55</sup> *NPRM*, 33 FCC Rcd at 4165, para. 27.

<sup>56</sup> See, e.g., Iridium Comments at 2, 4; Space Exploration Technologies Corp. Comments at 7-8 (rec. July 9, 2018) (SpaceX Comments); University Small-Satellite Researchers Comments at 8-9; CSSMA Comments at 6-7; ORBCOMM Comments at 6-7; EchoStar Satellite Operating Corporation and Hughes Network Systems, LLC Comments at 3 (filed July 9, 2018) (EchoStar/Hughes Comments); Open Research Institute, Inc. Comments at 6 (rec. July 9, 2018) (Open Research Institute Comments); Iridium Communications, Inc. Reply Comments at (rec. Aug. 7, 2018) (Iridium Reply); Audacy Corporation Reply Comments at 3-4 (rec. Aug. 7, 2018) (Audacy Reply); SES Americom, Inc. and O3b Limited Reply Comments at 3 (rec. Aug. 7, 2018) (SES/O3b Reply); ORBCOMM Inc. Reply Comments at 1 (rec. Aug. 7, 2018) (ORBCOMM Reply).

<sup>57</sup> Boeing Comments at 9.

<sup>58</sup> This statement also addresses a clarification sought by UbiquitiLink, Inc. on whether small satellite companies could file more than one application. Letter from Tony DeTory, VP of Government Affairs, UbiquitiLink, Inc. to Marlene Dortch, Secretary, FCC, IB Docket No. 18-86 at 2 (filed July 22, 2019) (UbiquitiLink *Ex Parte*). We do not place a limit on the number of applications that may be filed by a single entity under the new process.

<sup>59</sup> See Appendix A, Final Rules, Section 25.122(d)(6). Because this is a procedural rule, notice and comment is not required in advance of its adoption. See 5 U.S.C. § 553(b). This rule does not alter the substantive rights of the parties, even though it does alter the manner in which they present themselves to the Commission. See *Mendoza v. Perez*, 754 F.3d 1002, 1023 (D.C. Cir. 2014).

<sup>60</sup> CSSMA Comments at 7; Rob Boesel, Ted Myers Comments at 2 (rec. July 2, 2018) (filed on behalf of HybridX LLC) (HybridX Comments); Analytical Space Comments at 7; Commercial Spaceflight Federation Comments at 3.

<sup>61</sup> CSSMA Comments at 7.

could unfairly manipulate the process and create larger satellite constellations that would otherwise not warrant streamlined treatment.<sup>62</sup> ORBCOMM argues that the Commission should clarify that an applicant cannot file for multiple small satellite system licensees, thereby evading the “more rigorous review of a conventional application.”<sup>63</sup> ORBCOMM, SpaceX, and others further argue that failure to limit a single company from obtaining licenses for multiple systems runs the risk of greater collision and interference issues, thereby rendering streamlined treatment inappropriate.<sup>64</sup> While a theoretical possibility, when viewed in the context of the criteria established for the small satellite licensing process, these concerns are unlikely to be realized in practice. In particular, the six-year orbital lifetime and 600-kilometer maximum altitude (absent propulsion) criteria both correlate with lower collision risk, and the small size of these satellites also correlates with lower risk.<sup>65</sup> Each application will be considered individually and placed on public notice.

25. What is more, we will require each streamlined process applicant to demonstrate in its application that its proposed operations can co-exist with other operations in the requested frequency band and will not materially constrain future entrants seeking to use the band.<sup>66</sup> If a satellite system begins to amass significant and ongoing operations through a series of streamlined applications, there may come a point at which the scope of those operations will start to materially constrain future entrants seeking to use the same frequency bands, or cause issues in sharing with existing operators, and at that time the Commission would not approve the next additional application for satellites that are conducting those types of operations.

26. Moreover, there will be an application fee associated with each license application, which after a certain number of licenses will equal the cost of applying for a regular part 25 license. CSSMA argues, for example, that with a \$30,000 application fee, without ability to replenish those satellites, the fees are still substantial, and after a certain number of satellites, become cost prohibitive as compared to a full part 25 license application, which has a 15-year term.<sup>67</sup> While we recognize there are other benefits

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<sup>62</sup> ORBCOMM Comments at 4-5; SpaceX Comments at 7-8. SpaceX argues that we should maintain the limitations currently contained in section 25.159(b) of the Commission’s rules on the number of applications that may be filed, 47 CFR § 25.159(b). SpaceX Comments at 7-8. Since we disagree with SpaceX’s premise that we need to limit the number of streamlined applications that may be filed, or the number of licensed-but-unbuilt systems, we do not address whether section 25.159(b) would be an effective way to do so.

<sup>63</sup> ORBCOMM Comments at 4-5.

<sup>64</sup> SpaceX argues that the proposal to exempt small satellites from the Commission’s rule placing limits on an entity’s number of applications or licensed-but-unbuilt systems, 47 CFR § 25.159(b), does not consider the orbital debris implications of a large NGSO system cobbled together from a string of small satellite authorizations. SpaceX Comments at 7 (citing *NPRM*, 33 FCC Rcd at 4172, para. 46). See also SES/O3b Reply Comments at 3-4 (agreeing with SpaceX on applying 25.159(b) to small satellites).

<sup>65</sup> As discussed *infra*, section III.B.6, the issue of aggregate collision risk for constellations is the subject of a separate proceeding that may result in specification of additional criteria for evaluating all satellite systems, including those qualifying for the small satellite licensing process.

<sup>66</sup> See *infra* section III.D.

<sup>67</sup> CSSMA Comments at 8. CSSMA suggests that if each satellite has a lifetime of three years and there is no replenishment under the streamlined process, each satellite would have to be replaced five times to match a part 25 (15 year) license term, thereby costing \$150,000 per license (assuming a \$30,000 streamlined license application fee), and with a limit of ten satellites per license, there becomes a strong economic incentive to switch to a regular part 25 license at a constellation sized at roughly thirty satellites. *Id.* at 8, n.10. ORBCOMM, on the other hand, suggests that 15 planes of ten satellites could obtain streamlined treatment without financial penalty vis-à-vis a non-streamlined part 25 application. ORBCOMM Comments at 4-5, n.6. CSSMA states in response that ORBCOMM ignores the fact that each license application has appreciable preparation and coordination costs and multiple applications would not afford the applicant the same level of certainty as a part 25 license covering fifty satellites. CSSMA Reply Comments at 3.

to the streamlined process, such as a grace period for the bond, we believe these benefits are unlikely to motivate an applicant to file numerous applications under the streamlined process in a situation where the cumulative filing fees are higher than the application fee for a regular part 25 NGSO system application. So long as the applicant meets the criteria of the small satellite streamlined process, however, we will leave it up to the applicant to decide what approach best fits its business model or desired operational parameters.

27. To the extent that some commenters raise concerns regarding the number of small satellites in orbit as a general matter,<sup>68</sup> we believe this issue, along with the related issue of the mitigation of orbital debris are better addressed through the Commission's separate proceeding on orbital debris.<sup>69</sup>

28. By declining to cap the number of satellites that may be applied for by a single entity under the streamlined process, the Commission will also limit the potential for requests to waive any cap on the number of satellites, which would be inconsistent with streamlined processing. Boeing, for example, suggested a limit of 30 satellites per license, but proposed that the Commission consider streamlined applications for modestly more numbers of small satellites if good cause is shown to support a particular business case.<sup>70</sup> It is worth noting that the approach adopted here will avoid this type of particularized analysis or request to waive limits on the number of satellites in a single license, since applicants will be able to apply for another license for additional satellites.<sup>71</sup>

29. Aside from the comments on limiting the number of licenses than can be obtained under the streamlined process addressed above,<sup>72</sup> we did not receive any additional comments specific to our proposal that there would be no limit on the number of pending applications or licensed-but-unbuilt systems for streamlined applicants.<sup>73</sup> We adopt the *NPRM* proposal that no such limits apply.<sup>74</sup>

30. *Transition to Standard Part 25.* Several commenters suggest that the Commission establish a transition mechanism for an operator who may wish to build on a larger constellation over time and switch from operating under the streamlined authorization process to the standard part 25 authorization process.<sup>75</sup> We decline to specify a detailed mechanism for transitioning a small satellite license or licenses to a standard part 25 license. However, this would not preclude an operator from, for example, obtaining a license under the small satellite licensing process, and subsequently, during the term of that license, applying for and obtaining a standard part 25 license under which the small satellite would complete the period of operations specified in its original license. The Commission has followed a similar approach involving satellites first licensed for experimental operations, but which later are incorporated into commercial operations under a standard part 25 license. The experimental license is terminated once commercial operations begin. An operator may use information and operational characteristics from its streamlined small satellite operations to inform and support a regular part 25 application, but that application will be analyzed on its own merits, and as part of a processing round where appropriate. We emphasize that operators may apply for a standard license at any time they believe it would be better suited to their operational or business needs.

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<sup>68</sup> See, e.g., Open Research Institute Comments at 9; ORBCOMM Comments at 8.

<sup>69</sup> See generally *Orbital Debris Mitigation NPRM*.

<sup>70</sup> Boeing Comments at 9.

<sup>71</sup> This satellite or satellites will not be considered a "replacement" satellite for purposes of section 25.113 of the Commission's rules, 47 CFR 25.113. See Appendix A, Final Rules, § 25.113(i).

<sup>72</sup> See, e.g., SpaceX Comments at 7; SES/O3b Comments at 3-4.

<sup>73</sup> *NPRM*, 33 FCC Rcd at 4172, para. 46.

<sup>74</sup> See Appendix A, Final Rules, sections 25.137(d)(5) and 25.159(b).

<sup>75</sup> See, e.g., CSSMA Comments at 8-11; Commercial Spaceflight Federation Comments at 3.

## 2. Planned In-Orbit Lifetime

31. We adopt a slightly modified version of the *NPRM* proposal, which was that applicants for the part 25 streamlined small satellite process certify that the total in-orbit lifetime is planned to be five years or less, including the time it takes for the satellites to deorbit.<sup>76</sup> We will require that applicants seeking to use the streamlined process certify that the maximum in-orbit lifetime of any individual satellite in the system will be six years or less, including time to deorbit. While the *NPRM* proposed a five-year planned orbital lifetime, we find that adding an additional year to the satellite lifetime will provide some additional flexibility, requested by some commenters, while remaining consistent with the short duration nature of a streamlined authorization. As the Commission observed in the *NPRM*, applicants seeking to operate a small satellite for longer can seek a license or market access grant under our existing part 25 NGSO procedures, which provide for longer license terms.<sup>77</sup>

32. A number of commenters argue that the five-year limit proposed in-orbit lifetime is too short, particularly where the five years includes the time for the satellite(s) to deorbit.<sup>78</sup> CSSMA, for example, argues that orbital lifetime limits restrict launch opportunities and that an overly conservative limit may make the streamlined process commercially impracticable.<sup>79</sup> CSSMA proposes a limit that leaves sufficient commercially practicable launches available to applicants,<sup>80</sup> and that the in-orbit lifetime should apply on a satellite-by-satellite basis and not to all satellites under a given license, to allow for launch delays, launch spacing, and technology iteration all on one license.<sup>81</sup> Additionally, several commenters urge us to consider the five-year in-orbit lifetime proposal as only including the period of the satellites' active transmission and not the non-transmitting orbital decay period.<sup>82</sup> Other commenters supported the five-year orbital lifetime certification as proposed.<sup>83</sup> These commenters state that the requirement will help minimize the risk of orbital collisions.

33. While this orbital lifetime certification may narrow the scope of orbital placement options for certain small satellites or shorten a satellite's lifetime more than what the satellite is technologically capable of achieving,<sup>84</sup> the goal of this rulemaking has been to tailor a streamlined licensing process to a subset of satellite operations—those that are of short duration and present a relatively low risk of creating orbital debris.<sup>85</sup> As noted in the *NPRM*, the ITU has recently identified one to three years to be the typical operational timeline for a CubeSat-type mission of short duration.<sup>86</sup> The planned in-orbit lifetime certification we adopt of six years is twice what the ITU identified and should provide sufficient

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<sup>76</sup> 33 FCC Rcd at 4165, para. 28.

<sup>77</sup> *Id.*

<sup>78</sup> *See, e.g.*, CSSMA Comments at 8-11; Commercial Spaceflight Federation Comments at 4; HybridX Comments at 2; CSSMA Reply at 4-5; Analytical Space Comments at 8 (proposing a lifetime of up to 10 years, starting from the launch of the first satellite).

<sup>79</sup> CSSMA Reply at 4.

<sup>80</sup> *See also* Analytical Space Comments at 8 (arguing that a lifetime of up to 10 years would be more appropriate as it “encapsulates the expected lifetime of satellites, plus a margin, for up to standard sun synchronous orbits that many small satellite operators utilize”).

<sup>81</sup> CSSMA Reply at 4.

<sup>82</sup> *See, e.g.*, Small-Satellite Researchers Comments at 8; Commercial Spaceflight Federation Comments at 4.

<sup>83</sup> *See, e.g.*, ORBCOMM Comments at 5; Iridium Comments at 6; Boeing Comments at 10.

<sup>84</sup> CSSMA Comments at 8-9; Open Research Institute Comments at 6; Analytical Space Comments at 7-8; CSSMA Reply at 2-4; Audacy Reply at 4; Xplore, Inc. Reply Comments (rec. Aug. 7, 2018) (Xplore Reply).

<sup>85</sup> *NPRM*, 33 FCC Rcd at 4158, para. 13.

<sup>86</sup> *Id.* at 4161, para. 28.

flexibility for a wide variety of small satellite operations. Adding an additional year to the proposed in-orbit lifetime strikes a balance between providing additional flexibility and helping to ensure that these satellites are out-of-orbit well within accepted international guidelines<sup>87</sup> and that the operational timeline for these satellites is consistent with the relatively short-term spectrum use we intend to facilitate under this process. We disagree with the CSSMA's argument that this lifetime certification would not enable commercial viability for small satellite missions.<sup>88</sup> Although a six-year lifetime limit may rule out a few launch opportunities to higher altitudes that would not correspond to the satellites passively deorbiting within six years, many small satellites currently take advantage of launch opportunities to altitudes from which they do deorbit within six years. Moreover, removal of spacecraft from the environment in a timely manner is an effective means for preventing in-orbit collisions.<sup>89</sup> We find that the benefits of having these streamlined-licensed satellites removed from low-Earth orbit in a timely fashion outweigh any potential costs to operators, particularly where those operators are benefitting from the lower fee and faster processing associated with the streamlined part 25 procedures.

34. Commercial Spaceflight Federation suggests that where an applicant chooses a satellite design that will have a lifetime beyond five years, the streamlined process allow for a transition to a regular part 25 license for a long-term authorization.<sup>90</sup> We decline to adopt a new transition process specifically to address these circumstances. While we understand the desire among prospective applicants for maximum operational and launch flexibility, the procedure is designed to cover applications for missions of shorter duration, less intense frequency use and lower risk from an orbital debris perspective, which can be processed in a streamlined fashion under part 25. Operations presenting other characteristics, such as longer duration, are more appropriately processed under a regular part 25 authorization.

35. The *NPRM* sought comment on whether a satellite that would not passively deorbit within the proposed in-orbit lifetime could still satisfy the qualifying criteria if it had the capability to maneuver itself to a lower orbit that would ensure re-entry within the proposed lifetime.<sup>91</sup> The certification we adopt is based upon the satellite having a planned in-orbit lifetime of six years, and we conclude this may be achieved by either placing the satellite into an orbit from which it will passively deorbit within six years, or through a satellite design that ensures deorbiting within six years by active means, such as propulsion.<sup>92</sup> In support of the certification, we will require applicants to provide a

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<sup>87</sup> Existing guidance on spacecraft disposal suggests that spacecraft at altitudes roughly below 2,000 km should be designed to reenter the atmosphere no more than 25 years following completion of the spacecraft's mission. *See, e.g.*, NASA Technical Standard, Process for Limiting Orbital Debris, NASA-STD-8719.14B at 4.6.2 (April 25, 2019), <https://standards.nasa.gov/standard/nasa/nasa-std-871914> (NASA Standard); *see also, e.g.*, Inter-Agency Space Debris Coordination Committee (IADC), IADC Space Debris Mitigation Guidelines at 9 (Sept. 2007). This 25-year guidance is discussed in more detail in the Commission's orbital debris proceeding. *See Orbital Debris NPRM*, 33 FCC Red at 11372-73, paras. 58-59.

<sup>88</sup> CSSMA Comments at 8-11; CSSMA Reply at 2-4.

<sup>89</sup> *See, e.g.*, NASA Technical Standard, Process for Limiting Orbital Debris, NASA-STD-8719.14B at 4.6.1 (April 25, 2019), <https://standards.nasa.gov/standard/nasa/nasa-std-871914> (NASA Standard). Although a number of variables must be taken into account in assessing collision risk, a shorter time in orbit often correlates with a lower collision risk.

<sup>90</sup> Commercial Spaceflight Federation Comments at 4.

<sup>91</sup> 33 FCC Red at 4166, para. 28.

<sup>92</sup> *See* CSSMA Comments at 10 (agreeing that a small satellite that can maneuver to a lower orbit should be eligible as long as it meets the overall requirement that the Commission adopts as to orbital lifetime). As discussed below, the additional deployment criteria of the small satellite streamlined process, specifically that streamlined-licensed satellites be deployed to altitudes 600 km or lower if they lack propulsion, will help to ensure that all satellites authorized under the streamlined process will be disposed of by atmospheric re-entry within a relatively short time

(continued....)

description of the planned deorbit methodology in the application. This description will support the applicant's certification.

### 3. License Term

36. We modify the *NPRM* proposal slightly to adopt a six-year, rather than five-year license term for satellites authorized through the part 25 streamlined process. This is consistent with the six-year planned satellite lifetime, described above.<sup>93</sup>

37. As proposed, additional satellites covered by the same license, but launched at a later date, will also fall into the license timeline of the first satellite's placement into orbit.<sup>94</sup> This is consistent with the goal of this proceeding to create a streamlined process for short duration operations. Under the rules adopted, operations under any individual license will be limited to six years. We conclude that this shorter license term is commensurate with the shorter, less intensive frequency use that will be licensed in a streamlined fashion. Applicants seeking ongoing operations of a longer duration may consider the standard part 25 license process.

38. CSSMA proposes that the license term for a streamlined small satellites commence upon "bringing into use the authorized frequencies," consistent with ITU Radio Regulations Article 11,<sup>95</sup> and not when a "satellite is placed into its authorized orbit," as proposed in the *NPRM*.<sup>96</sup> CSSMA is concerned that as proposed, the term of the license would begin to be calculated even where a satellite was rendered non-functional due to launch anomalies.<sup>97</sup> We adopt our proposal in the *NPRM* with a slight modification so that the license term will be calculated from the time when the first satellite is placed into its authorized orbit and begins operating.<sup>98</sup>

39. A number of commenters also express concern that launch delays could end up shortening the license term for subsequent satellites in a constellation.<sup>99</sup> We have not adopted a limit on the number of licenses that can be applied for, however. Thus, in instances where there is an unforeseen launch delay that would shorten the operations of subsequent satellites within the original license, an

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period. See *infra* section III.B.4. CSSMA's comments regarding "capability to de-orbit" are further addressed in connection with this section below. See CSSMA Comments at 10-11.

<sup>93</sup> We clarify that the satellite in-orbit lifetime discussed in the last section applies to each individual satellite, whereas the license term applies to operations under the license. See, e.g., CSSMA Comments at 9. For example, for a constellation of two satellites, if there were only three years left in the license term when the second satellite begins operations, that satellite could be in-orbit for up to six years, including time to deorbit, but would need to cease its operations within three years, consistent with the remaining term of the license.

<sup>94</sup> Some commenters argue that subsequent launch delays would unnecessarily shorten the license term for the full constellation of satellites and therefore license extensions should be considered in such cases. See CSSMA Comments at 11-15; Analytical Space Comments at 8-9; Audacy Reply at 4; SES/O3b Reply at 4. See *infra* at para. 41 for discussion of license extensions.

<sup>95</sup> "Bringing into use" is a term of art used in the ITU Radio Regulations. See, e.g., ITU R.R. No. 11.44B.

<sup>96</sup> CSSMA Comments at 12 (citing *NPRM*, 33 FCC Rcd at 4166, para. 29).

<sup>97</sup> CSSMA Comments at 12.

<sup>98</sup> See Appendix A, Final Rules. This is slightly different from CSSMA's proposal, as it includes operations of the spacecraft using any frequencies, not just particular Commission-authorized frequencies. There may be instances, for example, where a non-U.S.-licensed satellite is operational but has not yet used specific frequencies authorized by the Commission. This satellite would be considered operational for purposes of calculating the license term. A satellite that is non-functional on arrival in orbit will not count toward satisfying the Commission's milestone requirements, as we describe below. See *infra* section III.F. The one-year grace period for posting of the bond begins thirty days after the license grant is issued.

<sup>99</sup> See, e.g., CSSMA Comments at 11-12.

operator can decide whether it makes sense to apply for a new license for those additional satellites or operate them within the remaining term of the initial license.<sup>100</sup> Some operators may choose at the outset to seek multiple licenses, each for one satellite operating with a six-year license term. This type of arrangement will give operators more flexibility, while allowing the Commission to assess the proposed operations under each license application in case operations under cumulative licenses begin to fall outside the scope of what was envisioned as part 25 streamlined small satellite operations. Moreover, for coordination and planning purposes, other operators will know that all operations under a particular license will conclude within six years, regardless of whether the applicant has launched additional satellites under the license. We find that this approach is in the public interest, as it combines flexibility for operators with Commission oversight ensuring that all operations authorized in this manner are consistent with criteria of the streamlined process, which is designed for operations of short duration.

40. SpaceX and Iridium propose proportionally shorter license terms for licensees whose satellites' operational lifetime is of a significantly shorter duration and, in addition to ORBCOMM, raise concerns of increased risk of collision and orbital debris with increased numbers of satellites.<sup>101</sup> In response to these concerns, we first note that the Commission will retain the discretion to specify a shorter license term, pursuant to section 25.121(b) of the Commission's rules, which remains unchanged.<sup>102</sup> Second, in the *Orbital Debris NPRM*, the Commission sought comment on issues related to orbit selection, including satellites that may remain in orbit for a long period of time relative to the time needed to perform its mission.<sup>103</sup> This issue is not unique to small satellites and will be addressed more fully in the Commission's ongoing orbital debris proceeding. Any requirements adopted there may be made applicable to all applicants, including applicants under parts 5, 25, and 97.<sup>104</sup>

41. *License Extensions and Replacement Satellites.* We adopt the proposal in the *NPRM* that licenses granted under these new rules will be valid only for the original satellite(s) launched and operated by the licensee without the possibility for replacement, e.g., replenishment of a constellation.<sup>105</sup> Several commenters support the *NPRM* proposal not to permit replacement satellites.<sup>106</sup> CSSMA and other commenters request, however, that the Commission allow an extension process and replacements for the original licensed satellites to account for launch delays or other events outside of the applicant's control.<sup>107</sup> We decline to adopt a process for license extensions on a routine basis for launch delays, for the reasons described above, but we do not rule out the possibility of license extensions in other limited circumstances outside of the control of the applicant, such as a loss of a satellite due to a launch failure. Additionally, we envision that if a satellite is lost due to a documented launch failure, that satellite could

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<sup>100</sup> As with other part 25 licensees, operators of small satellites licensed under the streamlined process must comply with section 25.173 of the Commission's rules, which includes a requirement to notify the Commission within 15 days after completing in-orbit testing whether a space station's measured performance is within authorized limits, whether the space station has been placed in its authorized orbit or orbital location, and whether it is capable of using its assigned frequencies. See 47 CFR § 25.173. This reporting requirement applies to each licensed satellite.

<sup>101</sup> SpaceX Comments at 4-5; Iridium Comments at 6-7; Iridium Reply at 7; ORBCOMM Reply at 3.

<sup>102</sup> 47 CFR § 25.121(b).

<sup>103</sup> See, e.g., *Orbital Debris NPRM*, 33 FCC Rcd at 11365, para. 32.

<sup>104</sup> See *id.* at 11380, para. 82.

<sup>105</sup> *NPRM*, 33 FCC Rcd at 4166-67, para. 30. In a footnote, the *NPRM* inadvertently cited to a non-existent section 25.128(e), rather than section 25.121(e) of the Commission's rules, which addresses replacement authorization for NGSO satellites. See *id.* at 4166, n. 103; 47 CFR § 25.121(e).

<sup>106</sup> CSSMA Comments at 13; Boeing Comments at 10-11; SES/O3b Reply at 4; CSSMA Reply at 5.

<sup>107</sup> See CSSMA Comments at 13-15; Commercial Spaceflight Federation Comments at 4; Analytical Space Comments at 8-9; CSSMA Reply at 2-6; Audacy Reply at 4.

be “replaced” within the terms of the license grant.<sup>108</sup> Iridium argues that we should consider developing provisions to terminate a license to prevent additional launches of small satellites with designs used in satellites that have previously failed in space.<sup>109</sup> Given the financial incentives that licensees have to ensure that their satellites are functional, we do not find it necessary to adopt a rule specific to the streamlined process that would terminate a license in certain instances related to prior satellite failures. To the extent that Iridium’s concern relates to design reliability more generally, however, we note that that issue was raised as part of the Commission’s *Orbital Debris NPRM*,<sup>110</sup> and licenses issued through the small satellite licensing process may be subject to additional requirements based upon the outcome of that proceeding.

#### 4. Deployment Orbit and Maneuverability

42. We will require that applicants certify that their satellite either will be deployed below 600 km or have sufficient propulsion capabilities to perform collision avoidance maneuvers and deorbit within the six-year in-orbit lifetime. Based on satellite technical characteristics as specified in FCC part 25 and experimental licensing files, 600 km roughly corresponds to the maximum altitude from which it is feasible for a CubeSat or other small satellite to passively reenter Earth’s atmosphere within six years.<sup>111</sup> We do not adopt a requirement that small satellites without propulsion capabilities authorized under the streamlined process be deployed from or below 400 km, roughly the altitude of the International Space Station (ISS), at this time.<sup>112</sup> We believe that issues related to all satellites transiting through the ISS orbit—both those licensed under the small satellite licensing process and those authorized under the regular part 25 process—can be better addressed on a more holistic basis in the context of Commission’s current orbital debris proceeding.<sup>113</sup>

43. In the *NPRM*, the Commission proposed that satellites authorized under the streamlined

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<sup>108</sup> For example, a particular license might cover launch and operation of up to ten satellites. If one or more of the satellites is lost during a launch failure, those lost satellites would not count toward the total of ten, since they were never launched or operated. Thus, the licensee could still launch additional satellites to replace those that were lost without seeking additional authorization. This would not be a “replacement” satellite as described in section 25.113(i) of the Commission’s rules, however, since the license granted by the Commission pursuant to the streamlined small satellite streamlined would not include provision for planned replenishment of the constellation. See 47 CFR § 25.113(i); Appendix A, Final Rules. As noted in the *NPRM*, in-orbit spares would also not be authorized under a small satellite license. *NPRM*, 33 FCC Rcd at 4166, n.105. See 47 CFR § 25.113(h); Appendix A, Final Rules.

<sup>109</sup> Iridium Comments at 6.

<sup>110</sup> *Orbital Debris NPRM*, 33 FCC Rcd at 11368, paras. 42-43.

<sup>111</sup> The NASA Debris Assessment Software provides a tool for calculating orbital lifetime based on spacecraft area, mass, and orbital parameters. See NASA Orbital Debris Program Office, Debris Assessment Software, <https://orbitaldebris.jsc.nasa.gov/mitigation/debris-assessment-software.html> (last visited May 22, 2019). Using a range of area-to-mass ratios of small satellites authorized by the Commission in the last several years, a calculation of expected orbital lifetime shows some would re-enter Earth’s atmosphere within six years if deployed at 600 km under the current solar cycle and assuming a circular orbit. Others would require lower deployment orbits in order to deorbit within six years.

<sup>112</sup> Under the *NPRM* proposal, applicants would certify that either (1) the satellite(s) would be deployed at an orbit below the orbit of the International Space Station (ISS), which is at an altitude of approximately 400 km; (2) the satellite(s) would be deployed from the ISS itself or a vehicle docked with the ISS; or (3) the satellite(s) would have sufficient propulsion capabilities to perform collision avoidance maneuvers and deorbit within the proposed in-orbit lifetime. 33 FCC Rcd at 4167-68, paras. 33-34.

<sup>113</sup> See *Orbital Debris NPRM*, 33 FCC Rcd at 11363-64, para. 30. For example, the Commission noted in the *NPRM* in this proceeding that satellites transiting through the ISS altitude band increase the likelihood that the ISS will need to conduct avoidance maneuvers, potentially disrupting ISS operations. *Small Satellite NPRM*, 33 FCC Rcd at 4168, para. 34.



process would either be deployed to an orbit below 400 km, or have propulsion.<sup>114</sup> A majority of commenters suggested that the proposed certifications regarding deployment were too restrictive and either proposed alternate certifications or suggested that there be no deployment-related certifications as part of the streamlined application process.<sup>115</sup> According to several commenters, the proposed limitations would make the streamlined process of little value to many commercial applicants.<sup>116</sup> Some commenters suggested that there are alternative means for protecting the ISS, including working with the ISS program as technology develops to determine what should be required of satellites deployed above the ISS.<sup>117</sup> Other commenters support the 400-km certification.<sup>118</sup> Iridium states that without adequate means of maneuverability, there is an increased risk of collision in more congested portions of low-Earth orbit, and suggests that the Commission may wish to require a more significant showing concerning the adequacy of maneuverability and deorbit systems, or process applications to launch small satellites under the standard part 25 licensing procedure.<sup>119</sup> SES/O3b agrees with the proposed certification as well, and notes that other satellite operators may need to expend time and resources assessing the efficacy of alternative means of collision avoidance.<sup>120</sup>

44. The Commission's initial proposal for a deployment certification would have, in some instances, limited the lifetime of a streamlined-licensed satellite to a period shorter than the certified maximum in-orbit lifetime. Although some commenters support the 400-km standard for certifications,<sup>121</sup> CSSMA notes that even with the originally proposed five-year orbital lifetime, many types of small satellites could go above 400 km and still meet the orbital lifetime requirement with passive or other means.<sup>122</sup> In lieu of 400 km, we therefore adopt a deployment certification that is based on the planned orbital lifetime of these small satellites. This will allow the streamlined small satellites to deploy at altitudes up to where it is feasible that they meet the in-orbit lifetime requirement of six years through passive deorbiting—an altitude of roughly up to 600 km. Of course, the exact altitude can vary widely based on a number of factors, including area-to-mass ratio, orbit, and solar activity, but we find that using 600 km as an upper altitude limit is a useful benchmark for now, which will in many instances be consistent with a six-year in-orbit satellite lifetime. We recognize that there may be some satellites that can deploy above 600 km and still re-enter the atmosphere within six years, but 600 km represents an upper end that is a useful reference altitude for purposes of streamlined processing. This maximum 600-km deployment certification will give operators more flexibility than the proposed 400-km certification, but will help to ensure that the satellites authorized on a streamlined basis will have relatively short in-orbit lifetimes. Similar to the in-orbit lifetime certification, this deployment certification may rule out some rideshare launch opportunities for small satellites lacking propulsion, if those satellites are licensed under the streamlined process. However, we find that this is a reasonable trade-off to ensure that satellites licensed on a streamlined basis will have a shorter in-orbit lifetime.

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<sup>114</sup> 33 FCC Rcd at 4167-68, paras. 33-34.

<sup>115</sup> See, e.g., CSSMA Comments at 16-17, Commercial Spaceflight Federation Comments at 6; HybridX Reply at 1; University Small-Satellite Researchers Comments at ii; Phase Four, Inc. Comments at 2 (rec. July 9, 2018) (Phase Four Comments); Boeing Comments at 11.

<sup>116</sup> See, e.g., CSSMA Comments at 16; University Small-Satellite Researchers Comments at 2-4.

<sup>117</sup> See, e.g., CSSMA Comments at 16.

<sup>118</sup> See, e.g., Iridium Comments at 5; SES/O3b Reply at 4-5.

<sup>119</sup> Iridium Comments at 6.

<sup>120</sup> SES/O3b Reply at 5.

<sup>121</sup> See, e.g., Iridium Comments at 5; SES/O3b Reply at 4-5.

<sup>122</sup> CSSMA Reply at 8. CSSMA was responding to comments by Iridium in which Iridium agreed with the Commission's original proposal and suggested that without sufficient maneuverability, small satellites deorbiting from higher altitudes may exceed the five-year term proposed by the Commission. Iridium Comments at 5.

45. In response to those commenters supporting the proposed 400-kilometer certification, we emphasize that as adopted, the streamlined small satellite process will only apply to qualifying applicants that have certified that, among other things, the authorized satellite(s) will deorbit within six years. Applicants will also certify that the risk of in-orbit collision with other large objects is 0.001 or less as calculated using NASA software or other higher fidelity models. These certifications and others applying to streamlined licensees will help to ensure that streamlined-licensed operations are associated with lower risk from an orbital debris perspective, and so we find that adopting a 600-kilometer certification is appropriate at this time for the streamlined process, pending additional discussion as part of the Commission’s orbital debris proceeding, which would cover all Commission-authorized satellites.

46. Additionally, SpaceX asks that the Commission adopt more rigorous certifications for applicants seeking streamlined processing. SpaceX suggests that the Commission require that in order to qualify for streamlined processing, a small satellite applicant must certify that its satellite(s) have sufficient propulsion capabilities to perform collision avoidance maneuvers, regardless of deployment altitude.<sup>123</sup> SpaceX expresses concern that a large number of non-maneuverable small satellites could present a significant space safety concern for NGSO systems operating at altitudes below the ISS and complicate deployment of any spacecraft that transits through the sub-ISS altitudes, such as satellites destined for higher orbits, as well as manned missions or space tourism activities.<sup>124</sup> According to SpaceX, a “steady rain of uncontrolled deorbiting smallsats” would present a significant collision concern for all of these spacecraft during operations below the altitude of the ISS.<sup>125</sup> We conclude that we do not need to adopt additional, more stringent requirements to protect other operators specifically from streamlined-licensed satellites at this time. These concerns appear to go beyond simply those satellites licensed on a streamlined basis, and instead relate to broader concerns about a safe operating environment in low-Earth orbit (LEO).<sup>126</sup> We conclude that these concerns can also be addressed as part of the Commission’s separate proceeding on orbital debris, which makes a number of proposals and seeks comment on various topics related to safe operations in LEO for all satellites.<sup>127</sup>

47. In adopting an altitude certification at this time, we will maintain the Commission’s proposal that the small satellites may be deployed above a particular altitude—now 600 km—if the operator certifies that the satellites have sufficient propulsion capabilities to perform collision avoidance maneuvers and deorbit within the in-orbit lifetime term. In the *NPRM*, the Commission tentatively concluded that more limited maneuvering capabilities, such as those relying primarily on drag, would be insufficient to support deployment at higher altitudes under the streamlined small satellite process, as those methods will likely require closer Commission review.<sup>128</sup> Numerous commenters argue that applicants be provided some flexibility in incorporating maneuverability in their satellite design, without specifically identifying propulsion as a requirement for streamlined small satellites deployed above a particular altitude.<sup>129</sup> Phase Four, for example, suggests that the Commission use the phrase “mobility” rather than propulsion, since several subsystems work in concert to execute collision avoidance

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<sup>123</sup> SpaceX Comments at 10.

<sup>124</sup> *Id.*

<sup>125</sup> *Id.*

<sup>126</sup> See Iridium Comments at 7; SpaceX Comments at 9-10.

<sup>127</sup> See, e.g., *Orbital Debris NPRM*, 33 FCC Rcd at 11361, para. 25 (“In an effort to ensure that the physical operations of both existing and planned systems do not contribute to the orbital debris environment, particularly in the heavily-used LEO region, we propose to update our rules.”).

<sup>128</sup> 33 FCC Rcd at 4168, para. 34.

<sup>129</sup> See, e.g., Boeing Comments at 11-12; Phase Four Comments at 3; University Small-Satellite Researchers Comments at 10-11; ORBCOMM Reply at 4.

maneuvers, and propulsion systems are not the only types of systems that can change a satellite orbit.<sup>130</sup> Boeing notes that techniques other than propulsion have been used and are being developed to permit small satellites to proactively maneuver without the use of propulsion, and thus enable collision avoidance.<sup>131</sup> These commenters rightly point out that alternatives to propulsion are available, but do not address the Commission's concern that these types of methods are likely to require closer Commission review and analysis concerning effectiveness and other issues, which is antithetical to processing these applications on a streamlined basis. For example, while drag augmentation devices may increase the area-to-mass ratio of a space structure and consequently reduce its orbital lifetime, the larger collision cross-section may increase the probability of collision during the orbital decay period.<sup>132</sup> If an operator wishes to undertake operations using these types of technologies above the deployment altitude specified here, then it should consider a regular part 25 authorization or other alternative licensing process where appropriate. We recognize that mobility technologies will continue to evolve, but at this juncture,<sup>133</sup> we find that determining whether a particular satellite does or does not have propulsion is a more effective shorthand for purposes of streamlined processing than analyzing specific satellite maneuverability details. The certification we adopt in this proceeding does not represent a requirement that all small satellites have propulsion, but instead will enable the Commission to process applications on a streamlined basis, with the knowledge that the satellites will generally re-enter Earth's atmosphere within a short period of time.

48. Our conclusion regarding the eligibility criteria for this process does not change our view regarding the importance of minimizing disruptions to the ISS and protecting crewed spacecraft. In the *NPRM*, the Commission observed that deployment of satellites lacking maneuvering capabilities to orbits from which they will eventually transit through the ISS altitude range increases the likelihood that the ISS will need to conduct avoidance maneuvers, potentially disrupting ISS operations.<sup>134</sup> Accordingly, we adopt the *NPRM* proposal that applicants under the streamlined process must describe in narrative form the design and operational strategies that will be used to avoid collision with crewed spacecraft.<sup>135</sup> We conclude that adopting a narrative informational requirement will help to ensure that small satellite operators take operations of the ISS and other crewed spacecraft into consideration in planning small satellite activities in orbit.<sup>136</sup> The information provided will also be on the record for evaluation by any interested parties.<sup>137</sup> We also note that the Commission sought comment on issues related to crewed

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<sup>130</sup> Phase Four Comments at 3.

<sup>131</sup> Boeing Comments at 11.

<sup>132</sup> See NASA Standard at 4.6.4.1. Analysis of these types of issues is likely to require a level of Commission review inconsistent with streamlined processing.

<sup>133</sup> Phase Four, a developer of propulsion systems, notes that small satellite propulsion systems are readily available or immediately available across a variety of propulsion methods including cold gas, chemical, and electric propulsion. Phase Four Comments at 2. Phase Four recommends that the Commission work with small satellite mobility manufacturers to identify mobility certification guidelines, such as lifetime testing, startup and shutdown testing, and qualification test requirements. *Id.* at 3. While this may be something to consider in the arena of limiting orbital debris as a general matter, it is unlikely that a more detailed mobility certification would be developed in the near future given the evolving state of mobility technologies, and therefore such a certification could not be immediately useful for the streamlined small satellite process we adopt here.

<sup>134</sup> 33 FCC Rcd at 4168, para. 34.

<sup>135</sup> A similar proposal was made, applicable to all NGSO satellites, in the *Orbital Debris NPRM*. 33 FCC Rcd at 11363-64, para. 30.

<sup>136</sup> For streamlined applicants whose satellite or satellites will have any means of maneuverability, we will also retain the current requirement in part 25 to indicate the anticipated evolution over time of the orbit of the proposed satellite or satellites. See 47 CFR § 25.114(d)(14)(iii); Appendix A, Final Rules.

<sup>137</sup> As discussed below, the public notice procedures will be the same for streamlined applicants as for regular part 25 applications. This includes the opportunity for interested parties to file petitions, comments, or other objections on the record. See 47 CFR §§ 25.152, 25.154.

spacecraft in the *Orbital Debris NPRM*,<sup>138</sup> and will generally address further issues specific to crewed spacecraft in the context of that proceeding.

## 5. Maximum Spacecraft Size

49. We adopt the proposal of the *NPRM* for a maximum mass requirement of 180 kg for any Earth-orbiting satellite that would be authorized under the streamlined process.<sup>139</sup> This upper mass limit is consistent with past small satellite license applications and with NASA demarcation of the small satellite category, as discussed in the *NPRM*.<sup>140</sup> A number of commenters agree with the mass standard for Earth-orbiting missions.<sup>141</sup>

50. Other commenters disagreed with the mass proposal or suggested that we should not use mass as a qualifying factor. ORBCOMM suggests that the Commission base its calculation on spectrum and orbit use as opposed to mass.<sup>142</sup> It argues that a satellite with the mass of 180 kg is capable of using a large amount of radiofrequency spectrum and could create interference, especially when considering constellations of satellites of this mass.<sup>143</sup> We disagree with this suggestion because the other criteria for small satellites—particularly the requirement that small satellites are compatible with existing operations and will not materially constrain future operations of other satellites in the requested frequency bands—will help to ensure that small satellites can co-exist with other operators.

51. Boeing and Analytical Space argue that a maximum mass criterion is superfluous and unnecessary considering the other eligibility characteristics set forth in this proceeding.<sup>144</sup> The Commercial Spaceflight Federation suggests using a measurement of the cross-surface section area instead of mass for determining size, arguing this method is more relevant to orbital debris mitigation.<sup>145</sup> We find that this maximum mass characteristic is useful to demarcate a particular type of licensee—a small satellite. Spacecraft are generally grouped according to their mass and mass is also easier to measure in many respects than cross-surface section area, which may change depending on what parts of the spacecraft are deployed following launch. Alongside the other qualifying characteristics, a maximum mass helps to act as a check on the types of operations that may be licensed in a streamlined fashion.

<sup>138</sup> See *Orbital Debris NPRM*, 33 FCC Rcd at 11363-64, para. 30.

<sup>139</sup> See *infra* section III.B.10 on non-Earth-orbiting mission licensing requirements.

<sup>140</sup> *NPRM*, 33 FCC Rcd at 4167, para. 32 (citing NASA Ames Research Center, Small Spacecraft Technology State of the Art, NASA/TP-2015-216648/REV1 at 1 (Dec. 2015), [https://www.nasa.gov/sites/default/files/atoms/files/small\\_spacecraft\\_technology\\_state\\_of\\_the\\_art\\_2015\\_tagged.pdf](https://www.nasa.gov/sites/default/files/atoms/files/small_spacecraft_technology_state_of_the_art_2015_tagged.pdf) (2015 NASA Small Spacecraft Technology Report)). NASA has since issued an updated version of its report on “State of the Art Small Spacecraft Technology.” This new version adopts the same terminology as the prior report, characterizing a “small spacecraft” as one with a wet mass below 180 kg. NASA Ames Research Center, Small Spacecraft Technology State of the Art, NASA/TP-2018-220027 at 15 (Dec. 2018), <https://sst-soa.arc.nasa.gov/download/1780/> (2018 NASA Small Spacecraft Technology Report).

<sup>141</sup> Iridium Comments at 4; EchoStar/Hughes Comments at 4; CSSMA Comments at 14 (agreeing with 180 kg mass limitation, but noting that a slightly higher number may also be appropriate); Iridium Reply at 2-3; Commercial Spaceflight Federation Reply at 3; CSSMA Reply at 6; Audacy Reply at 4-5 (agreeing with 180 kg limit for routine processing, but also requesting case-by-case review of larger spacecraft). A number of commenters suggested that we adopt a different maximum mass certification for non-Earth orbiting missions. Those comments are addressed below in the section considering rules for those types of missions.

<sup>142</sup> ORBCOMM Comments at 5.

<sup>143</sup> ORBCOMM Comments at 5; see also Robert E. Bruninga, et al. Reply Comments at 2-3 (rec. Aug. 1, 2018) (filed on behalf of Faculty/Amateur Radio Mentors of a Federal “University”) (suggesting a bandwidth restriction alongside a smaller mass) (Faculty/Amateur Radio Mentors Reply).

<sup>144</sup> Boeing Comments at 11; Analytical Space Comments at 12-13; CSSMA Reply Comments at 6.

<sup>145</sup> Commercial Spaceflight Federation Comments at 5; Commercial Spaceflight Federation Reply Comments at 3.

52. We conclude that 180 kilograms is a good approximation of small satellite size for this purpose, to help filter out any systems that are not appropriate for streamlined processing while allowing for variety in spacecraft design. Consistent with how NASA describes a “small spacecraft” in the document we referenced in the *NPRM*, we adopt 180 kilograms as a “wet mass” limit, which means that it includes propellant.<sup>146</sup>

## 6. Trackability

53. The Commission proposed that applicants under the streamlined process would certify that each authorized satellite would have physical dimensions greater than 10 cm x 10 cm x 10 cm to ensure trackability and that each satellite would be identifiable by unique telemetry markers allowing it to be distinguished from other space stations or objects.<sup>147</sup> This size is generally consistent with the 1U (one unit) CubeSat form factor and the vast majority of small satellites launched to date have been this size or larger.<sup>148</sup> All commenters addressing this issue support a trackability requirement, but they disagree on what specifically the requirement should entail. Some commenters argue that rather than minimum dimensions the requirement should be a “functional” trackability requirement, which could allow even smaller satellites to be authorized as technology advances and smaller space objects become more readily trackable.<sup>149</sup> Others argue that the 10 cm x 10 cm x 10 cm requirement should be adopted as a “safe harbor,” but that satellites with smaller dimensions should be permitted if the applicant provides a demonstration of trackability.<sup>150</sup>

54. We believe that adopting a minimum size for satellites using the streamlined process will help ensure that small satellites are trackable while reducing the time needed to review and process applications. The 18<sup>th</sup> Space Control Squadron (18 SPCS) acknowledges that it currently tracks objects as small as 1U in size.<sup>151</sup> We therefore adopt a certification requirement that each satellite authorized under the streamlined process must measure no less than 10 cm in its smallest dimension. Consequently, we do not see satisfying this requirement to be a substantial burden on potential applicants under the streamlined process. We note that the certification we adopt is a slight variant on the 10 cm x 10 cm x 10 cm minimum dimensions proposed in the *NPRM*, and requiring that the satellites be no smaller than 10 cm in their smallest dimension provides slightly more flexibility while achieving the same aim.<sup>152</sup>

55. We are not convinced by commenters who support a “functional” trackability requirement in lieu of adopting minimum dimensions. While we acknowledge that technologies exist that

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<sup>146</sup> See 2015 NASA Small Spacecraft Technology Report at 1; see also 2018 NASA Small Spacecraft Technology Report at 15 (also referring to a spacecraft as “small spacecraft” when its wet mass is below 180 kg).

<sup>147</sup> *NPRM*, 33 FCC Rcd at 4169, para. 38. The Commission observed that the 10 cm x 10 cm x 10 cm dimensions are consistent with the CubeSat specification (for a 1 unit or “1U” CubeSat), and that the certifications could help ensure that satellite operators will be able to assist entities that track space objects to more easily identify and distinguish between the small satellites and other space objects. *Id.*

<sup>148</sup> *NPRM*, 33 FCC Rcd at 4169, para. 38. Consistent with the Commission’s proposal to apply a minimum size generally consistent with the stowed CubeSat specification, i.e., 10 cm x 10 cm x 10 cm, we note that the minimum size does not include parts of the spacecraft that must be successfully deployed in order to increase the spacecraft size to the minimum specified for the streamlined process, e.g., deployable antennas.

<sup>149</sup> Analytical Space Comments at 13-14; CSSMA Comments at 18-19; Commercial Spaceflight Federation Comments at 5; Boeing Comments at 13; CSSMA Reply Comments at 13. *Cf.* Open Research Institute Comments at 9 (suggesting that as technical capabilities improve, the minimum licensable size should be reduced, but the size allowed must always be some classified amount larger than the actual minimum radar profile that can be reliability tracked).

<sup>150</sup> University Small-Satellite Researchers Comments at 11-12.

<sup>151</sup> 33 FCC Rcd at 4169, note 123.

<sup>152</sup> A spherical object with a diameter of 10 cm, for example, could still meet this certification.

can improve the trackability of spacecraft,<sup>153</sup> we continue to believe that assessing the effectiveness of these technologies will require additional review by the Commission, and that such review is inconsistent with a streamlined licensing process.

56. We also adopt the Commission’s proposal to require a certification that the spacecraft have unique telemetry markers. We clarify that we expect that when a spacecraft transmits telemetry data to the ground it will include in that transmission some marker that allows the spacecraft to be differentiated from other spacecraft.<sup>154</sup> This signal-based identification marker, which should be different from those of other objects on a particular launch, can assist with identification of a satellite for space situational awareness purposes. Several commenters support the proposal to require unique telemetry markers.<sup>155</sup> University Small-Satellite Researchers and CSSMA seek clarification on the telemetry markers,<sup>156</sup> with CSSMA suggesting that if they are “merely a few bits of information in a satellite’s telemetry it would perhaps not be an undue burden.”<sup>157</sup>

57. CSSMA further states that it is not clear what interest would be served by being able to distinguish between satellites licensed under the streamlined process and all other space objects—as other licensed satellites would not be distinguishable amongst each other by a unique telemetry marker.<sup>158</sup> As an alternative, CSSMA suggests that the Commission require that all satellites associated with any space station licensee be registered along with their International Designator, as it appears in all Joint Space Operations Center two-line element sets, with the Commission, so that an object and its orbit would be locked together permanently.<sup>159</sup> ORBCOMM and Iridium propose that small satellite operators be required to obtain and share real time ephemeris data with other operators.<sup>160</sup>

58. To the extent that there are additional technologies or methodologies available that could improve the identifiability of spacecraft,<sup>161</sup> we encourage operators to implement such technologies, but will not require additional certifications at this point for an applicant to be eligible for the streamlined licensing process. We believe the issues raised by ORBCOMM and Iridium relating to sharing of ephemeris data,<sup>162</sup> as well as other additional proposals or methodologies related to identification and new tracking technologies, are better addressed in connection with the Commission’s recent *NPRM* regarding

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<sup>153</sup> See *NPRM*, 33 FCC Rcd at para. 38 (“We note that while there may be methods for improving tracking of smaller objects, such as reflectors or transponders, these methods may require closer scrutiny and detailed analysis, and such analysis may be inconsistent with a streamlined process.”). See also, e.g., Iridium Comments at 7 (suggesting that laser retro reflectors or cross-sectional enhancements that improve tracking could be used).

<sup>154</sup> This is consistent with what CSSMA describes in its comments as a “few bits of information in the satellite’s telemetry.” CSSMA Comments at 19.

<sup>155</sup> See, e.g., SpaceX Comments at 6-7; Echostar/Hughes Comments at 5; SES/O3b Reply at 5-6.

<sup>156</sup> See, e.g., University Small-Satellite Researchers Comments at 11 (stating that the telemetry marker proposal is “underspecified and unclear”); CSSMA Comments at 19; University Small-Satellite Researchers Reply at 4.

<sup>157</sup> CSSMA Comments at 19.

<sup>158</sup> *Id.* CSSMA observes that the standard part 25 process of notifying the Commission of a deployment and insertion orbit allows satellites to be accurately tracked to a license, streamlined or otherwise. *Id.*

<sup>159</sup> *Id.*; see also SES/O3b Reply at 6. Two-line element sets are sets of data used to describe positional information for a particular satellite, and the international designator is part of the two-line element set. See CSSMA Comments at 19, n.42.

<sup>160</sup> ORBCOMM Comments at 11; Iridium Comments at 7.

<sup>161</sup> See, e.g., EchoStar/Hughes Comments at 5 (suggesting design characteristics such as retroreflectors to enhance trackability).

<sup>162</sup> Iridium Comments at 7; ORBCOMM Comments at 11.

orbital debris mitigation.<sup>163</sup> Although as CSSMA points out, this requirement will not apply to satellites other than those authorized under the streamlined process,<sup>164</sup> we believe that measures to improve the identification of these small satellites are nonetheless appropriate. Again, the Commission is considering these topics as they relate to Commission-authorized satellites more generally, as part of the *Orbital Debris NPRM*.<sup>165</sup>

## 7. Casualty Risk

59. We adopt the certification requirements as proposed in the *NPRM* regarding casualty risk, specifically that applicants for the part 25 streamlined process certify that their satellite(s) will be disposed of through atmospheric re-entry following conclusion of the mission,<sup>166</sup> and certify that they have conducted a casualty risk assessment using the NASA Debris Assessment Software or another higher fidelity model, and that the assessment resulted in a human casualty risk of zero.<sup>167</sup> Several commenters argued that a “true zero” casualty risk is likely impossible to achieve.<sup>168</sup> We disagree. There are numerous instances, documented in FCC files, of satellites that can be reliably predicted to burn up completely upon re-entry. We also note, however, that the Commission has accepted methodologies used for assessing debris re-entry casualty risk that consider debris as presenting a casualty risk only if it has a kinetic energy of 15 joules or greater.<sup>169</sup> Zero casualty risk, particularly with this methodology for assessment, is readily achievable for small satellites. This certification is generally consistent with applications that can be processed on a streamlined basis, as it typically indicates that no additional factual inquiry by the Commission or discussion of insurance and liability arrangements, for example, is necessary.<sup>170</sup>

60. The University Small-Satellite Researchers suggest allowing case-by-case exemptions to the zero-casualty risk requirement for researchers who may need to use certain metals that do not fully disintegrate on re-entry into Earth’s atmosphere, so long as they can demonstrate risk mitigation and obtain third-party liability insurance for any potential casualty risk.<sup>171</sup> We believe that the level of analysis that would be required to undertake such review is not consistent with processing on a streamlined basis and decline to adopt such an exemption.<sup>172</sup> Other commenters suggest that the same

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<sup>163</sup> See, e.g. SpaceX Comments at 7 (suggesting that the telemetry marker use one or more frequency bands that are commonly in use by international tracking networks); CSSMA Comments at 19 (suggesting registration of the International Designator with the Commission). In the *Orbital Debris NPRM*, the Commission sought comment on a number of questions related to tracking spacecraft, including, for example, new technologies that may improve tracking abilities. See 33 FCC Rcd at 11365-66, para. 36. The *Orbital Debris NPRM* also addresses the topic of sharing of satellite information, such as ephemeris data, with the 18<sup>th</sup> SPCS or a civilian successor entity. See *id.* at 11366, para. 37.

<sup>164</sup> See CSSMA Comments at 19.

<sup>165</sup> *Orbital Debris NPRM*, 33 FCC Rcd at 11365-66, para. 36.

<sup>166</sup> 33 FCC Rcd at 4170, para. 39.

<sup>167</sup> *Id.*

<sup>168</sup> See, e.g., CSSMA Comments at 20; Analytical Space Comments at 10-11; Commercial Spaceflight Federation Reply at 3.

<sup>169</sup> This is consistent with NASA standards. See, e.g., NASA Standard at 4.7.4.

<sup>170</sup> See *NPRM*, 33 FCC Rcd at 4170, para. 39.

<sup>171</sup> University Small-Satellite Researchers Comments at 8.

<sup>172</sup> With respect to small satellites, the issue of re-entry casualty risk and its relevance to the public interest was specifically identified in a Public Notice in 2013. See *Guidance on Obtaining Licenses for Small Satellites*, Public Notice, DA 13-445, 28 FCC Rcd 2555, 2558 & n.9 (March 15, 2013) (*Small Satellite Licensing Public Notice*). The Public Notice stated that small satellite designers were urged and expected to follow a “design to demise” approach in choosing materials. *Id.* For cases where the re-entry assessment did find surviving materials presenting a

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casualty risk standards should be used for small satellites in this streamlined process that are used for all other satellites and that the adoption of any new standards should be made in a separate rulemaking.<sup>173</sup> As discussed above, we believe a zero casualty risk standard is appropriate for the Part 25 streamlined process.

## 8. Cessation of Emissions

61. In the *NPRM*, the Commission sought comment on the proposal to require certification that each satellite has the ability to receive command signals and cease transmission upon receipt of a command.<sup>174</sup> We conclude that applicants must certify that there will be adequate control of radiofrequency operations to immediately eliminate any harmful interference as may be necessary under the terms of our rules or the space station authorization. In particular, satellites must have the capability for immediate cessation of emissions upon receipt of a telecommand from the ground. The ability to immediately eliminate harmful interference may also require, for some operations, that transmissions are initiated only by ground command, where, for example, there are a limited number of earth stations communicating with the satellite or satellites.

62. CSSMA proposes that streamlined applicants certify compliance with the Commission's current rule on cessation of emissions, section 25.207, and provide analysis as to how they do so.<sup>175</sup> Section 25.207 states that "[s]pace stations shall be made capable of ceasing radio emissions by the use of appropriate devices (battery life, timing devices, ground command, etc.) that will ensure definition cessation of emissions."<sup>176</sup> According to CSSMA, this rule already provides a more flexible standard for cessation of emissions and achieves the same end as the proposed *NPRM* requirement.<sup>177</sup> CSSMA and Boeing suggest that there are more reliable approaches to cessation of emissions than ground transmitting commands and argue that it may be appropriate to permit a small satellite to transmit for a certain period of time and refrain from resuming transmissions until the satellite receives another affirmative command from a ground station.<sup>178</sup> SES/O3b does not object to retaining section 25.207 in its current state, but opposes further requirements that would prohibit transmissions absent an active command, instead suggesting that it is more important to know that under any failure mode the satellite will cease transmission after a certain period.<sup>179</sup>

63. We note that section 25.207 of the Commission's rules has not been updated since it was

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casualty risk other than zero, the Public Notice stated that applicants should provide a detailed discussion of the need for use of high melting point materials, demonstrating that mission objectives cannot be met with an alternative spacecraft design. *Id.* This Public Notice guidance remains relevant to small satellites and we point out that these are the types of demonstrations that would need to be analyzed to support a case-by-case exception, as requested by University Small-Satellite Researchers, for example. *See* University Small-Satellite Researchers Comments at 8. The Public Notice also stated that applicants should identify steps taken or to be taken to obtain an insurance policy listing the United States as an insured party or additional insured party and demonstrating that the policy will provide adequate coverage. 28 FCC Rcd at 2558.

<sup>173</sup> *See, e.g.*, Boeing Comments at 13; Commercial Spaceflight Federation Comments at 5-6; Analytical Space Comments at 10-11; CSSMA Reply Comments at 14.

<sup>174</sup> 33 FCC Rcd at 4170-71, para. 40.

<sup>175</sup> CSSMA Comments at 20-21.

<sup>176</sup> 47 CFR § 25.207.

<sup>177</sup> CSSMA Comments at 20.

<sup>178</sup> Boeing Comments at 13; CSSMA Comments at 21; CSSMA Reply at 14.

<sup>179</sup> SES/O3b Reply at 6-7.



adopted in 1965<sup>180</sup> and varies slightly from the current ITU Radio Regulation No. 22.1, which states that “[s]pace stations shall be fitted with devices to ensure immediate cessation of their radio emissions by telecommand, whenever such cessation is required under the provisions of these Regulations.”<sup>181</sup> We are not modifying section 25.207 as a general matter in this proceeding. However, we find that it is appropriate to require that small satellites licensed under the streamlined process have the capability to immediately eliminate harmful interference when necessary, which must include the ability to cease radio emissions by telecommand. Depending on the system design, other means may also be necessary to ensure the immediate elimination of harmful interference, such as those described by CSSMA and Boeing, and operators should design their systems accordingly in order to satisfy the qualifying criterion for streamlined processing, although we will not prescribe specific designs.<sup>182</sup>

64. We thus do not adopt the *NPRM* proposal that applicants in all instances operate via a “passively safe” system.<sup>183</sup> We conclude that this broader standard of eliminating harmful interference allows for design flexibility alongside the backstop requirement to cease emissions by telecommand. The ability to eliminate harmful interference is important in any system, and particularly so in these systems which must share with existing operators and not materially constrain future operators in any particular frequency band.

#### 9. Streamlined Small Spacecraft Process

65. We adopt the *NPRM* proposal to allow small spacecraft with planned non-Earth orbiting missions, such as commercial lunar missions, to file under the streamlined process.<sup>184</sup> All commenters addressing the issue support the inclusion of a small spacecraft streamlined licensing process.<sup>185</sup> Commenters provided various suggestions for changes to the eligibility requirements for the streamlined process in order to allow for successful small spacecraft missions while maintaining a streamlined administrative process. These suggestions include increasing the maximum mass, allowing deorbit by means other than atmospheric re-entry, and increased operational lifetimes.<sup>186</sup>

66. Based on the record, we conclude that it is appropriate to exempt small spacecraft with planned non-Earth orbiting missions from several of the certifications required for most applicants under the streamlined process and make modifications to others.<sup>187</sup> Specifically, applicants for these missions

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<sup>180</sup> See *Amendment of Parts 21 and 25 of the Commission’s Rules to Provide for the Shared Use of the Frequency Bands 3700-4200, 5925-6425, 7250-7750 and 7900-8400 MC/S by the Fixed, Mobile, and Communication-Satellite Services*, Report and Order, 42 F.C.C.2d 1262, 1280 (1965).

<sup>181</sup> ITU R.R. No. 22.1.

<sup>182</sup> See Boeing Comments at 13 (stating that, as an example, it may be appropriate to permit a small commercial satellite to transmit for no more than 30 seconds at a time and refrain from resuming transmissions thereafter until it receives another affirmative command from its ground station); CSSMA Comments at 21 (stating that, as an example, software onboard a satellite can be programmed to cease emissions if and when a ground contact has not been established for a certain period of time).

<sup>183</sup> See *NPRM*, 33 FCC Rcd at 4170-71, para. 40. As discussed in the *NPRM*, in a “passively safe system” a satellite would not transmit unless it is actively commanded to transmit via a command and would cease transmission unless within view of a ground station. *Id.*

<sup>184</sup> *Id.* at 4167, para. 31.

<sup>185</sup> Moon Express Comments at 2; Commercial Spaceflight Federation Comments at 2; CSSMA Comments at 2, 14; SIA Comments at 5-6; CSSMA Reply at 6; Xplore Reply.

<sup>186</sup> Moon Express Comments at 1-2; Commercial Spaceflight Federation Comments at 8-9; Xplore Reply.

<sup>187</sup> In the *NPRM*, the Commission sought comment on whether any of the streamlined licensing criteria should be modified to accommodate non-earth orbiting missions, for example, whether the applications should be subject to different lifetime certifications or license terms, and whether the Commission should modify criteria such as those

(continued....)

will be exempt from the certifications regarding disposal by atmospheric re-entry and deployment altitude. While we will not require a qualifying certification related to spacecraft disposal by atmospheric re-entry, we will ask that applicants for a streamlined small spacecraft license provide a brief description of their disposal plan, since there are multiple potential disposal scenarios.<sup>188</sup> In addition, we modify the mass certification to specify a maximum mass for these spacecraft, including fuel, of 500 kilograms. This is consistent with the comments we received suggesting that we adopt a higher mass limit for non-Earth-orbiting small spacecraft systems.<sup>189</sup>

67. We also received comments proposing that spacecraft applying under the small spacecraft streamlined process be subject to different license terms, for example, 10 or 25 years.<sup>190</sup> SIA, on the other hand, proposed that there should not necessarily be different license terms for non-Earth-orbiting missions, as such missions are limited by component life, the deep space environment, and the initial launch trajectory.<sup>191</sup> It is unclear whether such non-Earth-orbiting missions would in fact need a longer license term, and so we decline to adopt a different license term or spacecraft lifetime certification for small spacecraft at this time, and apply a maximum six-year license term. This maximum six-year license term and spacecraft lifetime, as described above, can be considered generally commensurate with short duration operations.<sup>192</sup> We may revisit this topic in the future once we have additional experience authorizing these missions, but at this time missions seeking longer license terms may apply under the Commission's other existing licensing processes.

#### 10. Operational Debris and Collision Risk

68. In the *NPRM*, the Commission proposed that applicants for the streamlined process certify (1) that their satellite(s) will release no operational debris; (2) that the satellite operator has assessed and limited the probability of accidental explosions, including those resulting from the conversion of energy on board the satellite into energy that fragments the spacecraft; and (3) that the probability of an in-orbit collision between each satellite and any other large object<sup>193</sup> during the orbital lifetime of the space station is less than 0.001.<sup>194</sup>

69. With respect to the first two certifications—release of operational debris and accidental

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related to atmospheric re-entry and deployment orbit to accommodate these missions. 33 FCC Rcd at 4167, para. 31.

<sup>188</sup> See, e.g., SIA Comments at 6 (supporting exemption from disposal by atmospheric re-entry, and suggesting that disposal criteria could be met for these non-Earth-orbit missions through analysis of collision potential, alongside a requirement that the spacecraft cease emissions); Robert L. Ehresman Jr. Comment (rec. May 14, 2018) (suggesting that a lunar impact or solar orbit disposal options may be appropriate for some small satellites).

<sup>189</sup> Several commenters note that many potential commercial lunar spacecraft include built-in upper-stage engines to get the vehicle from Earth to the final destination and need to be heavier than a typical small satellite to survive a more rugged space environment. Commercial Spaceflight Federation Comments at 9; Moon Express Comments at 2; CSSMA Comments at 14-15.

<sup>190</sup> See Xplore Reply.

<sup>191</sup> SIA Comments at 5; see also Moon Express Comments at 2 (noting that most commercial missions to the Moon will likely last days or weeks, rather than years).

<sup>192</sup> We reserve the right to issue a license with a shorter license term for planned operations of less than six years.

<sup>193</sup> A "large object" will be considered to be a space object larger than 10 cm in diameter. See NASA Standard at 4.5-1. NASA's Debris Analysis Software, for example, will calculate probability of accidental collision with space objects larger than 10 cm in diameter. See NASA Orbital Debris Program Office, Debris Assessment Software User's Guide, Version 2.1 at 3.5 (October 2016).

<sup>194</sup> 33 FCC Rcd at 4168-69, paras. 35-37.

explosions—all the commenters addressing these topics agreed with the proposed certifications.<sup>195</sup> We therefore adopt the certifications as proposed in the *NPRM*, limiting eligibility for the streamlined licensing process to those satellites that release no operational debris during mission lifetime and requiring a certification from applicants that the satellite operator has assessed and limited the probability of accidental explosions, including those resulting from the conversion of energy sources on board the space station into energy that fragments the spacecraft.<sup>196</sup> The *NPRM* also sought comment on whether a certification alone was adequate with respect to the probability of accidental explosions or on whether there may be circumstances in which a more detailed disclosure and review is appropriate.<sup>197</sup> We did receive some comments relevant to this question of what demonstrations should be submitted to the Commission, specifically whether an Orbital Debris Assessment Report<sup>198</sup> should be included with each streamlined application, and those comments are addressed in the section of this *Order* on application requirements.<sup>199</sup>

70. We also adopt the third proposed applicant certification on this topic, specifically that the probability of each satellite's risk of in-orbit collision with large objects is less than 0.001, noting that this certification is consistent with the technical guidance developed by NASA for its space missions.<sup>200</sup> In the *NPRM*, we sought comment on whether the 0.001 metric was appropriate for satellites under the streamlined process, or whether a more stringent standard may be appropriate.<sup>201</sup> A number of commenters agreed with a 0.001 probability of risk of in-orbit collision certification proposed in the *NPRM*.<sup>202</sup> CSSMA agrees with the 0.001 risk of collision certification, but argues that the Commission should adopt this certification in lieu of limiting the orbital altitude or requiring propulsive capability.<sup>203</sup> As described in the previous sections, the orbital altitude certification, and corresponding certification that streamlined-licensed satellites above that altitude must have propulsion, help to ensure that the operations authorized under the streamlined process are limited in duration and that the satellites will not remain in low-Earth orbit for long periods of time following the end of their useful lives. Although a low collision risk as calculated using available modeling tools is an important part of orbital debris mitigation, the other qualifying criteria we adopt also decrease the probability that such spacecraft will contribute to the

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<sup>195</sup> See Analytical Space Comments at 3-4; Boeing Comments at 12; CSSMA Comments at 17; ORBCOMM Comments at 11-12; Iridium Reply at 3-5; Audacy Reply at 5-6; CSSMA Reply at 11 (noting that these proposed certifications “do not impose a substantial burden”).

<sup>196</sup> See Appendix A, Final Rules. The Commission's application rules for part 25 space stations currently include the requirement that applicants provide a statement with a “demonstration that debris generation will not result from the conversion of energy sources on board the spacecraft into energy that fragments the spacecraft.” 47 CFR § 25.114(d)(14)(ii). The rule states that energy sources include chemical, pressure, and kinetic energy. *Id.* It further states that “[t]his demonstration should address whether stored energy will be removed at the spacecraft's end of life, by depleting residual fuel and leaving all fuel line valves open, venting any pressurized system, leaving all batteries in a permanent discharge state, and removing any remaining source of stored energy, or through other equivalent procedures specifically disclosed in the application.” *Id.* A similar provision exists in the rules for experimental and amateur space stations. 47 CFR §§ 5.64(b)(2), 97.207(g)(1)(ii). See also *Mitigation of Orbital Debris*, Second Report and Order, 19 FCC Rcd 11567, 11580-83, paras 29-33 (background and discussion in proceeding originally adopting this rule).

<sup>197</sup> 33 FCC Rcd at 4169, para. 36.

<sup>198</sup> Further description of an Orbital Debris Assessment Report is included *infra* in section III.C.

<sup>199</sup> See *infra* section III.C.

<sup>200</sup> See *NPRM*, 33 FCC Rcd at 4169, para. 37.

<sup>201</sup> *Id.*

<sup>202</sup> See, e.g., Boeing Comments at 12; EchoStar/Hughes Comments at 4; CSSMA Comments at 18; Analytical Space Comments at 3-4; Commercial Spaceflight Federation Reply at 3; Audacy Reply at 5.

<sup>203</sup> CSSMA Comments at 18.

creation of orbital debris, consistent with the public interest in the continued viability of operations in LEO.

71. In its comments, ORBCOMM suggests that there should be updates to the Commission's rules more broadly on the topic of orbital debris and space traffic management.<sup>204</sup> "Given the limits of using models to forecast potential collision risks," ORBCOMM states, the Commission should adopt robust space traffic management obligations that would apply to small satellite system operators and other NGSO satellite system operators.<sup>205</sup> The Center for Space Standards and Innovation (CSSI) suggests that we consider reviewing the risk of collision in aggregate, rather than for each individual satellite.<sup>206</sup> As noted, subsequent to the release of the *Small Satellite NPRM*, the Commission adopted the *Orbital Debris NPRM*, seeking comment on a wide variety of topics related to orbital debris and operations under part 25, among other things. The issues raised by both CSSI and ORBCOMM are discussed more broadly in the *Orbital Debris NPRM*.<sup>207</sup> For purposes of this proceeding, we therefore adopt the certification regarding satellite risk of in-orbit collision with large objects as it was proposed in the *NPRM*, including that the certification will be on an individual satellite basis. This certification for streamlined small satellites may be modified, however, based on the outcome of the *Orbital Debris NPRM*.

#### 11. Other Characteristics

72. *Scope of Frequency Use.* In the *NPRM*, the Commission sought comment on the typical frequency use characteristics of small satellites that would be authorized under the proposed streamlined process, and on the type and quantity of spectrum that would be needed for small satellites to operate and the extent to which transmissions requiring larger bandwidth could be conducted via inter-satellite links or alternatives such as optical links.<sup>208</sup> CSSMA responded to the Commission's inquiry with fairly extensive information regarding typical current and future frequency use characteristics of small satellites, based on what it describes as its own internal review, taking into consideration its members' business plans and experiences.<sup>209</sup> SpaceX suggests that we consider specifying bandwidth and power limits for systems seeking streamlined consideration to correspond with the expectations expressed by the Commission in the *NPRM*.<sup>210</sup> Also, ORBCOMM suggests that the Commission should consider establishing a streamlined processing qualification envelope based more concretely on spectrum and orbit use.<sup>211</sup>

73. We do not find that it is necessary, however, even given the potential capabilities of a 180 kg satellite and some of the upper ranges of data rates, power levels, and bandwidths described by CSSMA, to adopt generalized limitations on spectrum use for streamlined small satellites, other than the

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<sup>204</sup> ORBCOMM Comments at 8; *see also* ORBCOMM Comments at 10 (discussing its concerns regarding a past planned deployment of a large number of small satellites from a deployment device).

<sup>205</sup> *Id.* at 10. ORBCOMM also suggests that the Commission should ensure that its rules complement the actions of other executive agencies regarding space traffic management. *Id.* at 10-11.

<sup>206</sup> *See* Daniel L. Oltrogge, The Center for Space Standards and Innovation (CSSI) Comments (rec. July 9, 2018) (CSSI Comments) (further suggesting that we consider a "fleet-summed time integrated value" for the probability of collision).

<sup>207</sup> *See Orbital Debris NPRM*, 33 FCC Rcd at 11361-63, paras. 26-28.

<sup>208</sup> *Id.* at 4175, para. 58.

<sup>209</sup> CSSMA Comments at 27, 27-28 (Table 1), 32-33 (Table 2), 34-35 (Table 3). CSSMA describes itself as one of the largest associations in the satellite industry, with 31 members from 11 countries. *Id.* at 1.

<sup>210</sup> SpaceX Comments at 3.

<sup>211</sup> ORBCOMM Comments at 6. ORBCOMM expresses concern that a 180 kg satellite can support a power subsystem that can output hundreds of watts of RF power and consume hundreds of megahertz of bandwidth, and is concerned about potential interference issues associated with this type of satellite communications footprint. *Id.*

sharing requirements that have already been described. Contrary to the suggestions of SpaceX and ORBCOMM,<sup>212</sup> we believe the other qualifying criteria of the streamlined process are sufficiently rigorous even without a limitation on bandwidths or power levels. Specifically, concerns regarding potential interference from a streamlined applicant, such as those expressed generally by ORBCOMM,<sup>213</sup> can be addressed through the application process described, wherein an applicant must certify and describe how its operations can share with existing operations in the requested frequency band and not materially constrain future operations. So long as an applicant can make a sufficient demonstration that it can satisfy those qualifying characteristics, we do not see a reason to adopt a rule limiting the power or bandwidth that can be used by streamlined licensees as a general matter. Depending on the system design and frequency band requested, a satellite that will operate at a higher power and use a larger bandwidth than what might now be considered typical for a small satellite may have difficulty sharing with other operations. In that case, such a satellite would not be able to be licensed under the streamlined process. In other instances, perhaps there are system characteristics that would permit sharing despite the fact that a satellite would be operating at a relatively higher power and/or using a larger bandwidth.

74. *Efficiency of Spectrum Use.* SpaceX proposes that the Commission consider efficiency of spectrum use as an additional criterion for small satellite applicants seeking streamlined treatment, and suggests that the Commission give applicants proposing more spectrally-efficient systems “more expedited consideration” under the streamlined process.<sup>214</sup> SpaceX expresses concern that some of the examples of indicia of sharing that the Commission listed in the *NPRM*, such as small satellites operating at only certain times during the day or only at specific geographic locations, would hamper another satellite system that sought to operate at the same times or in the same locations.<sup>215</sup> SpaceX suggests that, within the streamlined process, the Commission prioritize what SpaceX describes as technologically innovative approaches such as use of phased array antennas, and adaptive beam-forming strategies allowing for satellites to target narrow coverage areas more precisely and reuse spectrum many times over to maximize throughput.<sup>216</sup>

75. We decline to adopt a separate “spectrum efficiency” qualifying characteristic or to prioritize certain types of sharing within the streamlined process. We agree with SpaceX that spectral efficiency is important. However, the approach SpaceX identifies appears to relate to more general concerns applicable beyond the streamlined small satellite process, including the processing of NGSO-like applications in processing rounds. We continue to believe that more limited types of operations should be the focus of this proceeding. We do not believe anything would be gained by establishing some type of prioritization within the streamlined process for systems with certain types of technological capability related to spectrum efficiency, although we expect that such systems will be more readily able to establish that they can operate without materially constraining other operators.

### C. Application Requirements

76. We adopt our proposal from the *NPRM* to use the Form 312 and Schedule S as the basis for applications filed under the part 25 streamlined process.<sup>217</sup> Commenters who addressed this issue generally support our proposals.<sup>218</sup>

77. CSSMA suggests that we also consider allowing applicants to provide a range of

<sup>212</sup> See SpaceX Comments at 3; ORBCOMM Comments at 6.

<sup>213</sup> See ORBCOMM Comments at 5-6.

<sup>214</sup> SpaceX Comments at 14-15.

<sup>215</sup> *Id.* at 15.

<sup>216</sup> *Id.* at 14.

<sup>217</sup> 33 FCC Rcd at 4172-73, para. 47.

<sup>218</sup> See, e.g., Echostar/Hughes Comments at 8; CSSMA Comments at 24; Audacy Reply at 7.

operational altitudes and inclinations with their applications and to submit representative worst-case gain contour plots for antennas.<sup>219</sup> SES/O3b opposed CSSMA's proposal, arguing that orbital parameters and antenna gain contour plots are necessary for existing operators to conduct an analysis of the potential for interference posed by the small satellite system.<sup>220</sup> We decline to adopt CSSMA's proposal to relax the Schedule S requirements for small satellites. While we think that it is appropriate to streamline certain parts of our rules, we continue to believe that the requirements of Form 312 and Schedule S provide necessary basic information that allows the Commission to assess the suitability of the applicant for licensing and allows other operators to assess the risk of interference posed by the system, and we decline to make modifications to Schedule S. In the event that an applicant under the streamlined process has concerns or questions about how to fill out a certain part of Schedule S, the applicant may file a supplement explaining how it completed the form or otherwise inquire with staff about how best to proceed.<sup>221</sup>

78. Additionally, several commenters suggested that we specifically require the submission of an Orbital Debris Assessment Report.<sup>222</sup> An Orbital Debris Assessment Report is a report intended to document compliance with orbital debris mitigation requirements, using a format developed for NASA missions. It is described in the NASA Standard as having fourteen sections, some of which relate to the launch vehicle.<sup>223</sup> Some applicants for experimental and part 25 licenses currently submit a version of an Orbital Debris Assessment Report with their application materials, consisting of information relevant to an FCC evaluation. The information typically contained in an Orbital Debris Assessment Report is submitted to satisfy the Commission's existing orbital debris disclosure requirements, and some information in an Orbital Debris Assessment Report may be beyond what is currently required by the Commission's rules. The Orbital Debris Assessment Report usually contains, for example, a section on assessment of spacecraft debris released during normal operations, which would include descriptive information on any object expected to be released, a section on potential for explosions, which would provide detailed plans regarding passivation and other issues, and a section on potential for in-orbit collisions, which would include a calculation using the NASA Debris Assessment Software.<sup>224</sup> While the Orbital Debris Assessment Report format often includes sufficient information to satisfy FCC disclosure requirements, particularly for non-maneuverable spacecraft, it does not solicit information about some aspects of satellite operations, such as "flight plans" or the maintenance of orbital parameters via propulsion, that are identified in FCC rules. CSSMA and SIA suggest that we ask streamlined applicants to submit an Orbital Debris Assessment Report,<sup>225</sup> "prepared in a manner consistent with existing part 25 rules."<sup>226</sup> CSSMA states that preparation of an Orbital Debris Assessment Report is not a significant

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<sup>219</sup> CSSMA Comments at 23-24. Audacy similarly proposed that the Commission consider modifications to Schedule S to allow operators to input orbital parameters and service area plots in a way that recognizes that they will change over the course of the satellite's operational life. Audacy Reply at 7.

<sup>220</sup> SES/O3b Reply at 7-8. In SES/O3b's view, submission of a single worst-case representative antenna gain contour plot will not provide sufficient data to allow other satellite operators, which operate a range of NGSO-like as well as GSO systems, to adequately assess the potential impact of the proposed operations on their systems. *Id.* at 8.

<sup>221</sup> SIA also noted that spacecraft that will be in a non-Earth orbit are not able to provide orbital parameters relative to Earth, but orbital parameters could be provided relative to another celestial body. SIA Comments at 6. This type of explanation can be addressed in a narrative associated with the application.

<sup>222</sup> CSSMA Comments at 17; SIA Comments at 3; ORBCOMM Comments at 3-4; Audacy Reply at 5-6.

<sup>223</sup> See NASA Standard at Appendix A.

<sup>224</sup> See *id.*; NASA Orbital Debris Program Office, Debris Assessment Software, <https://orbitaldebris.jsc.nasa.gov/mitigation/debris-assessment-software.html> (last visited June 3, 2019)

<sup>225</sup> CSSMA Comments at 17, SIA Comments at 3.

<sup>226</sup> CSSMA Comments at 17.

burden to a satellite operator and provides all other operators and the Commission with detailed analysis of how the requirements are met.<sup>227</sup> It notes that the free NASA Debris Assessment Software is available to assist with such analysis, and that the analysis is a critical element of ensuring the orbital debris mitigation guidelines are met.<sup>228</sup> SIA notes that an Orbital Debris Assessment Report requirement would allow the Commission and other operators to review the assumptions and analysis that goes into the certifications. Relatedly, CSSI expresses concern that the standard applicant will not have the technical familiarity and subject matter expertise to certify their ability to assess collision probability.<sup>229</sup> CSSI also states that the Commission should allow sophisticated applicants to use a higher fidelity approach to determining probability of collision in certain instances.<sup>230</sup>

79. We adopt the certification process proposed in the NPRM. We decline to specify a single format, such as the Orbital Debris Assessment Report, for submitting information in response to orbital debris mitigation requirements, since we want to provide applicants with flexibility. However, certifications should not be made casually, and applicants should ensure that certifications are made only after appropriate planning and analysis. For that reason, it is advisable for applicants to prepare an Orbital Debris Assessment Report or similar document outlining the process used to verify the accuracy of certifications. We expect that all applicants will use the NASA Debris Assessment Software or other higher fidelity modeling tools to perform the calculations necessary to address the various certifications and will maintain documentation associated with each of the certifications for inclusion in the public application file upon request.<sup>231</sup> Furthermore, because the certifications will not in all circumstances address all required disclosures under our debris mitigation rules, applicants will need to submit narrative information in addition to certifications.

#### D. Application Processing

80. There is general support in the record for the proposal to exempt streamlined small satellites from the NGSO processing round procedures.<sup>232</sup> We adopt our proposals related to streamlined application processing based on our understanding of the characteristics and scope of operations that generally define small satellites. In particular, as noted in the *NPRM*, a small satellite is typically designed to serve its purpose within a limited, relatively short period of time, and these satellites have more limited frequency use characteristics than more traditional operations licensed under part 25.<sup>233</sup> An

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<sup>227</sup> *Id.* at 17-18.

<sup>228</sup> *Id.* at 18.

<sup>229</sup> CSSI Comments.

<sup>230</sup> *Id.* CSSI suggests that the Commission consider posting a link to an online tool, the “Number of Encounters Assessment Tool” for calculating collision risk against larger objects. *Id.* (citing ComSpOC Number of Encounters Assessment Tool, <http://comspoc.com/neat/> (last visited Feb. 21, 2019)). This website is maintained by a private third party, Analytical Graphics, Inc.

<sup>231</sup> *See, e.g.*, University Small-Satellite Researchers, IB Docket Nos. 18-86 and 18-313, at 14 (rec. Apr. 5, 2019). In comments filed to the *Orbital Debris NPRM* and also filed in the docket for this proceeding, University Small-Satellite Researchers suggest that the Commission clarify what is an acceptable analytical method for an applicant to determine compliance with the 0.001 collision risk probability, for example. *Id.*

<sup>232</sup> *See, e.g.*, Analytical Space Comments at 11-12; CSSMA Comments at 21; Globalstar Comments at 6; ORBCOMM Comments at 6-7; University Small-Satellite Researchers Comments at 12-13; Xplore Reply; Audacy Reply at 6; CSSMA Reply at 15.

<sup>233</sup> *See NPRM*, 33 FCC Rcd at 4165, para. 26; *see also id.* at 4175-76, para. 58. In the past, the Commission has granted waivers of the processing round rules for NGSO satellites, including small satellites, and these waivers were based on the applicants’ demonstrations that they can avoid interference events through means such as scheduling of transmissions, and also that they would not preclude future entrants from using the same spectrum. *See id.* at 4171, para. 42 (citing, for example, IBFS File No. SAT-LOA-20130626-00087 (granting waiver of the modified processing round conditioned on the ability of future operators to enter the 8025-8400 MHz frequency band)).

applicant under the streamlined process will not be subject to processing round procedures or default service rules.<sup>234</sup>

81. Instead, we adopt the following qualifying requirement, generally as proposed in the *NPRM*, designed to support the exemption for these small satellites from the part 25 processing round.<sup>235</sup> An applicant will be required to (a) certify that operations of its satellites will not interfere with those of existing operators, (b) certify that it will not materially constrain future operators from using the assigned frequency band(s), and (c) provide a brief narrative description illustrating the methods by which both current and future operators will not be materially constrained. We expect that the spectrum demands of systems qualifying for the streamlined process will differ substantially from the requirements for full-time system availability that characterize the NGSO systems typically processed through a processing round.<sup>236</sup> Examples of applications that might satisfy these sharing requirements may include scenarios in which a satellite operates with a limited number of earth stations and downlinks during relatively short periods of time, with the ability to effectively schedule transmissions such that future satellite entrants can be accommodated.<sup>237</sup> Applications that fail to adequately satisfy the sharing demonstration will be subject to dismissal, without prejudice to refile for processing under regular part 25 procedures. We note that even if an applicant's demonstration does satisfy this qualifying criteria for streamlined processing, that does not automatically mean the application for the requested frequency bands will be granted—the proposed RF operations will be subject to further review for compliance with the Commission's rules and policies, as with a regular part 25 application, and may require coordination with other operations in the band, whether those operations are commercial (including satellite and non-satellite) or Federal in nature, and may be subject to additional conditions as necessary.

82. We note that in the *NPRM* the Commission proposed that small satellite applicants be required to certify and demonstrate that they would not “unreasonably preclude” future operators from using the assigned frequency band(s). In comments, Boeing expresses concern that the “unreasonably preclude” certification standard may impose little or no practical obligation on licensees.<sup>238</sup> We agree, and we find that requiring that applicants' planned operations not “materially constrain” future entrants from using the frequency band(s) imposes a clearer obligation on licensees vis-à-vis a future satellite operator in the same band(s). For example, under an “unreasonably preclude” standard an applicant could

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<sup>234</sup> See 47 CFR § 25.157 (consideration of applications for NGSO-like satellite operation); 47 CFR § 25.127 (default service rules). ORBCOMM states that the *NPRM* proposed to use “first-come, first-served” approach for streamlined small satellites. ORBCOMM Comments at 6. While the new process is a first-come, first-served process in the sense that applications will be processed without establishing the “cut-off” dates used in processing rounds, the approach proposed and adopted here differs in some respects from the Commission's first-come, first-served procedures as applied in the geostationary-orbit satellite (GSO) context. See 47 CFR § 25.158. In that context, FCC rules preclude subsequent operators seeking to operate at or close to the same particular orbital location with the same coverage and in the same frequency band. See, e.g., *Amendment of the Commission's Space Station Licensing Rules and Policies*, First Report and Order and Further Notice of Proposed Rulemaking, 18 FCC Rcd 10760, 10795, para. 79 (2003); compare *Orbcomm License Corp.*, 23 FCC Rcd 4804, at n. 26 and para. 23 (applying a first-come first served approach, subject to accommodation of new licensees). By contrast, here there are no “orbital locations” as there are in GSO, and a small satellite operator filing subsequent to another small satellite operator in the same frequency bands will not be precluded, since the initial filer (and all subsequent filers) will have certified that its operations will not materially constrain future operators in the requested frequency bands.

<sup>235</sup> See *NPRM*, 33 FCC Rcd at 4171, para. 42 (noting that the Commission has granted waivers of the processing round in certain circumstances, relying on the applicants' demonstrations that they can avoid interference events through means such as scheduling transmissions, and would not preclude future entrants from using the same spectrum).

<sup>236</sup> See *id.*

<sup>237</sup> See *id.*

<sup>238</sup> Boeing Comments at 4-5.



have sought to operate in such a way that would make it impractical for future entrants to operate in the frequency band, but may argue that the preclusion is somehow “reasonable.” Under a review of whether that same applicant would impose material constraints on future entrants into the frequency band, however, it would be clear that such operations would be imposing material constraints, and the applicant would not be able to argue that it satisfies the required certification. Thus, we find that the “materially constrain” standard provides more clarity to applicants in what the Commission will consider as an adequate certification and demonstration supporting exemption from the processing round procedures. In the *NPRM*, the Commission described an example scenario, where a satellite operates with a limited number of earth stations for purposes of downlinking sensing data during relatively short periods of time, but still may be able to accommodate future entrants using the same frequency bands.<sup>239</sup> The Commission could find that such operations would not materially constrain future entrants from using the frequency bands, even if new entrants might be unable to use the frequencies for certain periods of time at certain locations when the earlier-licensed operator is communicating with its earth stations, and so would satisfy the requirements we adopt here.

83. Boeing further argues that even following authorization, a streamlined licensee should be required to make “technically feasible” changes to its system if required to facilitate sharing of scarce orbital and spectrum resources with other small commercial satellites.<sup>240</sup> In Boeing’s view, non-streamlined NGSO licensees are arguably subject to a higher standard of sharing with other operators than “unreasonable preclusion,” in that they are required to “discuss their technical operations in good faith with an aim to accommodating both systems.”<sup>241</sup> So long as the applicant has provided the required certifications and narrative that describes the methodology by which the system is capable of sharing with other operations and will not materially constrain future entrants in the requested frequency band, we see no reason to impose additional generalized obligations—specifically the inclusion of a “technically feasible” requirement, as Boeing suggests, in addition to the proposed certifications. It is important to note, however, that we expect the methodology for sharing to include coordination in good faith with other operators, including, if necessary, acceptance of new constraints on operations, because failing to do so would in effect be “materially constraining” other operations. We expect that the system design will also provide a basis for capability to share, alongside the fact that no more than 10 satellites will be authorized under a single license and the total term for all operations under a license will not exceed six years.

84. Several commenters suggest criteria for examining the sufficiency of certifications concerning impact on other operations. Iridium states that eligible small satellite applicants should not be able to obtain a license based on conclusory assertions that they will operate on a non-interference, unprotected basis but should be required to explain the technical basis for their determination that there will be no harmful interference.<sup>242</sup> We agree. The narrative statement supporting certification will require more than a conclusory assertion. A commitment to cease transmissions if interference is reported is not sufficient by itself. Instead, the narrative should provide a technical analysis to support the

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<sup>239</sup> *NPRM*, 33 FCC Rcd at 4171, para. 42.

<sup>240</sup> Boeing Comments at 4. As examples of technically feasible “adjustments,” Boeing references some of the indicia of sharing described in the *NPRM* such as limiting transmissions to certain times of day, limiting earth stations to certain defined geographic locations, and installing directional antennas on ground stations. *Id.* (citing *NPRM*, 33 FCC Rcd at 4171, para. 43).

<sup>241</sup> Boeing Comments at 5 (quoting *Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters*, Report and Order and Further Notice of Proposed Rulemaking, 32 FCC Rcd 7809, 7825, para. 48 (2017) (*NGSO FSS R&O*)). Boeing also notes that the ITU has employed similar guidance, explaining that “no administration obtains any particular priority as a result of being the first to start either the advance publication phase (section I of Article 9) or the request for coordination procedure (section II of Article 9).” Boeing Comments at 5 (quoting ITU-R Rules of Procedure, part A1, AR9 at 3 (interpreting ITU R.R. 9.6)).

<sup>242</sup> Iridium Comments at 8.

applicant's certification. Of course, the content and length of the narrative may vary depending on what frequency band is requested. The radiofrequency environment in a particular requested frequency band, as well as the scope and type of operations contemplated by the applicant, will inform the content of the narrative description, including whether coordination is necessary with incumbent operators. Relatedly, ORBCOMM urges the Commission to require any new small satellite system applicant to complete spectrum and orbit resource coordination before any such applicant is authorized to operate any satellites under the streamlined procedures.<sup>243</sup> In a frequency band where the only viable way to share with an existing operator is through operator-to-operator coordination, we would expect that the applicant would describe the status of that coordination process and reserve the right to grant the application only after that coordination is completed.

85. Additionally, SIA proposes that the Commission allow applicants for the streamlined process to identify ground station requirements or ground station options, rather than specify a complete ground station plan in the narrative.<sup>244</sup> According to SIA, once an applicant knows its ground station plan, it can provide the plan in a supplemental filing and/or through direct communications with other operators during the coordination process.<sup>245</sup> We decline to adopt SIA's suggestion and will require that applicants provide ground station information along with their application. We appreciate SIA's interest in providing applicants with flexibility and recognize that ground station plans can sometimes change as system design evolves. However, ground station plans are an important part of the coordination process, including with Federal users. Other operators are likely to be interested in ground station plans as well, and therefore this information is an important part of the public record for a streamlined small satellite application. We believe that this information should be made available at the outset to the fullest extent possible, even if in some instances it may need to later be revised.

86. We received several comments suggesting that the Commission modify public notice procedures to its standard application review processes for small satellite applications.<sup>246</sup> CSSMA proposes a reduction in the public notice period for the streamlined process to 15 days and proposes that the nature of comments be limited to only those that challenge the qualifications of an operator to use the streamlined process.<sup>247</sup> We decline to adopt these proposals. Under our current part 25 rules, once public notice has been issued announcing that an application has been accepted for filing, interested parties have up to 30 days to file a petition to deny, petition for other form of relief or other objections or comments.<sup>248</sup> We conclude that the amount of time gained from reducing the public notice period would not be worth establishing an entirely separate set of timelines for the comment period on these streamlined applications, and might unreasonably restrict the opportunity for meaningful comment on applications.

87. We also decline to limit the scope of issues that comments can address as requested by CSSMA.<sup>249</sup> If an interested party has a concern about something outside the scope of the streamlined characteristics, for example, the orbital parameters of a particular system, or seeks clarification on what it views as an inconsistency within an application, that interested party should be able to raise those issues within the public notice process. We also note that applications will include narrative information that

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<sup>243</sup> ORBCOMM Comments at 16; ORBCOMM Reply at 5.

<sup>244</sup> SIA Comments at 3; *see also* CSSMA Reply at 16-17.

<sup>245</sup> SIA Comments at 3.

<sup>246</sup> CSSMA Comments at 22-23; University Small-Satellite Researchers Comments at 13; SIA Comments at 3-4; CSSMA Reply at 14-15.

<sup>247</sup> CSSMA Comments at 22.

<sup>248</sup> *See* 47 CFR § 25.154(a)(2).

<sup>249</sup> While we recognize that the experimental category of applications does not have a public notice and comment process, that category is not meant for commercial operations and all operations under an experimental license must be on a non-interference and unprotected basis.

addresses matters other than eligibility for the small satellite licensing process. Restricting comment concerning this information and any issues it may raise would be unreasonable.

88. CSSMA further requests that we institute a period of 45 days for comments to be resolved between operators following the end of the public notice period, and that in the absence of an agreement, the Commission must act to dismiss the application or dismiss the petition to deny.<sup>250</sup> We believe adding this formal timeline is also unnecessary. As the Commission has stated in various arenas, including for example, in the context of NGSO operator-to-operator coordination, we expect parties to coordinate in good faith.<sup>251</sup> If questions arise as to whether a party is coordinating in good faith to resolve an issue, the matter may be quickly brought to the attention of the Commission, and we will intervene to make a decision. We do not find it necessary to adopt a rule on this topic, however, since the circumstances will differ for each individual scenario.

89. Additionally, the University Small-Satellite Researchers and CSSMA ask that we provide additional transparency by instituting a process to enable application tracking, following the submission of an application to the Commission, for example, through the International Bureau Filing System (IBFS), for both the streamlined process and regular part 25 applications.<sup>252</sup> While we understand the desire for timely feedback both on any technical issues with an application as well as on application status, we believe that our existing system is adequate and decline to make changes to our application tracking systems as part of this proceeding.

#### E. Interference Protection Status

90. The *NPRM* proposed that systems authorized under the streamlined process would typically receive the level of interference protection they are entitled to under the relevant service allocation in the U.S. Table of Frequency Allocations (U.S. Table).<sup>253</sup> In bands where part 25 licensees have been authorized pursuant to a non-streamlined process, i.e., through a processing round, the Commission proposed that licensees under the streamlined process would be subject to some limitations on a frequency-band specific basis, including, in appropriate circumstances, that operations are on a non-interference basis with respect to part 25 systems authorized in a processing round.<sup>254</sup> The Commission also sought comment on the interference protection status of streamlined small satellites vis-à-vis non-satellite services.<sup>255</sup>

91. Commenters generally support adoption of the Commission's proposal that systems authorized under the streamlined process would typically receive the level of interference protection they are entitled to under the relevant service allocation in the U.S. Table of Frequency Allocations (U.S. Table),<sup>256</sup> and we adopt this proposal. Small satellites authorized through the streamlined procedure will

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<sup>250</sup> CSSMA Comments at 22-23.

<sup>251</sup> See *NGSO FSS R&O*, 32 FCC Rcd at 7825, para. 48 (“If a question arises as to whether one operator is coordinating in good faith, the matter may be brought to the Commission and we may intervene to enforce the condition or aid the parties to find a solution.”).

<sup>252</sup> See University Small-Satellite Researchers Comments at 13; CSSMA Reply at 14.

<sup>253</sup> 47 CFR § 2.106. See *NPRM*, 33 FCC Rcd at 4172, 4175, paras. 44, 56.

<sup>254</sup> 33 FCC Rcd at 4172, para. 44.

<sup>255</sup> *Id.* at 4175, para. 56.

<sup>256</sup> 47 CFR § 2.106. See *NPRM*, 33 FCC Rcd at 4172, 4175, paras. 44, 56. See e.g., Boeing Comments at ii; CSSMA Comments at 30-31; University Small-Satellite Researchers Comments at 15. In comments, the Commercial Spaceflight Federation and Analytical Space suggest that the Commission eliminate mention of “interference protection” for small satellites, but these parties appear to believe that the *NPRM* proposed requiring interference protection for all small satellite operations, including experimental satellites, which is not the case. See Analytical Space Comments at 6-7; Commercial Spaceflight Federation Comments at 2.

in general have status consistent with the relevant service as allocated in the U.S. Table<sup>257</sup> and will be subject to the same rules as a regular part 25 licensee with respect to sharing with systems operating in frequencies allocated to other services, including non-satellite services. However, we will evaluate small satellite applications filed under the streamlined procedure on a case-by-case basis, and if necessary, may impose certain other conditions to minimize adverse effects of such operations on current or potential future use of the relevant bands by satellite and non-satellite services, including the protection of, or acceptance of interference from, satellite and non-satellite services. In evaluating the effects of small satellite operations on current or potential use of the relevant bands by other services, we will evaluate the proposed operations as we would those of any other system filed under Part 25. For operations in bands shared with Federal users, conditions may also be imposed as required per coordination of the requested operations with Federal users.<sup>258</sup>

92. With respect to the status of streamlined licensees vis-à-vis regular part 25 licensees, we also adopt the Commission's proposal that streamlined small satellites will operate on a non-interference basis relative to regularly-authorized part 25 satellites<sup>259</sup> operating in the same service.<sup>260</sup> Some commenters state that streamlined small satellite licensees should be required to protect all regularly authorized part 25 licensees operating in any service, even if they are operating in a service with a lower allocation status.<sup>261</sup> In the unlikely event that a streamlined small satellite licensee is operating in a service that has a higher status afforded by the U.S. Table than a service being used by a regularly-authorized part 25 operator, however, we would not expect that the small satellite would be required to, for example, accept harmful interference from the regular part 25 operator.

#### F. Revised Bond Requirement

93. The *NPRM* sought comment on the proposal to adopt a one-year "grace period," applicable to small satellite streamlined licensees, during which the licensees would not need to post the surety bond required under the Commission's rules.<sup>262</sup> We adopt the *NPRM* proposal. As proposed and adopted, this grace period would begin 30 days after the license was granted.<sup>263</sup> Under the existing rules, licensees for most NGSO systems are required to have a surety bond on file no later than 30 days

<sup>257</sup> See 33 FCC Rcd at 4172, para. 44.

<sup>258</sup> See *infra* section III.I.1.

<sup>259</sup> There is support in the record for requiring streamlined licensees to protect regular part 25 licensees or market access grantees operating in the same service, including those processed through a processing round, as well as those authorized through first-come, first-served procedures or granted waivers related to application processing. See, e.g., Boeing Comments at 6. Thus, "regularly-authorized" part 25 licensees or grantees will be any satellites or systems authorized under part 25 not through the streamlined small satellite process. To the extent that any operator has concerns about interference to its authorized part 25 system, that operator may raise concerns regarding the application through the standard public notice process.

<sup>260</sup> See, e.g., CSSMA Comments at 30 (stating that small satellites under the streamlined process that are not subject to a processing round should have a lower level of spectrum rights than satellites that have spectrum allocated via a processing round in the same level of priority).

<sup>261</sup> See, e.g., Boeing Comments at 6; Iridium Comments at 8; see also EchoStar Comments at 5-6 (suggesting that to the extent that small satellites are permitted to operate in frequency bands allocated for FSS operations, that they are required to operate on a secondary, non-interference basis with respect to other satellite operations).

<sup>262</sup> *NPRM*, 33 FCC Rcd at 4173, para. 49. The Commission's rules require that most NGSO licensees or recipients of market access must have on file a surety bond, requiring payment in the event that the licensee either fails to meet certain build-out milestones specified in the Commission's rules, or surrenders the license before meeting certain milestones for the operation of its system. See 47 CFR §§ 25.164 (milestones), 25.165 (surety bonds). See also 47 CFR § 25.137(d)(4) (surety bond requirement applies for non-U.S.-licensed space stations that are not in orbit and operating).

<sup>263</sup> *NPRM*, 33 FCC Rcd at 4173, para. 50.

following grant of a license or request for market access.<sup>264</sup> The surety bond must initially require payment of \$1 million in the event of default, and the amount payable under the bond must steadily escalate, to a maximum of \$5 million.<sup>265</sup> Under the rules, a licensee will be considered to be in default with respect to the bond if it fails to satisfy certain milestone requirements or surrenders its license before meeting an applicable milestone requirement.<sup>266</sup> The part 25 milestone rules require that a recipient of an initial authorization for an NGSO system must launch 50% of the maximum number of space stations authorized for service, place them in their assigned orbits, and operate them in accordance with the station authorization no later than 6 years after the grant of the authorization.<sup>267</sup> As adopted here for streamlined small satellite systems, if by the end of the one-year grace period this milestone has been met then no bond is required.<sup>268</sup>

94. While several commenters agree with our proposal to modify the bond requirement by adopting a grace period for streamlined small satellites,<sup>269</sup> a number of commenters argue that the bond requirement should be eliminated altogether for small satellites authorized under the streamlined process.<sup>270</sup> Many of these commenters contend that spectrum “warehousing”<sup>271</sup> is not implicated by the streamlined process, since spectrum would be authorized on a non-exclusive basis, and therefore there is no need for the bond and milestone requirements as a deterrent to speculative applications.<sup>272</sup>

95. We are not convinced by the argument that there is no value to having any type of bond requirement for these systems. As the Commission recently noted in a separate proceeding, unused authorizations for spectrum-orbit resources can create unnecessary coordination burdens and uncertainty for other operators.<sup>273</sup> This is true even where, as under the streamlined process, the satellite operators have effectively the same status relative to each other, and the frequency assignments are non-exclusive. While some commenters allege that the application fee presents a sufficient deterrent to speculative applications in this area,<sup>274</sup> we disagree, since some applicants could view a Commission license grant as an asset worth the now-reduced application fee, even though their satellite or system is far from launch.

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<sup>264</sup> 47 CFR §§ 25.165(a)(1); 25.137(d)(4). The exceptions to the NGSO surety bond requirement are for Direct Broadcast Service (DBS) space stations, Satellite Digital Audio Radio Service (SDARS) space stations, and space stations that will replace an existing NGSO space station, none of which are relevant to the streamlined small satellite process. See 47 CFR § 25.165(a), (e).

<sup>265</sup> 47 CFR § 25.165(a)(1).

<sup>266</sup> 47 CFR § 25.165(c).

<sup>267</sup> 47 CFR § 25.164(b)(1). There is an additional build-out milestone for NGSO systems that have met the 6-year milestone. This additional milestone requires that the full system be launched and operational by nine years after grant or accept a reduction in its authorized satellites to the number launched and operational at that time. 47 CFR § 25.164(2).

<sup>268</sup> *NPRM*, 33 FCC Rcd at 4174, para. 53.

<sup>269</sup> See University Small-Satellite Researchers Comments at 14; SES/O3b Reply at 10.

<sup>270</sup> CSSMA Comments at 24-25; Boeing Comments at 7-8; ORBCOMM Comments at 7; Commercial Spaceflight Federation Comments at 6; Analytical Space Comments at 11; HybridX Comments at 3; Audacy Reply at 7-8; CSSMA Reply at 17-18. To the extent that commenters ask us to revisit the bond requirement for all NGSO systems, that issue is outside the scope of this proceeding. See ORBCOMM Comments at 7; CSSMA Reply at 18.

<sup>271</sup> The Commission has described “warehousing” as occurring when an entity holds exclusive authorization on priority for spectrum use or an orbital position, but is unable or unwilling to deploy its authorized satellite system in a timely manner.

<sup>272</sup> See CSSMA Comments at 25; Boeing Comments at 7-8; ORBCOMM Comments at 7; Commercial Spaceflight Federation Comments at 6; HybridX Comments at 3; Xplore Reply; CSSMA Reply at 17.

<sup>273</sup> *NGSO FSS R&O*, 32 FCC Rcd at 7830, para. 66, note 146.

<sup>274</sup> See CSSMA Comments at 25; Audacy Reply at 8.

96. Boeing suggests that if we do decide to retain the bond for streamlined small satellite licensees, the grace period should be extended to two years.<sup>275</sup> Boeing states that satellite operators may order long-lead items such as radio transmitters and receivers only after securing Commission authorization for particular frequency bands, and that the manufacturing time for these items combined with spacecraft assembly, testing, and scheduling of launch can easily exceed 12 months.<sup>276</sup> We decline to extend the grace period to more than one year, as we believe the one-year time period provides a benefit to operators qualifying for the streamlined process and is consistent with the typically shorter development timelines for these satellites, while deterring speculative filings. Before the one-year mark, we believe a licensee should be able to assess if and when it will realistically be able to begin operations. Thus, we adopt the one-year grace period before an operator must file a bond.

97. Consistent with the *NPRM* proposal, we also conclude that following the one-year grace period, operators that have met the 50% milestone may still launch and operate additional satellites, provided that the satellite(s) can still satisfy the criteria for the streamlined process, including deorbit within the six-year license term.<sup>277</sup> Licensees failing to begin operations during the one-year grace period may surrender their license to avoid the bond requirement, and would not be precluded from filing another license application.<sup>278</sup> Finally, licensees launching and operating one or more satellites within the one-year grace period, but failing to launch and operate 50% of their authorized satellites within that period, may choose to either post a bond and be subject to the standard NGSO bond and milestone requirements,<sup>279</sup> or in the case of licenses that specify multiple satellites, accept an automatic reduction in the number of authorized satellites to the number actually in orbit as of the close of the grace period.<sup>280</sup>

#### G. Technical Rules

98. We adopt the proposal from the *NPRM* that the existing generally applicable technical rules in part 25 also apply to small satellites authorized under the streamlined process. No commenters disagreed with this proposal.<sup>281</sup>

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<sup>275</sup> Boeing Comments at 8-9. *See also* CSSMA Reply at 18.

<sup>276</sup> Boeing Comments at 8-9.

<sup>277</sup> *See NPRM*, 33 FCC Rcd at 4174, para. 52.

<sup>278</sup> Boeing argues that licensees should be able to secure extensions on the grace period if good cause is shown, and CSSMA argues that the process of requesting waivers of bonding requirements on a case-by-case basis creates burden on the Commission and licensee and could create inefficiencies in the streamlined process. Boeing Comments at 8, CSSMA Comments at 25. Given the one-year grace period, we do not expect that many licensees will be granted waivers of the bond and milestone requirements. We expect that licensees will plan in advance for launch delays and other events that may delay initial operations of their satellite or satellites.

<sup>279</sup> The applicable NGSO milestones and bond amount will be calculated from the time of license grant, thus, while a licensee has a one-year grace period from filing the bond, the licensee must secure a bond in the amount that is required one year into its license grant. *See* 47 CFR § 25.165(a)(1). Similarly, the applicable milestone will be calculated beginning on the date of license grant. *See* 47 CFR § 25.164(b)(1).

<sup>280</sup> *See NPRM*, 33 FCC Rcd at 4174, para. 53. Boeing suggests that we alternatively adopt a build-out requirement voiding the license if the streamlined small satellite licensee has not launched at least one of the satellites authorized by the license within three years of the license grant. Boeing Comments at 8. We find that applying the existing milestone and bond requirements, with a bond grace period, achieves the same incentives, but gives applicants additional flexibility and does not require creation a separate build-out regime from what is already applicable to NGSO systems.

<sup>281</sup> *See* University Small-Satellite Researchers Comments at 15 (agreeing that part 25 technical rules such as limits on out-of-band emission and power limits should apply to small satellites authorized under the streamlined process); EchoStar/Hughes Comments at 5 (stating that adherence to the existing technical rules will ensure that small satellites will operate safely, in compliance with international rules, and avoid interference to other satellite

(continued....)

## H. Fees

99. *Application Fees.* We adopt the *NPRM* proposal and set an application fee for applicants under the part 25 streamlined process at \$30,000. At this time, we believe this application fee is a reasonable estimate of the cost of processing these types of applications. Under a recent amendment to the Communications Act (the Act), the RAY BAUM'S Act of 2018, which became effective October 1, 2018,<sup>282</sup> the Commission is directed to "amend the schedule of application fees . . . if the Commission determines that the schedule requires amendment . . . so that such schedule reflects the consolidation or addition of new categories of applications."<sup>283</sup> The Act states that "[t]he Commission shall assess and collect application fees at such rates as the Commission shall establish in a schedule of application fees to recover the costs of the Commission to process applications."<sup>284</sup> Our preliminary estimate of the cost of processing these types of applications is approximately \$30,000.<sup>285</sup> Processing these applications will include, among other things, review of the Form 312 and Schedule S, as well as review of the certifications and narrative for acceptability for filing, preparation of public notices, review of the applications on the merits and preparation of grant documents, including development of grant conditions. Applications will also require submission of ITU filings, and prior to grant many applications are likely to require coordination either with other Commission bureaus or offices and/or with Federal users.<sup>286</sup> As more experience in processing these new streamlined small satellite applications is acquired, this fee may be reviewed in the future and adjusted as necessary. However, our expectation is that review of satellite applications filed under the proposed streamlined process will be less resource-intensive than the review of a regular part 25 NGSO application, given the streamlined application process we adopt here, including lack of processing rounds.<sup>287</sup>

100. As noted, we are adopting our proposal to make streamlined processing available for entities seeking access to the U.S. market using foreign-licensed satellites through a declaratory ruling.<sup>288</sup> While in the past application fees have not applied to foreign-licensed entities seeking access to the U.S. market through a declaratory ruling,<sup>289</sup> here we are adopting an entirely new regulatory process designed for small satellites, and a fee category pursuant to the recent amendments to the Act. As noted, section 8 of the Act, as revised, requires that the Commission assess and collect application fees at such rates as to "recover the costs of the Commission to process applications."<sup>290</sup> This represents a change from the prior version of section 8 of the Act, which established a schedule of fees, including specific fee categories, by

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operations). *See also* CSSMA Comments at 29, 37 (asking that the Commission not create additional technical rules specific to small satellite operations, but not disagreeing with the application of existing rules).

<sup>282</sup> 47 U.S.C. § 158. Consolidated Appropriations Act, 2018, Division P — RAY BAUM'S Act of 2018, Title I, FCC Reauthorization, Public Law No. 115-141, § 102, 132 Stat. 348, 1082 (2018) (codified at 47 U.S.C. § 158).

<sup>283</sup> 47 U.S.C. § 158(c)(2).

<sup>284</sup> 47 U.S.C. § 158(a).

<sup>285</sup> *See* 47 U.S.C. § 158(a) ("The Commission shall assess and collect application fees at such rates as the Commission shall establish in a schedule of application fees to recover the costs of the Commission to process applications.").

<sup>286</sup> In estimating the costs of processing these applications for purposes of this proceeding, we generally considered, for example, the expected tasks required to process an application, the job title of employees performing the specific tasks, general schedule pay grade for those employees, estimated expected number of hours per task, and estimated probability that the task needs to be performed in processing any particular application.

<sup>287</sup> *See* 47 U.S.C. § 158(a).

<sup>288</sup> *See supra* section III.A.

<sup>289</sup> *See NPRM*, 33 FCC Rcd at 4182, n.206.

<sup>290</sup> 47 U.S.C. § 158(a).

statute, and did not give the Commission authority to establish new categories of application fees. Here, where we are adding a new category to the fee schedule, pursuant to our authority under section 8 as revised, the new fee we are adding should recover the processing costs associated with such applications, which will include petition for declaratory ruling applications from entities seeking to access the U.S. market using foreign-licensed satellites through the small satellite process.<sup>291</sup> These filings will include the same information as applications for U.S. licenses, and can be expected to incur comparable processing costs.<sup>292</sup> Therefore, in order to comply with the statute as revised, we conclude that the \$30,000 application fee will apply to entities seeking market access for small satellites under the streamlined process. The amendment of the fee schedule for small satellites and small spacecraft within the NGSO category is an amendment to the schedule as defined in section 8(c) of the Act, which, pursuant to section 9a(b)(2), must be submitted to Congress at least 90 days before it becomes effective.<sup>293</sup>

101. In adopting this new application fee category and application fee amount as part of this proceeding, we make an important observation. The Commission will be undertaking, as part of a separate proceeding, a comprehensive review of its application fees, which may consider, among other things, the appropriate methodologies for calculating application fees. We believe it is nonetheless appropriate to adopt a fee here, as it will permit us to begin processing applications under the small satellite process – which should ultimately yield more data on what Commission resources are required for application processing in this area. We understand there is additional work to be undertaken in this area regarding specific methodologies for calculating fees, and that, as noted above, modifications may be necessary to the \$30,000 fee adopted here as such methodologies are implemented, and the Commission gains experience processing these types of applications.<sup>294</sup> The existing fee for NGSO part 25 systems, \$471,575.00, is plainly not an appropriate fee for much-less-resource-intensive review required for these systems.

102. No commenter opposed the proposed fee, and several commenters argued that there were powerful policy reasons for adopting a lower fee for small satellite applications.<sup>295</sup> We recognize these policy rationales, while noting that the basis of our adoption of the \$30,000 fee is the estimated cost of

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<sup>291</sup> In this proceeding we address the issue of application fees for U.S.-market access applicants only as it pertains to the new “small satellite” fee category we are adopting here. We do not address application fees pertaining to authorizations for U.S. market access outside the small satellite process.

<sup>292</sup> Unlike for U.S.-licensees, the Commission would not submit ITU filings for non-U.S.-licensed systems, but we do not expect for this to account for much difference in processing costs. This minor differentiation can be addressed as part of the Commission’s overall review of fees, which will be informed by our experience processing these applications.

<sup>293</sup> 47 U.S.C. § 159A(b)(2).

<sup>294</sup> In an *ex parte* filing, Loft Orbital Solutions Inc. (Loft Orbital) requests that the Commission proportionally reduce other fees as well for systems that qualify for small satellite streamlined processing, such as transfer of control, assignment, modification, or amendment fees. *See* Letter from Tony Lin, Hogan Lovells US LLP, to Marlene H. Dortch, Secretary, FCC, IB Docket No. 18-86 at 1 (filed July 25, 2019); *see also* 47 CFR § 1.1107 (listing in the schedule other types of fees for NGSO space station filings). We decline at this time, and based on the record established in this proceeding, to undertake revisions to those additional types of application fees. These fees will be considered as part of the Commission’s upcoming proceeding on application fees, which may, for example, discuss the threshold question of whether fees different from those for other NGSO systems are appropriate for streamlined small satellite system transfers of control, amendments, etc.

<sup>295</sup> *See, e.g.*, CSSMA Comments at 7 (“CSSMA believes that a limit of ten satellites per license, when paired with the Commission’s suggested fee of \$30,000 (which equates to as low as \$3,000 per satellite), is a reasonable fee for small innovative companies to pay to license their satellites out of the United States.”); Boeing Comments at 10; Commercial Spaceflight Federation Comments at 8 (stating that it believes \$30,000 to be an appropriate application fee – most likely not a barrier to aspiring commercial operators but high enough to avoid frivolous applications); Steven Nixon, President, Small Satellite Alliance, *Ex Parte* Letter (filed March 4, 2019) (supporting reduced application fees for small satellite systems).



processing the application. The University Small-Satellite Researchers would have the Commission go further, and urge us to make the streamlined process viable for educational and scientific missions<sup>296</sup> and to place the application fees for small satellite applicants from educational institutions on par with the fee structure for part 5 experimental licenses.<sup>297</sup> The University Small-Satellite Researchers contend that the Commission should consider holistically the aggregate impact of both the application fee and multiple years of regulatory fees on small satellite missions.<sup>298</sup> According to the University Small-Satellite Researchers, aggregating the proposed application fee along with the proposed regulatory fee for a two-year mission could result in a fee that could represent more than 15 percent of the budget of an educational satellite mission.<sup>299</sup> They suggest that these costs are likely to be prohibitive for even well-resourced missions and therefore the additional interference protections<sup>300</sup> and other benefits of the streamlined part 25 process will not be sufficient to enable educational institutions to shoulder the additional costs.<sup>301</sup> We emphasize that the part 5 experimental licensing process will remain available for academic and research missions. We appreciate that even the much-reduced \$30,000 application fee can be significant for research missions, but we disagree with the suggestion that the Commission create a separate application fee category for a subset of licensees, such as educational institutions, within the NGSO streamlined small satellite fee category. Under section 8 of the Act, the Commission is directed to set application fees that cover the costs of the Commission to process applications,<sup>302</sup> and unlike in section 9 of the Act, addressing regulatory fees,<sup>303</sup> there is no general exemption from application fees for a nonprofit entity.<sup>304</sup> No commenters argue that the Commission's cost in processing a certain educational or research subset of the part 25 streamlined applications will be significantly less than for a different type of small satellite streamlined application.

103. SIA proposes that the Commission reevaluate the streamlined process application fees one year after the process takes effect, and consider a lower application fee for those providing a non-

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<sup>296</sup> University Small-Satellite Researchers Reply 2; Samuelson-Glushko Clinic Sept. 13, 2018 *Ex Parte* Letter at 1-2; *see also* SIA Comments at 4-5 (stating that many of the potential licensees under the streamlined process will be university students/faculties and early-stage companies attempting to quickly prove technology viability).

<sup>297</sup> University Small-Satellite Researchers Comments at 16; Dr. Scott Palo, et al. Comments, IB Docket No. 18-86, MD Docket No. 18-175, at 1 (rec. June 21, 2018) (filed on behalf of University Small-Satellite Researchers) (University Small-Satellite Researchers Fee Comments); *see also* HybridX Comments at 1 (supporting the comments of the University Small-Satellite Researchers on fees); Commercial Spaceflight Federation Reply at 2 (agreeing with comments of University Small-Satellite Researchers that proposed fee is too high for educational satellites).

<sup>298</sup> University Small-Satellite Researchers Comments at 15-16.

<sup>299</sup> *Id.*

<sup>300</sup> *See* Samuelson-Glushko Clinic Sept. 13, 2018 *Ex Parte* Letter at 2 (stating that the principal benefit of a streamlined part 25 process for university or non-profit small satellite missions would be increased interference protection that could not be obtained through part 5 experimental licensing or part 97 amateur radio procedures).

<sup>301</sup> University Small-Satellite Researchers Fee Comments at 4. University Small-Satellite Researchers note that the proposed \$30,000 application fee is still many orders of magnitude higher than the \$70.00 experimental license fee that most educational users currently incur. University Small-Satellite Researchers Fee Comments at 5.

<sup>302</sup> 47 U.S.C. § 158(a).

<sup>303</sup> *See* 47 U.S.C. § 159(e)(1)(A) (providing an exception to regulatory fees for “a governmental entity or nonprofit entity”).

<sup>304</sup> *See* 47 U.S.C. § 158(d)(1) (providing an exception to application fees specifically for “a nonprofit entity licensed in the Local Government, Police, Fire, Highway Maintenance, Forestry-Conservation, Public Safety, or Special Emergency Radio radio services”).

commercial service at that time.<sup>305</sup> ORBCOMM expresses concerns that the \$30,000 fee is disproportionately low as compared with the regular NGSO satellite system fee, but similarly suggests that the Commission commit to re-evaluating the application filing fees once it has gained experience under the new streamlined processing rules, and notes that the lower fee may be acceptable in the interim.<sup>306</sup> EchoStar/Hughes also suggests that once the fee is selected, the Commission revisit it within a year to determine if it properly reflects the costs of application review and processing.<sup>307</sup> As noted, the Commission will be undertaking a review of application fees Commission-wide, which will provide an opportunity to reassess, if necessary, the fee amount we adopt here.

104. *Regulatory Fees.* The *NPRM* also noted that entities authorized to operate NGSO systems under part 25 must pay an annual regulatory fee, and proposed that comments regarding regulatory fees, as applicable to small satellites, be filed in the proceeding(s) conducted for annual review of those fees.<sup>308</sup> Regulatory fees are reviewed by the Commission on an annual basis. In the regulatory fee proceeding for FY 2018, the Commission sought comment on a new regulatory fee category for small satellites and the appropriate fee associated with that category.<sup>309</sup> The Commission proposed a fee that would be 1/20<sup>th</sup> of the regulatory fee applicable to part 25 NGSO systems.<sup>310</sup> The Commission received a number of comments regarding the proposed category and regulatory fee as part of the FY 2018 regulatory fee proceeding.<sup>311</sup> In the FY 2018 Report and Order addressing regulatory fees, the Commission deferred consideration of a new regulatory fee category, and the appropriate regulatory fee, for small satellites until a definition of “small satellites” was adopted in this proceeding.<sup>312</sup>

105. On May 8, 2019, we adopted a Notice of Proposed Rulemaking addressing the assessment and collection of regulatory fees for FY 2019.<sup>313</sup> Since the definition of “small satellites” had not yet been adopted, we did not propose a category for “small satellites” in the FY 2019 *NPRM*.<sup>314</sup> In this proceeding we have established a definition of small satellites, and we also define and establish the new regulatory fee category applicable to such “small satellites.” The regulatory fee for part 25 space stations applies to licensed and operational geostationary orbit space stations and non-geostationary orbit satellite systems.<sup>315</sup> The new “small satellite” subcategory would apply to licensed and operational

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<sup>305</sup> SIA Comments at 5. In comments filed during the reply period, Xplore, Inc. asks us to consider lower fees for commercial missions as well, and to consider a payment schedule which could address cash flow issues at newer companies. *See* Xplore Reply. As noted, we believe the \$30,000 fee is appropriate at this time, and we decline to address the topic of a payment schedule, which is outside the scope of this proceeding.

<sup>306</sup> ORBCOMM Comments at 7-8. ORBCOMM argues that many of the Commission’s processing costs are not clearly dependent on spectrum or orbit utilization, or on the size of the satellites or the constellation. *Id.* ORBCOMM states that it also supports appropriate review and reduction of filing fees for other classes of FCC satellite license applications, such as modifications, where such action is merited. *Id.* at 8.

<sup>307</sup> EchoStar/Hughes Comments at 8-9.

<sup>308</sup> 33 FCC Rcd at 4183, para. 77.

<sup>309</sup> *See 2018 Regulatory Fee NPRM*, 33 FCC Rcd at 5103, para. 32.

<sup>310</sup> *Id.*

<sup>311</sup> *See 2018 Regulatory Fee R&O*, 33 FCC Rcd at 8510, Appendix A (listing commenters to the *2018 Regulatory Fee NPRM*); *see also* ECFs, MD Docket No. 18-175.

<sup>312</sup> *2018 Regulatory Fee R&O*, 33 FCC Rcd 8497, 8499, n.21.

<sup>313</sup> *Assessment and Collection of Regulatory Fees for Fiscal Year 2019*, Notice of Proposed Rulemaking, MD Docket No. 19-105, FCC 19-37 (May 7, 2019).

<sup>314</sup> *See id.* at para. 15.

<sup>315</sup> *See id.* at Appendix F, para. 21.

satellite systems authorized under the new process adopted in this proceeding.<sup>316</sup> Since we are creating a new category in the regulatory fee schedule that is separate from the existing fee categories, the regulatory fee will also apply to grantees of U.S. market access, similar to the small satellite application fee.<sup>317</sup> Historically, the Commission has not applied regulatory fees to non-U.S.-licensed space stations granted access to the U.S. market.<sup>318</sup> RAY BAUM's Act of 2018 revised section 9, effective October 1, 2018.<sup>319</sup> The new category we adopt for small satellites is created pursuant to this new version of section 9.<sup>320</sup> In creating a new category, we thus establish that the existing regulatory fee for "Space Stations (Non-Geostationary Orbit)"<sup>321</sup> will not apply to the operations authorized under the small satellite process. This adoption of a fee subcategory for small satellites within the NGSO category is an amendment to the schedule as defined in section 9(d) of the Act, which, pursuant to section 9a(b)(2), must be submitted to Congress at least 90 days before it becomes effective.<sup>322</sup>

106. We defer consideration of the regulatory fee amount for this new category to the Commission's future regulatory fee proceedings for several reasons. First, the Commission is charged with ensuring that regulatory fees will result in the collection of an amount that can reasonably be expected to equal amounts appropriated by Congress for each fiscal year.<sup>323</sup> Unlike application fees, with regulatory fees the Commission allocates the total amount to be collected among the various regulatory fee categories, and a change in the regulatory fee schedule applicable to one category may affect the regulatory fees applicable to other categories.<sup>324</sup> The future regulatory fee proceeding will also address how the regulatory fee will be calculated and applied to market access grantees. Second, as a practical matter there will still be ample time to assess and adopt the appropriate fee amount in the separate proceeding before any small satellites authorized under the small satellite process would be required to pay regulatory fees. For example, the annual regulatory fees due and payable in September of this year (the FY 2019 regulatory fees) for space stations must only be paid for space stations or systems that were

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<sup>316</sup> Accordingly, this new category would include small spacecraft non-Earth orbit missions as well. *See* section III.A. (noting that we refer to the "small satellite" process for practical purposes, but we adopt both a streamlined "small satellite" and streamlined "small spacecraft" process).

<sup>317</sup> In 2013 and 2014, the Commission considered, among other things, whether to add a new regulatory fee category for non-U.S.-licensed space stations. *See Assessment and Collection of Regulatory Fees for Fiscal Year 2013*, Notice of Proposed Rulemaking and Further Notice of Proposed Rulemaking, 28 FCC Rcd 7790, 7809-7810, paras.47-49 (2013); *Assessment and Collection of Regulatory Fees for Fiscal Year 2014*, Notice of Proposed Rulemaking, Second Notice of Proposed Rulemaking, and Order, 29 FCC Rcd 6417, 6433-34, paras. 47-50 (2014). The Commission did not add a new fee category at that time, and concluded that it would adjust the regulatory fees for earth stations in order to reflect the number of full-time employees working on market access requests from non-U.S.-licensed satellites. *Assessment and Collection of Regulatory Fees for Fiscal Year 2014*, Report and Order and Further Notice of Proposed Rulemaking, 29 FCC Rcd 10773, para. 12 (2014). Rather than attempt to account for a new category of space stations exclusively through some adjustment to the existing earth station fees, in adopting the new small satellite regulatory fee category we at least provide the opportunity for regulatory fees to be assessed to non-U.S.-licensed small satellite space station operators.

<sup>318</sup> *See Assessment and Collection of Regulatory Fees for Fiscal Year 1999*, Report and Order, 14 FCC Rcd 9868, 9883, para. 39 (1999).

<sup>319</sup> Consolidated Appropriations Act, 2018, Division P — RAY BAUM'S Act of 2018, Title I, FCC Reauthorization, Public Law No. 115-141, § 102, 132 Stat. 348, 1082 (2018) (codified at 47 U.S.C. § 158).

<sup>320</sup> 47 CFR § 159(d).

<sup>321</sup> 47 CFR § 1.156.

<sup>322</sup> 47 U.S.C. § 159a(b)(2).

<sup>323</sup> 47 U.S.C. § 159(a), (b); *FY 2019 Regulatory Fee NPRM*, FCC 19-37, at para. 8.

<sup>324</sup> *See, e.g., FY 2019 Regulatory Fee NPRM*, FCC 19-37, at para. 8.

both licensed and operational on or before the first day of the fiscal year (October 1, 2018).<sup>325</sup> It is unlikely that any space stations authorized under the streamlined small satellite process will be licensed and operational on or before the first day of FY 2020 (October 1, 2019).<sup>326</sup> As such, the earliest such operators are likely to be subject to regulatory fees is FY 2021—fees which would be due and payable in September 2021.<sup>327</sup>

## I. Frequency Considerations for Small Satellites

### 1. Compatibility and Sharing with Federal Users

107. In the *NPRM*, the Commission noted that many of the frequency bands where small satellites have been authorized, and where there are non-Federal allocations for services such as EESS and space operations, are shared with Federal users.<sup>328</sup> The U.S. Table is divided into the Federal Table of Frequency Allocations and the non-Federal Table of Frequency Allocations, and some bands are allocated to both Federal and non-Federal uses.<sup>329</sup> Additionally, some footnotes to the U.S. Table specify that use of a particular frequency band is subject to successful coordination with Federal uses of the band.<sup>330</sup> As noted in the *NPRM*, there are procedures that generally guide frequency coordination with Federal users.<sup>331</sup> The Commission sought comment on any rules that could be adopted by the Commission specific to these frequency bands that would better enable small satellite operators to consider, in advance of coordination, whether they may be able to operate in these bands while still protecting Federal operations.<sup>332</sup> The Commission sought comment on any approaches that could streamline sharing and on how the establishment of rules or other requirements on a band-specific basis might help to facilitate compatibility among separate systems and development of new types of shared and efficient uses of space and spectrum resources.<sup>333</sup> The Commission noted that such rules would not necessarily replace the need to coordinate with Federal systems on a case-by-case basis, but could potentially help to streamline sharing.<sup>334</sup>

108. In response to the Commission's inquiry, CSSMA and SIA offered several suggestions for improving coordination with Federal users,<sup>335</sup> including:

- Creation of a database, on a band-by-band basis, that would reflect the “knowable”

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<sup>325</sup> *Id.* at para. 5 (FY 2019 regulatory fees due in September 2019); *id.* at Appendix F, para. 21 (describing which entities must pay regulatory fees associated with space stations and earth stations). Because small satellites would have to have been licensed and operational by Oct. 1, 2018 to be subject to FY 2019 regulatory fees—which is impossible because we are only now authorizing the licensing of small satellites—there will be no small satellites subject to FY 2019 regulatory fees.

<sup>326</sup> This accounts for the time required for these rules to come into effect as well as the time required to receive and process any initial applications.

<sup>327</sup> We note that governmental and nonprofit entities are exempt from regulatory fees. 47 U.S.C. § 159(h); 47 CFR § 1.1162.

<sup>328</sup> 33 FCC Rcd at 4176-77, para. 61.

<sup>329</sup> See U.S. Table of Frequency Allocations, 47 CFR § 2.106; *NPRM*, 33 FCC Rcd at 4176, para. 60.

<sup>330</sup> See 47 CFR § 2.106.

<sup>331</sup> See *NPRM*, 33 FCC Rcd at 4176, para. 60.

<sup>332</sup> *Id.* at 4177, para. 61.

<sup>333</sup> *Id.*

<sup>334</sup> *Id.*

<sup>335</sup> See CSSMA Comments at 38-40; SIA Comments at 3-4.

information about spectrum usage in each band.<sup>336</sup>

- Mandatory pre-coordination<sup>337</sup> meetings between applicants and representatives of all Federal agencies affected by a newly-filed application with the Commission.<sup>338</sup>
- Formal coordination beginning concurrently with public notice.<sup>339</sup>

CSSMA and SIA argue that failure of Federal agencies to act in a timely manner prejudices commercial companies by causing missed launches, lower service levels to customers, and time-to-market disadvantages.<sup>340</sup>

109. These suggestions go beyond service rules or other requirements on a band-specific basis and contain broader suggested changes regarding processes, not currently the subject of part 25 rules and in large part involving the processes of other agencies. The suggestions also go beyond processes affecting small satellites and would potentially affect other satellite license applicants as well. We therefore decline to address these processes through rule changes within this small-satellite focused rulemaking proceeding.

110. CSSMA also argues that if there is not meaningful change to the coordination process, then it recommends that critical bands be divided into sub-bands, with one sub-band available exclusively to the Federal side of U.S. Table and one sub-band available exclusively to the non-Federal side of the U.S. Table.<sup>341</sup> We do not have enough information at this time to thoroughly consider CSSMA's recommendation regarding division of frequency bands into sub-bands. Such a proposal would need to be addressed on a frequency band-specific basis, likely through a separate rulemaking proceeding or proceedings, and as such, is beyond the scope of this rulemaking.

## 2. Spectrum Assignments for Streamlined Small Satellites

111. The Commission sought comment on whether the proposed streamlined process should be limited to specific frequency bands, whether the Commission should adopt a non-exclusive list of frequencies available for streamlined processing, or whether the Commission should simply consider small satellite frequency assignments on a case-by-case basis, bearing in mind the relevant frequency allocations.<sup>342</sup> The *NPRM* highlighted several frequency bands for potential identification for use by streamlined small satellites (137-138 MHz, 148-150.05 MHz, and 1610.6-1613.8 MHz), and sought

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<sup>336</sup> CSSMA Comments at 38. CSSMA states that its members do not find the existing NTIA Government Spectrum Compendium to contain the complete or updated information required for coordination. *Id.* at 38. In CSSMA's view, a regularly-updated database should include information about both Federal and non-Federal systems such as information regarding the funding status of programs, launch and key activity dates, basic technical information regarding bandwidths, channelization plans, ground station locations (both domestic and foreign), and basic G/T and EIRP information. *Id.*

<sup>337</sup> These parties use the term "pre-coordination" to refer to discussions occurring prior to the formal coordination involving the FCC and Federal agencies, in which a proposed grant document is referred to NTIA for final consideration by Federal agencies through Interdepartment Radio Advisory Committee (IRAC) processes.

<sup>338</sup> CSSMA Comments at 39; SIA Comments at 3-4; CSSMA Reply at 20. According to CSSMA and SIA, this will provide months of time for pre-coordination, CSSMA Comments at 39, SIA Comments at 4, and CSSMA believes that NTIA and Commission representatives should be invited and encouraged to attend, and minutes should be kept and made available to Commission and NTIA personnel involved in the related license application(s), CSSMA Comments at 39.

<sup>339</sup> CSSMA Comments at 39; SIA Comments at 4.

<sup>340</sup> CSSMA Comments at 39; SIA Comments at 4; CSSMA Reply at 21.

<sup>341</sup> CSSMA Comments at 40.

<sup>342</sup> *NPRM*, 33 FCC Rcd at 4175, para. 57.

comment on the accommodation of small satellites in those bands,<sup>343</sup> as well as frequency bands that could be identified for small satellite inter-satellite links.<sup>344</sup>

112. We decline in this proceeding to adopt any new limitation on or lists of available frequencies and will consider frequencies on a case-by-case basis, subject to the same analysis for compliance with Commission rules and policies as other part 25 applicants. We anticipate, however, that applications for small satellite systems under the streamlined procedures generally will be limited to bands where there currently is an allocation for satellite services in the U.S. Table of Allocations and in the International Table of Allocations, and that applications for other bands would require a request for waiver and an accompanying justification, as described below. Further, if such waiver requests are granted, these systems would be authorized on a non-interference basis. To the extent that any commenters argue for limitations on the frequency bands available for the streamlined process, they generally argue that frequency bands subject to a processing round or otherwise used by NGSO FSS, MSS, or other operations requiring full-time uninterrupted availability of spectrum should not be listed as available for streamlined processing.<sup>345</sup> SpaceX and SES/O3b argue that the complexities of operations in these bands yield limited or nonexistent ability to share spectrum with all existing and future operators.<sup>346</sup> On the other hand, EchoStar/Hughes does not object to small satellites operating in frequency bands allocated for FSS operations, so long as they are required to operate on a secondary, non-harmful interference basis with respect to other satellite operations.<sup>347</sup> CSSMA argues that applicants should be able to apply for any frequency band that matches their category of service.<sup>348</sup>

113. We disagree with commenters who argue that small satellites should be per se excluded from operating in frequency bands where a processing round has occurred or where there is an allocation for FSS or MSS or another service in which systems typically require full-time availability of the assigned spectrum. We do not think it is productive to adopt an outright limitation on applications requesting operations in those bands in case sharing can in some instances be accomplished because of the limited nature of the small satellite operations or other factors. We also received a number of comments on the topic of whether we should create a non-exclusive list of frequencies available for streamlined small satellites. Several commenters suggest that a list of frequencies available for small satellite could be useful either in the rules or in a different format to provide guidance and flexibility,<sup>349</sup>

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<sup>343</sup> *Id.* at 4177-81, paras. 62-69.

<sup>344</sup> *Id.* at 4181-82, paras. 70-73.

<sup>345</sup> See SpaceX Comments at 12; SES/O3b Reply at 9. To the extent that commenters raise concerns regarding small satellite operations in other specific frequency bands, specific concerns regarding interference can be addressed on a case-by-case basis, if a streamlined small satellite applicant requests operations in those frequency bands.

<sup>346</sup> SpaceX Comments at 11; SES/O3b Reply at 9. While SpaceX characterizes this as a Commission statement from the *NPRM*, the *NPRM* stated that *operations* typically requiring full-time uninterrupted availability of assigned spectrum were unlikely to demonstrate the required indicia of sharing to qualify for the small satellite process, not necessarily that *frequency bands* where these operations typically take place could never be shared by small satellite operations that do not require full-time uninterrupted availability of assigned spectrum. See *NPRM*, 33 FCC Rcd 4172, para. 45.

<sup>347</sup> EchoStar/Hughes Comments at 6.

<sup>348</sup> CSSMA Comments at 2; see also Analytical Space Comments at 11-12 (arguing that the Commission should not limit small satellites to certain frequencies beyond what is stipulated by the Table of Frequency Allocations).

<sup>349</sup> See, e.g., SpaceX Comments at 12; Commercial Spaceflight Federation Comments at 7 (suggesting outline of frequency allotments via guidance document rather than regulatory rule); Analytical Space Comments at 12 (supporting non-exclusive list issued via public notice); SES/O3b Reply at 8.

but CSSMA argues that a non-exclusive list of frequencies could be potentially misleading.<sup>350</sup> We agree with CSSMA that such a list could be potentially misleading if applicants were to view those frequencies as quick or guaranteed options for authorization, when in fact the frequency bands most often used by small satellites to date often require coordination with Federal users and other operators. We believe operations authorized under this process may represent more varied and potentially more unique scenarios in terms of spectrum use as compared with operations we have historically authorized under part 25, but note that applicants' proposed radiofrequency obligations will be subject to Commission rules and policies, including applicable coordination obligations and potential conditions, and thus qualifying for the small satellite process does not guarantee that requested operations will be granted.

114. Commenters raised concerns with designation of specific frequencies for use by small satellite systems,<sup>351</sup> and we conclude that a case-by-case approach, analyzed under the Commission's rules and policies on a band-specific basis, is best suited to address the varied factual scenarios that may be presented under the new process.<sup>352</sup> Accordingly, we are not adopting any changes to the Table of Frequency Allocations at this time or other rule modifications regarding use of specific frequencies.<sup>353</sup> Given the different types of operations that may be undertaken by "small satellites," we believe that in this instance it would be premature to adopt the rule changes prior to updates at the ITU. We are not foreclosing future proceedings, however, to implement ITU spectrum allocations.

115. Drawing on our experience with small satellites to date, including experiments that may transition to commercial operations, we expect that in some instances small satellite license applications may request operations not consistent with the current International Table of Allocations. In the *NPRM*,

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<sup>350</sup> CSSMA Comments at 31. According to CSSMA, publication of a list would not be helpful unless the Commission is able to find one or more frequency bands to allocate to small satellite specifically and which can be subject to service rules that would allow for expedited coordination with Federal agencies and other users. *Id.*

<sup>351</sup> See, e.g., Globalstar, Inc. Comments at 8-10 (rec. July 9, 2018) (Globalstar Comments), ORBCOMM Comments at 13-16; Aviation Spectrum Resources, Inc. Comments at 2-6 (rec. July 9, 2018); Iridium Reply at 8-9; Globalstar, Inc. Reply Comments at 1-7 (rec. Aug. 7, 2018) (Globalstar Reply); ORBCOMM Reply at 5-9. See also Letter from Bruce A. Olcott, Counsel to The Boeing Company, to Marlene H. Dortch, Secretary, FCC, IB Docket No. 18-86 (filed Sept. 5, 2018); Letter from Edward A. Yorkgitis, Jr., Counsel for Aviation Spectrum Resources, Inc. to Marlene H. Dortch, Secretary, FCC, IB Docket No. 18-86 (filed Apr. 25, 2019).

<sup>352</sup> In an *ex parte* letter, UbiquitiLink, Inc. seeks clarification on whether the rules we adopt here will allow for various types of inter-satellite links, including within a streamlined small satellite system, and with other satellites processed on a streamlined or non-streamlined basis. UbiquitiLink *Ex Parte* at 2. Also in an *ex parte* letter, Globalstar seeks clarification on the process for non-streamlined operators to obtain authority to conduct inter-satellite communications with small satellite systems. Letter from Stephen J. Berman, Lawler, Metzger, Keeney & Logan, LLC to Marlene H. Dortch, Secretary, FCC, IB Docket No. 18-86 at 2 (filed July 24, 2019). As part of this *ex parte* request for clarification, Globalstar appears to raise for the first time the issue of whether there is a new procedure necessary for authorizing such communications. See *id.* We note that any operator may avail themselves of existing procedures, including under part 25 or part 5 experimental licensing, as appropriate, for obtaining authorization for inter-satellite communications. Inter-satellite communications with streamlined-licensed small satellites would be treated the same as inter-satellite communications with any other satellite for purposes of authorization. For existing U.S. licensees this may require a license modification, or for a non-U.S.-licensed system, appropriate authorization by the licensing administration.

<sup>353</sup> We also note that we are not making any changes to the existing procedures for submission of materials to the ITU. See *NPRM*, 33 FCC Rcd at 4161-63, paras. 19-20 (describing procedures for notification of frequency assignments to the ITU). The agenda for the ITU World Radiocommunication Conference 2019 contains an item discussing the possible modification to the ITU regulatory process for a certain category of NGSO satellite networks and systems with short-duration missions. See International Telecommunication Union, 2<sup>nd</sup> Session of the Conference Preparatory Meeting for WRC-19, CPM Report on technical, operational and regulatory/procedural matters to be considered by the World Radiocommunication Conference 2019, Agenda Item 7(I), 3/7/9, <https://www.itu.int/md/R15-CPM19.02-R-0001/en>. Any revisions to ITU processes would be addressed, where appropriate, following the adoption of such revisions at the ITU.

the Commission observed that there may be benefits associated with such operations by small satellites in certain circumstances.<sup>354</sup> Under current rules, a part 25 application is deemed not acceptable for filing if it requests authority to operate a space station in a frequency band that is not allocated internationally for such operations under the ITU Radio Regulations, regardless of whether a waiver is requested.<sup>355</sup> We modify this rule to provide an exception, so that such streamlined small satellite applications requesting to operate in bands not allocated internationally, and which include an appropriate waiver request, can be considered on their merits without being deemed unacceptable for filing.<sup>356</sup> There may be cases where, for example, an operator is using equipment that has been shown to successfully operate on a non-interference basis under a previous experimental license or licenses. We anticipate that we may see requests for inter-satellite link operations between small satellites and the satellites in the Globalstar or Iridium systems, for example.<sup>357</sup> We will continue to treat applications for these or other space-to-space operations as non-conforming with respect to the Table of Allocations where the applicant requests to operate in satellite frequency bands allocated only for operations in the space-to-Earth or Earth-to-space directions,<sup>358</sup> noting that this matter is under additional study at the ITU.

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<sup>354</sup> For example, the Commission observed that there may be benefits from use of inter-satellite links in alleviating some of the difficulties faced by small satellite operators in identifying frequencies for Earth-to-space and space-to-Earth links and building or seeking out ground station infrastructure. *NPRM*, 33 FCC Rcd at 4182, para. 72.

<sup>355</sup> 47 CFR § 25.112(a)(3), (b).

<sup>356</sup> In the *NPRM*, the Commission proposed consideration of applications requesting spectrum bands for use that would be non-conforming to the International Table of Allocations in specific bands. *See, e.g., NPRM*, 33 FCC Rcd at 4182, paras. 72-73 (seeking comment on making changes to the Commission's rules to facilitate small satellite inter-satellite links in MSS allocations, not currently consistent with the International Table of Allocations). Several commenters also suggested small satellite operations in additional frequency bands not currently allocated for such operations in the U.S. Table of Allocations. *See, e.g., Inmarsat Inc. Comments* (rec. July 9, 2018) at 5; *Analytical Space Comments* at 4. Although as noted, we decline to make any changes to the U.S. Table of Allocations, we adopt our proposals to the extent that we will review requests for non-conforming operations (with requests for waivers) on their merits in the context of specific applications, on a case-by-case basis, rather than deeming those applications unacceptable for filing as is required under current part 25 rules. *See* 47 CFR § 25.112(a)(3), (b). Were any such operations to be granted, they would be on a non-interference basis.

<sup>357</sup> Consistent with the case-by-case approach we adopt here, concerns regarding operations of inter-satellite links in particular frequencies or services can be addressed in the context of specific applications. *See, e.g., SpaceX Comments* at 12-13 (opposing use of inter-satellite links in FSS frequency bands, as further complicating an already challenging coordination environment); *EchoStar/Hughes Comments* at 7-8 (noting that specific allocations of frequency bands for use as inter-satellite links are traditionally made by competent World Radiocommunication Conferences based on study contributions and analysis that guarantee the safe use of those frequency bands for such service); *SES/O3b Reply* at 9-10 (noting that there is no assessment of potential impact on GSO or other NGSO operations of use of MSS or FSS frequencies for small satellite inter-satellite links and further analysis would be required to ensure appropriate conditions for protection, as well as further analysis on the record of compliance of these small satellite links with EPFD limits for protection of the GSO arc); *Audacy Reply* at 8-9 (expressing concerns about the ability to coordinate co-channel small satellite space-to-space communications against geostationary and non-geostationary space-to-ground communications, and stating that approval of small satellite inter-satellite links in co-channel frequencies used by GSO and NGSO systems would "represent both an immediate real-world interference threat, and a long-term disincentive to investment" in the FSS spectrum); *see also* Letter from Jennifer A. Manner, Senior Vice President, Regulatory Affairs, Hughes Network Systems, LLC to Marlene H. Dortch, Secretary, FCC, IB Docket No. 18-86, Attach. at 2-3 (filed Sept. 21, 2018) (*Hughes Ex Parte* Letter) (stating that use of certain FSS frequencies for inter-satellite links has not been subject to completed technical studies to ensure interference protection to GSO operations).

<sup>358</sup> *See NPRM*, 33 FCC Rcd at 4181, para. 70. Such operations are assigned on a non-conforming basis consistent with ITU Radio Regulations 4.4. *See* ITU R.R. 4.4. Several parties argue that the definition of MSS and FSS in the Commission's rules already contemplate inter-satellite links, and such links may be authorized under existing allocations, even where the Table of Allocations directional indicators specify Earth-to-space or space-to-Earth. *See* *ViaSat, Inc. Reply Comments* at 2-4 (rec. Aug. 7, 2018); *Hughes Ex Parte* Letter, Attach.; Letter from John P. Janka (continued....)



116. If an applicant were to request authorization for a non-conforming operation, that applicant would be required to submit a request for a waiver of the Table of Allocations, section 2.106,<sup>359</sup> along with sufficient justification to support that waiver request. This process is not intended to alter the allocation status in these bands. We would also expect applicants to provide a sufficient electromagnetic compatibility analysis to support an FCC finding that the intended use of the frequency assignment will not cause harmful interference to all other stations operating in conformance with the ITU Radio Regulations.<sup>360</sup> The applicant must also state its willingness to accept an assignment on a non-interference, unprotected basis.<sup>361</sup> Status as a small satellite for purposes of streamlined processing in no way guarantees that a waiver of the Table of Allocations will be granted. We anticipate that these types of uses under part 25 would be extremely limited and we would expect that such applicants would be engaged contemporaneously in activities to work toward modification of the International Table of Allocations at the ITU. Similarly, if an applicant were to request authorization for a small satellite system in a band where there is no satellite allocation in the U.S. Table of Allocations, such applications would require a waiver request and an accompanying justification. For administrative efficiency, we encourage entities that are considering making a request for authorization for a non-conforming operation to discuss the request with Commission staff prior to filing.

#### J. Other Issues

117. *Responsibility for Securing Licenses.* SpaceX asks the Commission to make clear that small satellite operators and their agents bear the responsibility for securing all necessary licenses prior to launch, and for providing accurate information to launch providers as to the status of such licenses.<sup>362</sup> In its comments, SpaceX describes the role that parties such as small satellite aggregators, rideshare coordinators, or satellite integrators increasingly play in making launch arrangements on behalf of small satellite customers.<sup>363</sup> SpaceX notes that as a launch services provider, its contracts with these types of aggregators require that all of the small satellite payloads subject to that contract have secured all relevant licenses, and that it must be able to rely on such assurances from the aggregators.<sup>364</sup> This topic appears to go beyond the scope of this part 25-specific rulemaking, and relate to authorization of satellites generally, whether those satellites are authorized under the part 25 streamlined process or not.<sup>365</sup> Thus, we decline

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and Elizabeth R. Park, Counsel to ViaSat, Inc. to Marlene H. Dortch, Secretary, FCC, IB Docket No. 18-86, at 2 (filed Sept. 27, 2018) (ViaSat *Ex Parte* Letter).

<sup>359</sup> 47 CFR § 2.106.

<sup>360</sup> See ITU Rules of Procedure, 1.6, Rules Concerning Article 4 of the ITU R.R., Edition of 2017 (+rev.2) (2018) (stating that administrations, prior to bringing into use any frequency assignment to a transmitting station operating under No. 4.4 of the ITU Radio Regulations shall determine: (a) that the intended use of the frequency assignment to the station will not cause harmful interference into the stations of other administrations operating in conformity with the radio regulations; and (b) what measures it would take in order to comply with the requirement to immediately eliminate harmful interference under No. 8.5 of the ITU Radio Regulations).

<sup>361</sup> See also Boeing Comments at 6 (stating that the Commission should require any part 25 streamlined small satellite licensee operating in a band not allocated for the service to operate on an unprotected, non-harmful interference basis, just like an experimental licensee).

<sup>362</sup> SpaceX Comments at 17.

<sup>363</sup> SpaceX Comments at 16-17.

<sup>364</sup> SpaceX Comments at 16.

<sup>365</sup> SpaceX also requests that the Commission make clear that a small satellite licensee remains responsible for its spacecraft through atmospheric demise, and therefore must make appropriate arrangements for ongoing controls and monitoring throughout the entire period covered by its authorization. SpaceX Comments at 5. This topic similarly goes beyond the scope of this streamlined part 25 small satellite process rulemaking, and relates to satellite licensees generally.

in this proceeding to adopt any rules relating to this issue. We note, however, that the Commission sought comment on issues related to multi-satellite deployments as part of its recent *NPRM* on orbital debris mitigation, including whether we should include in our rules any additional information requirements regarding these launches.<sup>366</sup>

118. *Rules Concerning Amateur and Experimental Satellites.* The Commission did not seek comment in the *NPRM* on any modifications or updates to the rules governing experimental or amateur satellite licensing. The streamlined part 25 small satellite process adopted in the *Order* is an alternative to existing license processes and does not replace or modify the authorization procedures for satellites currently contained in parts 5, 25, or 97 of the Commission's rules.<sup>367</sup> Nevertheless, we received a number of comments in response to the *NPRM*, particularly regarding the rules applicable to amateur satellite operations, suggesting that aspects of those rules be improved or clarified.<sup>368</sup> These comments address topics outside the scope of this proceeding, and we decline to adopt any of the requested rule modifications or updates at this time.

#### IV. PROCEDURAL MATTERS

119. *Regulatory Flexibility Act.*—Pursuant to the Regulatory Flexibility Act of 1980, as amended, 5 U.S.C. § 601 *et seq.* (RFA), the Commission's Final Regulatory Flexibility Analysis in this Report and Order is attached as Appendix B.

120. *Paperwork Reduction Act.*—This document contains modified information collection requirements subject to the Paperwork Reduction Act of 1995 (PRA), Public Law 104-13. It will be submitted to the Office of Management and Budget (OMB) for review under section 3507(d) of the PRA. OMB, other Federal agencies, and the general public are invited to comment on the modified information collection requirements contained in this document. In addition, we note that pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107-198, see 44 U.S.C. 3506(c)(4), we previously sought specific comment on how the Commission might further reduce the information collection burden for small business concerns with fewer than 25 employees.

121. In this document, we have assessed the effects of reducing the application burdens of small satellite applicants, and find that doing so will serve the public interest and is unlikely to directly affect businesses with fewer than 25 employees.

122. In addition, this document contains proposed modified information collection requirements. The Commission, as part of its continuing effort to reduce paperwork burdens, invites the general public and the Office of Management and Budget to comment on the information collection requirements contained in this document, as required by the Paperwork Reduction Act of 1995, Public Law 104-13. In addition, pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107-198, see 44 U.S.C. 3506(c)(4), we seek specific comment on how we might further reduce the information collection burden for small business concerns with fewer than 25 employees.

123. *Congressional Review Act.*—The Commission has determined, [and the Administrator of the Office of Information and Regulatory Affairs, Office of Management and Budget, concurs] that these rules are non-major under the Congressional Review Act, 5 U.S.C. § 804(2). The Commission will send a copy of this Report & Order to Congress and the Government Accountability Office pursuant to 5

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<sup>366</sup> *Orbital Debris NPRM*, 33 FCC Rcd at 11367, paras. 40-41; *see also FCC Satellite Licensing Enforcement Advisory*, 33 FCC Rcd at 3594.

<sup>367</sup> *See infra* at section III.A.

<sup>368</sup> *See e.g.*, Radio Amateur Satellite Corporation (AMSAT) Comments (rec. July 9, 2018); ARRL, The National Association for Amateur Radio Comments (rec. July 9, 2018); Open Research Institute Comments at 2-5; Ray Soifer Comments (rec. June 29, 2018); Radio Amateur Satellite Corporation (AMSAT) Reply Comments (rec. Aug. 8, 2018); Faculty/Amateur Radio Mentors Reply; Ray Soifer Reply Comments (rec. Aug. 7, 2018); Open Research Institute, Inc. Reply Comments (rec. Aug. 7, 2018).

U.S.C. § 801(a)(1)(A).

**V. ORDERING CLAUSES**

124. IT IS ORDERED, pursuant to sections 4(i), 7, 8, 9, 301, 303, 308, and 309 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 154(i), 157, 158, 159, 301, 303, 308, 309, that this Report and Order IS ADOPTED, the policies, rules, and requirements discussed herein ARE ADOPTED, and parts 1 and 25 of the Commission's rules ARE AMENDED as set forth in Appendix A.

125. IT IS FURTHER ORDERED that this Report and Order contains new or modified information collection requirements that require review and approval by the Office of Management and Budget under the Paperwork Reduction Act, and WILL BECOME EFFECTIVE after the Commission publishes a notice in the Federal Register announcing such approval and the relevant effective date, except for the amendments to the schedules of application and regulatory fees. The amendments to the application fee schedule WILL BECOME EFFECTIVE no earlier than 90 days following notification to Congress, in accordance with 47 U.S.C. 159A(b)(2). The amendment to the regulatory fee schedule WILL BECOME EFFECTIVE following the adoption of a fee amount for the category as part of a separate Commission rulemaking proceeding, and no earlier than 90 days following the subsequent notification to Congress, in accordance with 47 U.S.C. 159A(b)(2).

126. IT IS FURTHER ORDERED that the Commission SHALL NOTIFY Congress of the amendments to the application fee schedule and regulatory fee schedule pursuant to 47 U.S.C. section 158(c) and 47 U.S.C. section 159(d), *see* 47 U.S.C. § 159A(b)(2).

127. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of this Report and Order, including the Final Regulatory Flexibility Analyses, to the Chief Counsel for Advocacy of the Small Business Administration.

128. IT IS FURTHER ORDERED that the Commission SHALL SEND a copy of this Report and Order in a report to be sent to Congress and the Government Accountability Office pursuant to the Congressional Review Act, *see* 5 U.S.C. § 801(a)(1)(A).

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch  
Secretary

**APPENDIX A  
FINAL RULES**

The Federal Communications Commission amends title 47 of the Code of Federal Regulations, parts 1 and 25, as follows:

**PART 1 – PRACTICE AND PROCEDURE**

1. The authority citation for part 1 continues to read as follows:

**Authority:** 47 U.S.C. 151, 154(i), 154(j), 155, 157, 225, 227, 303(r), 309, 1403, 1404, 1451, and 1452.

2. In § 1.1107, amend the table by adding a new entry for “b. Application for Authority to Launch and Operate (small satellite system)” under “9. Space Stations (NGSO),” and redesignate the current 9.b.-f. as 9.c.-g., to read as follows:

**§ 1.1107 Schedule of charges for applications and other filings for the international services.**

\* \* \* \* \*

| Service  | FCC Form No.                            | Fee amount | Payment type code |
|--|---|------------|-------------------|
| * * * * *  |   |            |                   |
| 9. Space Stations (NGSO):  |   |            |                   |
| * * * * *  |   |            |                   |
| b. Application (license or market access for small satellite or small spacecraft system) | 312 Main & Schedule S & 159             | 30,000.00  | CLW               |
| c. Assignment or Transfer (per system)   | 312 Main & Schedule A & 159             | 13,480.00  | CZW               |
| d. Modification (per system)   | 312 Main & Schedule S (if needed) & 159 | 33,685.00  | CGW               |
| e. Special Temporary Authority (per request)   | Corres & 159                            | 3,375.00   | CXW               |
| f. Amendment of Pending Application (per request)  | 312 Main & Schedule S & 159             | 6,740.00   | CAW               |
| g. Extension of Launch Authority (per system)  | 312 Main & 159                          | 3,375.00   | CXW               |
| * * * * *  |   |            |                   |

**PART 25 – SATELLITE COMMUNICATIONS**

3. The authority citation for part 25 continues to read as follows:

**Authority:** 47 U.S.C. 154, 301, 302, 303, 307, 309, 310, 319, 332, 605, and 721, unless otherwise noted.

4. In § 25.103, add the definition of “small satellite” and “small spacecraft” as follows:

**§ 25.103 Definitions.**

*Small Satellite.* An NGSO space station eligible for authorization under the application process described in § 25.122.

*Small Spacecraft.* An NGSO space station operating beyond Earth's orbit that is eligible for authorization under the application process described in § 25.123.

5. In § 25.112, revise paragraph (a)(3) to read as follows:

**§ 25.112 Dismissal and return of applications.**

(a) \* \* \*

\* \* \* \* \*

(3) The application requests authority to operate a space station in a frequency band that is not allocated internationally for such operations under the Radio Regulations of the International Telecommunication Union, unless the application is filed pursuant to § 25.122 or § 25.123.

\* \* \* \* \*

6. In § 25.113, revise paragraphs (h) and (i) to read as follows:

**§ 25.113 Station construction, deployment approval, and operation of spare satellites.**

(h) An operator of NGSO space stations under a blanket license granted by the Commission, except for those granted pursuant to the application process in § 25.122 or § 25.123, need not apply for license modification to operate technically identical in-orbit spare satellites in an authorized orbit. However, the licensee must notify the Commission within 30 days of bringing an in-orbit spare into service and certify that its activation has not exceeded the number of space stations authorized to provide service and that the licensee has determined by measurement that the activated spare is operating within the terms of the license.

(i) An operator of NGSO space stations under a blanket license granted by the Commission, except for those granted pursuant to the application process in § 25.122 or § 25.123, need not apply for license modification to deploy and operate technically identical replacement satellites in an authorized orbit within the term of the system authorization. However, the licensee must notify the Commission of the intended launch at least 30 days in advance and certify that its operation of the additional space station(s) will not increase the number of space stations providing service above the maximum number specified in the license.

7. In § 25.114, revise paragraph (d) to read as follows:

**§ 25.114 Applications for space station authorizations.**

\* \* \* \* \*

(d) The following information in narrative form shall be contained in each application, except space station applications filed pursuant to § 25.122 or § 25.123:

\* \* \* \* \*

8. In § 25.117, revise paragraph (d)(1) to read as follows:

**§ 25.117 Modification of station license.**

\* \* \* \* \*

(d)(1) Except as set forth in § 25.118(e), applications for modifications of space station authorizations shall be filed in accordance with § 25.114 and/or § 25.122 or § 25.123, as applicable, but only those items of information listed in § 25.114 and/or § 25.122 or § 25.123 that change need to be submitted, provided the applicant certifies that the remaining information has not changed.

\* \* \* \* \*

9. In § 25.121, revise paragraphs (a)(1) and (d)(2) and add paragraphs (a)(3) and (d)(3) to read as follows:

**§ 25.121 License term and renewals.**

(a) \* \* \*

(1) Except for licenses for DBS space stations, SDARS space stations and terrestrial repeaters, 17/24 GHz BSS space stations licensed as broadcast facilities, and licenses for which the application was filed pursuant to § 25.122 and § 25.123, licenses for facilities governed by this part will be issued for a period of 15 years.

\* \* \* \* \*

(3) Licenses for which the application was filed pursuant to § 25.122 or § 25.123 will be issued for a period of 6 years, without the possibility of extension or replacement authorization.

\* \* \* \* \*

(d) \* \* \*

\* \* \* \* \*

(2) For non-geostationary orbit space stations, except for those granted under § 25.122 or § 25.123, the license period will begin at 3 a.m. Eastern Time on the date when the licensee notifies the Commission pursuant to §25.173(b) that operation of an initial space station is compliant with the license terms and conditions and that the space station has been placed in its authorized orbit. Operating authority for all space stations subsequently brought into service pursuant to the license will terminate upon its expiration.

(3) For non-geostationary orbit space stations granted under § 25.122 or § 25.123, the license period will begin at 3 a.m. Eastern Time on the date when the licensee notifies the Commission pursuant to §25.173(b) that operation of an initial space station is compliant with the license terms and conditions and that the space station has been placed in its authorized orbit and has begun operating. Operating authority for all space stations subsequently brought into service pursuant to the license will terminate upon its expiration.

\* \* \* \* \*

10. Add § 25.122, to read as follows:

**§ 25.122 Applications for streamlined small space station authorization.**

(a) This section shall only apply to applicants for NGSO systems that are able to certify compliance with the certifications set forth either in paragraph (c) of this section. For applicants seeking to be authorized under this section, a comprehensive proposal for Commission evaluation must be submitted for each space station in the proposed system on FCC Form 312, Main Form and Schedule S, as described in § 25.114(a)-(c), together with the certifications described in paragraph (c) of this section and the narrative requirements described in paragraph (d) of this section.

(b) Applications for NGSO systems may be filed under this section, provided that the total number of space stations requested in the application is ten or fewer.

(1) To the extent that space stations in the satellite system will be technically identical, the applicant may submit an application for blanket-licensed space stations.

(2) Where the space stations in the satellite system are not technically identical, the applicant must certify that each space station satisfies the criteria in paragraph (c) of this section, and submit technical information for each type of space station.

(c) *Certifications under this section.* Applicants filing for authorization under the streamlined procedure described in this section must include with their applications certifications that the following criteria will be met for all space stations to be operated under the license:

- (1) The space station(s) will operate only in non-geostationary orbit;
- (2) The total in-orbit lifetime for any individual space station will be six years or less;
- (3) The space station(s):
  - (i) Will be deployed at an orbital altitude of 600 km or below; or
  - (ii) Will maintain a propulsion system and have the ability to make collision avoidance and deorbit maneuvers using propulsion.
- (4) Each space station will be identifiable by a unique signal-based telemetry marker distinguishing it from other space stations or space objects;
- (5) The space station(s) will release no operational debris;
- (6) The space station operator has assessed and limited the probability of accidental explosions, including those resulting from the conversion of energy sources on board the space station(s) into energy that fragments the spacecraft;
- (7) The probability of a collision between each space station and any other large object (10 centimeters or larger) during the orbital lifetime of the space station is 0.001 or less as calculated using current NASA software or other higher fidelity model;
- (8) The space station(s) will be disposed of post-mission through atmospheric re-entry. The probability of human casualty from portions of the spacecraft surviving re-entry and reaching the surface of the Earth is zero as calculated using current NASA software or higher fidelity models;
- (9) Operation of the space station(s) will be compatible with existing operations in the authorized frequency band(s). Operations will not materially constrain future space station entrants from using the authorized frequency band(s);
- (10) The space station(s) can be commanded by command originating from the ground to immediately cease transmissions and the licensee will have the capability to eliminate harmful interference when required under the terms of the license or other applicable regulations;
- (11) Each space station is 10 cm or larger in its smallest dimension;
- (12) Each space station will have a mass of 180 kg or less, including any propellant.

(d) *Other application information.* The following information in narrative form shall be contained in each application:

- (1) An overall description of system facilities, operations, and services and an explanation of how uplink frequency bands would be connected to downlink frequency bands;
- (2) Public interest considerations in support of grant;
- (3) A description of means by which requested spectrum could be shared with both current and future operators, (e.g., how ephemeris data will be shared, antenna design, earth station geographic locations) thereby not materially constraining other operations in the requested frequency band(s);
- (4) For space stations with any means of maneuverability, including both active and passive means, a description of the design and operation of maneuverability and deorbit systems, and a description of the anticipated evolution over time of the orbit of the proposed satellite or satellites; and

(5) In any instances where spacecraft capable of having crew aboard will be located at or below the deployment orbital altitude of the space station seeking a license, a description of the design and operational strategies that will be used to avoid in-orbit collision with such crewed spacecraft shall be furnished at time of application. This narrative requirement will not apply to space stations that will operate beyond Earth's orbit.

(6) A list of the FCC file numbers or call signs for any known applications or Commission grants related to the proposed operations (e.g., experimental license grants, other space station or earth station applications or grants).

11. Add § 25.123, to read as follows:

**§ 25.123 Applications for streamlined small spacecraft authorization.**

(a) This section shall only apply to applicants for space stations that will operate beyond Earth's orbit and that are able to certify compliance with the certifications set forth in paragraph (b) of this section. For applicants seeking to be authorized under this section, a comprehensive proposal for Commission evaluation must be submitted for each space station in the proposed system on FCC Form 312, Main Form and Schedule S, as described in § 25.114(a)-(c), together with the certifications described in paragraph (b) of this section and the requirements described in paragraph (c) of this section.

(b) *Certifications under this section.* Applicants filing for authorization under the streamlined procedure described in this section must include with their applications certifications that the following criteria will be met for all space stations to be operated under the license:

- (1) The space station(s) will operate and be disposed of beyond Earth's orbit;
- (2) The total lifetime from deployment to spacecraft end-of-life for any individual space station will be six years or less;
- (3) Each space station will be identifiable by a unique signal-based telemetry marker distinguishing it from other space stations or space objects;
- (4) The space station(s) will release no operational debris;
- (5) No debris will be generated in an accidental explosion resulting from the conversion of energy sources on board the space station(s) into energy that fragments the spacecraft;
- (6) The probability of a collision between each space station and any other large object (10 centimeters or larger) during the lifetime of the space station is 0.001 or less as calculated using current NASA software or higher fidelity models;
- (7) Operation of the space station(s) will be compatible with existing operations in the authorized frequency band(s). Operations will not materially constrain future space station entrants from using the authorized frequency band(s);
- (8) The space station(s) can be commanded by command originating from the ground to immediately cease transmissions and the licensee will have the capability to eliminate harmful interference when required under the terms of the license or other applicable regulations;
- (9) Each space station is 10 cm or larger in its smallest dimension; and
- (10) Each space station will have a mass of 500 kg or less, including any propellant.

(c) *Other application information.* Applicants must also provide the information in specified in § 25.122(d) in narrative form.

12. In § 25.137, revise paragraphs (b) and (d)(5) to read as follows:

**§ 25.137 Requests for U.S. market access through non-U.S.-licensed space stations.**

\* \* \* \* \*



(b) Any request pursuant to paragraph (a) of this section must be filed electronically through the International Bureau Filing System and must include an exhibit providing legal and technical information for the non-U.S.-licensed space station of the kind that § 25.114 or § 25.122 or § 25.123 would require in a license application for that space station, including but not limited to, information required to complete Schedule S. An applicant may satisfy this requirement by cross-referencing a pending application containing the requisite information or by citing a prior grant of authority to communicate via the space station in question in the same frequency bands to provide the same type of service.

\* \* \* \* \*

(d) \* \* \*

(5) Recipients of U.S. market access for NGSO-like satellite operation that have one market access request on file with the Commission in a particular frequency band, or one granted market access request for an unbuilt NGSO-like system in a particular frequency band, other than those filed or granted under the procedures in § 25.122 or § 25.123, will not be permitted to request access to the U.S. market through another NGSO-like system in that frequency band. This provision shall not apply to recipients of U.S. market access applying under § 25.122 or § 25.123.

13. In § 25.156, revise paragraph (d)(1) to read as follows:

**§ 25.156 Consideration of applications.**

\* \* \* \* \*

(d)(1) Applications for NGSO-like satellite operation will be considered pursuant to the procedures set forth in § 25.157, except as provided in § 25.157(b) or § 25.157(i), as appropriate.

\* \* \* \* \*

14. In § 25.157, revise paragraph (a), and add paragraph (i) to read as follows:

**§ 25.157 Consideration of applications for NGSO-like satellite operation.**

(a) This section specifies the procedures for considering license applications for “NGSO-like” satellite operation, except as provided in paragraphs (b) and (i) of this section. For purposes of this section, the term “NGSO-like satellite operation” means:

- (1) Operation of any NGSO satellite system, and
- (2) Operation of a GSO MSS satellite to communicate with earth stations with non-directional antennas.

\* \* \* \* \*

(i) For consideration of license applications filed pursuant to the procedures described in § 25.122 or § 25.123, the application will be processed and granted in accordance with §§ 25.150-25.156, taking into consideration the information provided by the applicant under § 25.122(d) or § 25.123(c), but without a processing round as described in this section and without a queue as described in § 25.158.

15. In § 25.159, revise paragraph (b) to read as follows:

**§ 25.159 Limits on pending applications and unbuilt satellite systems.**

\* \* \* \* \*

(b) Applicants with an application for one NGSO-like satellite system license on file with the Commission in a particular frequency band, or one licensed-but-unbuilt NGSO-like satellite system in a particular frequency band, other than those filed or licensed under the procedures in § 25.122 or § 25.123, will not be permitted to apply for another NGSO-like satellite system license in that frequency band. This provision shall not apply to applicants filing under § 25.122 or § 25.123.

\* \* \* \* \*

16. In § 25.165, revise paragraphs (a) and (e)(1), to read as follows:

**§ 25.165 Surety bonds.**

(a) For all space station licenses issued after September 20, 2004, other than licenses for DBS space stations, SDARS space stations, space stations licensed in accordance with § 25.122 or § 25.123, and replacement space stations as defined in paragraph (e) of this section, the licensee must post a bond within 30 days of the grant of its license. Space station licensed in accordance with § 25.122 or § 25.123 must post a bond within one year plus 30 days of the grant of the license. Failure to post a bond will render the license null and void automatically.

\* \* \* \* \*

(e) A replacement space station is one that:

(1) Is authorized to operate at an orbital location within  $\pm 0.15^\circ$  of the assigned location of a GSO space station to be replaced or is authorized for NGSO operation and will replace an existing NGSO space station in its authorized orbit, except for space stations authorized under § 25.122 or § 25.123;

\* \* \* \* \*

17. In § 25.217 of the Commission's rules, revise paragraph (b)(1) as follows:

**§ 25.217 Default service rules.**

(b)(1) For all NGSO-like satellite licenses, except as specified in paragraph (b)(4), for which the application was filed pursuant to the procedures set forth in § 25.157 after August 27, 2003, authorizing operations in a frequency band for which the Commission has not adopted frequency band-specific service rules at the time the license is granted, the licensee will be required to comply with the following technical requirements, notwithstanding the frequency bands specified in these rule provisions: §§ 25.143(b)(2)(ii) (except NGSO FSS systems) and (iii), 25.204(e), and 25.210(f) and (i).

\* \* \* \* \*

(4) For all small satellite licensees, for which the application was filed pursuant to § 25.122 or § 25.123, authorizing operations in a frequency band for which the Commission has not adopted frequency-band specific service rules at the time the license is granted, the licensee will not be required to comply with the technical requirements specified in this section.

\* \* \* \* \*

## APPENDIX B

## Final Regulatory Flexibility Analysis

As required by the Regulatory Flexibility Act of 1980, as amended (RFA),<sup>1</sup> an Initial Regulatory Flexibility Analysis (IRFA) was incorporated in the *Notice of Proposed Rulemaking (NPRM)* released in April 2018 in this proceeding.<sup>2</sup> No comments were filed addressing the IRFA. This present Final Regulatory Flexibility Analysis (FRFA) conforms to the RFA.<sup>3</sup>

**A. Need for, and Objectives of, the Proposed Rules**

This Report and Order adopts a number of proposals relating to the Commission's rules and policies regarding the licensing of small satellites. Adoption of these changes will, among other things, make the licensing process more accessible, decrease processing times, limit regulatory burdens, and offer protection for critical communication links, while promoting orbital debris mitigation and efficient use of spectrum.

The Report and Order adopts several changes to 47 CFR parts 1 and 25. Principally, it:

- 1) Establishes a new, optional licensing and market access process within part 25 for "small satellites" and "small spacecraft." Satellites and systems licensed under this new streamlined process will meet several qualifying criteria, which are consistent with the goals of enabling faster review of applications in order to facilitate the deployment and operation of these systems.
- 2) Modifies the Commission's part 25 processing procedures applicable to qualifying small satellite systems, so that unlike most part 25 NGSO satellite systems, qualifying small satellite systems will not be subject to processing rounds.
- 3) Amends the Commission's satellite surety bond policies to provide a one-year grace period, applicable to small satellite streamlined licensees, during which the licensees would not need to post the surety bond required under the Commission's rules.
- 4) Adopts a new application fee category for the streamlined small satellite license and market access applicants in the amount of \$30,000, and adopts a new regulatory fee category for streamlined small satellite licensees and market access grantees.

**B. Summary of Significant Issues Raised by Public Comments in Response to the IRFA**

No comments were filed that specifically addressed the IRFA.

**C. Response to Comments by the Chief Counsel for Advocacy of the Small Business Administration**

Pursuant to the Small Business Jobs Act of 2010, which amended the RFA, the Commission is required to respond to any comments filed by the Chief Counsel for Advocacy of the Small Business Administration (SBA), and to provide a detailed statement of any change made to the proposed rules as a result of those comments.<sup>4</sup> The Chief Counsel did not file any comments in response to the proposed rules in this proceeding.

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<sup>1</sup> See 5 U.S.C. § 603. The RFA, see 5 U.S.C. § 601-612, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996, (SBREFA) Pub. L. No. 104-121, Title II, 110 Stat. 857 (1996).

<sup>2</sup> *Streamlining Licensing Procedures for Small Satellites*, Notice of Proposed Rulemaking, 33 FCC Rcd 4152 (2018).

<sup>3</sup> See 5 U.S.C. § 604.

<sup>4</sup> 5 U.S.C. § 604(a)(3).

**D. Description and Estimate of the Number of Small Entities To Which the Proposed Rules Will Apply**

The RFA directs agencies to provide a description of, and, where feasible, an estimate of, the number of small entities that may be affected by the proposed rules and policies, if adopted herein.<sup>5</sup> The RFA generally defines the term “small entity” as having the same meaning as the terms “small business,” “small organization,” and “small governmental jurisdiction.”<sup>6</sup> In addition, the term “small business” has the same meaning as the term “small business concern” under the Small Business Act.<sup>7</sup> A “small business concern” is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the Small Business Administration (SBA).<sup>8</sup> Below, we describe and estimate the number of small entity licensees that may be affected by adoption of the final rules.

***Satellite Telecommunications and All Other Telecommunications.***

The rules proposed in this Notice would affect some providers of satellite telecommunications services, if adopted. Satellite telecommunications service providers include satellite and earth station operators. Since 2007, the SBA has recognized two census categories for satellite telecommunications firms: “Satellite Telecommunications” and “All Other Telecommunications.” Under both categories, a business is considered small if it had \$32.5 million or less in average annual receipts.<sup>9</sup>

The first category of Satellite Telecommunications “comprises establishments primarily engaged in providing telecommunications services to other establishments in the telecommunications and broadcasting industries by forwarding and receiving communications signals via a system of satellites or reselling satellite telecommunications.”<sup>10</sup> For this category, Census Bureau data for 2012 show that there were a total of 333 satellite telecommunications firms that operated for the entire year.<sup>11</sup> Of this total, 299 firms had annual receipts of under \$25 million, and 12 firms had receipts of \$25 million to \$49,999,999.<sup>12</sup>

The second category of Other Telecommunications is comprised of entities “primarily engaged in providing specialized telecommunications services, such as satellite tracking, communications telemetry, and radar station operation. This industry also includes establishments primarily engaged in providing satellite terminal stations and associated facilities connected with one or more terrestrial systems and capable of transmitting telecommunications to, and receiving telecommunications from, satellite systems. Establishments providing Internet services or voice over Internet protocol (VoIP) services via client-supplied telecommunications connections are also included in this industry.”<sup>13</sup> For this category, Census Bureau data for 2012 show that there were a total of 1,442 firms that operated for the entire year.<sup>14</sup> Of

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<sup>5</sup> *Id.*

<sup>6</sup> 5 U.S.C. § 601(6).

<sup>7</sup> 5 U.S.C. § 601(3) (incorporating by reference the definition of “small-business concern” in the Small Business Act, 15 U.S.C. § 632). Pursuant to 5 U.S.C. § 601(3), the statutory definition of a small business applies “unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register.”

<sup>8</sup> 15 U.S.C. § 632.

<sup>9</sup> See 13 CFR § 121.201 NAICS code 517410 and code 517919.

<sup>10</sup> U.S. Census Bureau, 2007 NAICS Definitions, “517410 Satellite Telecommunications”.

<sup>11</sup> See <https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk>.

<sup>12</sup> *Id.*

<sup>13</sup> U.S. Census Bureau, 2007 NAICS Definitions, “517919 Satellite Telecommunications”.

<sup>14</sup> See 13 CFR § 121.201, NAICS code 517919.

this total, 1,415 firms had annual receipts of under \$25 million.<sup>15</sup> Some of these “Other Telecommunications firms,” which are small entities, are earth station applicants/licensees, but since we do not adopt changes to our licensing rules specific to earth stations, we do not anticipate that these entities would be affected if our proposed rule changes are adopted.

We anticipate that our proposed rule changes may have an impact on some space station applicants and licensees. While traditionally space station applicants and licensees only rarely qualified under the definition of a small entity, some small satellite applicants and licensees applying under the streamlined process adopted in this Order may qualify as small entities.

**E. Description of the Projected Reporting, Recordkeeping, and Other Compliance Requirements**

The Report and Order adopts several rule changes that would affect compliance requirements for space station operators. As noted above, some of these parties may qualify as small entities.

The rules adopted generally lower the compliance burden on all affected entities, including small entities. The streamlined small satellite process adopted in the Order is optional, and so will not create any additional burden in terms of compliance requirements. Entities seeking to apply under existing procedures may do so. The streamlined small satellite process lowers the compliance burden by, among other things, giving qualifying applicants the opportunity to provide information by certifications rather than by narrative in many instances, and to obtain an exemption from the Commission’s processing round procedures. The Report and Order also decreases the part 25 application fees applicable to qualifying small satellites and establishes a new category for small satellite regulatory fees.

**F. Steps Taken to Minimize the Significant Economic Impact on Small Entities, and Significant Alternatives Considered**

The RFA requires an agency to describe any significant alternatives that it has considered in developing its approach, which may include the following four alternatives (among others): “(1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance and reporting requirements under the rule for such small entities; (3) the use of performance rather than design standards; and (4) an exemption from coverage of the rule, or any part thereof, for such small entities.”<sup>16</sup>

In this Report and Order, the Commission relaxes or removes requirements on NGSO satellite operators who qualify for the streamlined small satellite process. Applicants may submit information in the form of certifications, rather than providing detailed narrative information, in a number of instances. The application requirements for applicants seeking to apply under the streamlined small satellite process have been moved to a new rule section for easier reference. The Report and Order considers the various qualifying characteristics proposed in the *NPRM*, as well as possible alternatives proposed in the comments. In several instances, based on the record, the Report and Order adopts relaxed qualifying criteria. Further, small satellite applicants will not be subject to the Commission’s processing round procedures, and small satellite operators will have a grace period before they must post a surety bond. The Report and Order also adopts an application fee for streamlined small satellite applicants that is significantly reduced from the fees that would be currently applicable to applicants and licensees for NGSO systems currently under part 25.

**G. Federal Rules that May Duplicate, Overlap, or Conflict with the Proposed Rules**

None.

<sup>15</sup> <https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk>.

<sup>16</sup> 5 U.S.C. § 603(c)(1)-(4).

## APPENDIX C

**List of Commenters to NPRM****Comments**

Analytical Space, Inc.  
ARRL, the National Association for Amateur Radio  
Aviation Spectrum Resources, Inc.  
Center for Space Standards and Innovation  
Commercial Smallsat Spectrum Management Association  
Commercial Spaceflight Federation  
EchoStar Satellite Operating Corporation and Hughes Network Systems, LLC  
Globalstar, Inc.  
Inmarsat, Inc  
Iridium Communications, Inc.  
Moon Express, Inc.  
Open Research Institute, Inc.  
ORBCOMM Inc.  
Phase Four, Inc  
Radio Amateur Satellite Corporation (AMSAT)  
Ray Soifer  
Rob Boesel, Ted Myers, HybridX LLC  
Satellite Industry Association  
Scott Palo, et al., University Small-Satellite Researchers  
Space Exploration Technologies Corp.  
The Boeing Company

**Reply Comments**

Audacy Corporation  
Commercial Smallsat Spectrum Management Association  
Commercial Spaceflight Federation  
Dennis Silage  
Globalstar, Inc.  
Iridium Communications, Inc.  
Open Research Institute, Inc.  
ORBCOMM Inc.  
Radio Amateur Satellite Corporation (AMSAT)  
Ray Soifer  
Robert Bruninga, Dr. Jin Kang, and Todd Brunner  
SES Americom, Inc. and O3B Limited  
Scott Palo, et. al, University Small-Satellite Researchers  
Space Exploration Technologies Corp.  
Viasat, Inc.  
Xplore Inc.

**Ex Parte Filings**

Alba Orbital  
Alistair Funge  
Analytical Space, Inc.  
Aviation Spectrum Resources, Inc., Collins Aerospace, Harris Corporation, and SITAONAIR  
Globalstar, Inc.  
Hughes Network Systems, LLC

Loft Orbital Solutions Inc.  
Maxar Technologies Holdings Inc.  
Ray Soifer  
Robert L. Ehresman Jr.  
Satellite Industry Association  
Scott Palo, Blake E. Reid, et al., Samuelson-Glushko Technology Law & Policy Clinic  
Spire Global, Inc.  
Steven Nixon, SmallSat Alliance  
The Boeing Company  
UbiquitiLink, Inc.  
ViaSat, Inc.

**STATEMENT OF  
CHAIRMAN AJIT PAI**

Re: *Streamlining Licensing Procedures for Small Satellites*, IB Docket No. 18-86.

Under my leadership, the FCC has been working hard to promote American innovation in space. After all, the space sector has had a major impact on national life, producing new inventions and technologies that have transformed our society for the better. Impelled by the space race, the Jet Propulsion Laboratory developed advanced digital imaging technology. This technology ultimately helped to create computer-aided tomography (CAT) scans, which diagnose life-threatening conditions in American patients every day. The explosive charges used to separate devices on the Space Shuttle were tweaked and miniaturized to operate the “jaws of life,” which extricates the victims of horrific car crashes from their vehicles. And who can forget Tang?

Needless to say, innovation in space is hard. And burdensome regulations can make it harder. Despite the fact that satellite technology has diversified dramatically in recent years—from tiny CubeSats to shimmering lightsails, soaring around the Earth on beams of sunlight—our rules for processing satellite applications haven’t kept up. We still require small satellites, which have minimal mass and short orbital lifetimes, to jump through the same regulatory hoops as larger, heavier satellites that may stay in low Earth orbit for many years. But there is no reason why a satellite the size of a shoebox, with the life expectancy of a guinea pig, should be regulated the same way as a satellite the size of a school bus that will stay in orbit for centuries.

That’s why the FCC is creating a new, separate, streamlined licensing procedure for small satellites. This optional application process for small satellites is grounded in our Part 25 rules. In order to qualify for this process, an application must include ten or fewer satellites, and those satellites must have an on-orbit lifetime of six years or less, a maximum wet mass of 180 kilograms, and other characteristics designed to reduce the risk of orbital debris and spectrum interference.

Those qualifying for this process would submit a streamlined application, be exempted from the Commission’s processing round procedures, be granted a one-year grace period from posting of a surety bond, and pay a smaller application fee. In other words, they would face a shorter and less expensive application process.

This streamlined process would be in addition to, and not a replacement for, the existing processes for satellite authorization under Parts 5 (experimental), 25, and 97 (amateur) of the Commission’s rules. And again, no one will be required to use the streamlined process; it may be invoked at the option of those who qualify.

My gratitude to the many Commission staffers working to make it easier and cheaper to license small satellites. I’d like to thank Jose Albuquerque, Stephen Duall, Jennifer Gilsean, Samuel Karty, Karl Kensinger, Brian Murff, Sankar Persaud, Tom Sullivan, Troy Tanner, and Merissa Velez from the International Bureau; Don Stockdale and Joel Taubenblatt from the Wireless Telecommunications Bureau; Ira Keltz, Julius Knapp, and Nicholas Oros from the Office of Engineering and Technology; Dick Kwiakowski and Emily Talaga from the Office of Economics and Analytics; Ashley Boizelle, Deborah Broderon, David Horowitz, and Linda Oliver from the Office of the General Counsel; and Mika Savir and Deena Shetler from the Office of the Managing Director.



**STATEMENT OF  
COMMISSIONER MICHAEL O'RIELLY**

Re: *Streamlining Licensing Procedures for Small Satellites*, IB Docket 18-86.

I am generally supportive of efforts to streamline our licensing procedures for small satellites. This item should provide some helpful relief for the small set of academics, scientists, and entrepreneurs who are looking to test out their innovative ideas via this technology. Although the term “small sats” can also refer to those that make up the large NGSO fleets, today’s item is intended to streamline processes for smaller systems – those with fewer satellites, used for a shorter duration, at far lower cost.

Facilitating the launch of multiple small sats, however, does raise the lingering and unresolved issue of orbital debris once again. Space used to be reserved for a handful of players, but now with cost barriers reduced, technology improved, and commercialization taking hold, the practice of launching satellites has become commonplace. In fact, we do not know exactly which or how many entities will avail themselves of the opportunity we provide today, but with it comes responsibility. All participants must be answerable stewards; otherwise, space junk from launches, old satellites, or even mishaps could turn space into a hazardous, and potentially unusable, obstacle course.

Even before the launch activity for the huge NGSO constellations and these small sats really gets underway, it has already been estimated that there are 128 million pieces of space debris between 1 mm to 1 cm in size in space; 900,00 objects from 1 cm to 10 cm; and 34,000 pieces larger than 10 cm.<sup>1</sup> And, this is likely to increase. One large NGSO operator recently launched 60 satellites, but three didn’t work quite as planned.<sup>2</sup> This is not a criticism in any way – sometimes technology doesn’t match expectations and these satellites are being monitored by the company for deorbiting. But this is just one example of many more mishaps likely to come. Given the Commission’s adoption of rules that could result in thousands of satellites being put into orbit and industry’s activity in starting to launch,<sup>3</sup> we cannot sidestep this issue any further. This is why the Commission started an orbital debris proceeding. While I understand that other federal agencies with different expertise have been considering this matter and the Commission is part of an interagency working group, it makes most sense to consider the issue expeditiously, not two years from now. If others fail to act, the Commission may have to shoulder the responsibility.

Additionally, the Commission should look at ways to improve interagency coordination when federal and commercial entities share spectrum bands. There is information in the record suggesting that coordination is slowing down the commercial sector, resulting in missed launches, delays, and lower service quality. Since this issue affects more than just small sats, the Commission does not take any action to address it today. However, the coordination process for federal and non-federal satellite spectrum should be fully reviewed and appropriately improved as soon as possible.

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<sup>1</sup> European Space Agency, *Space Debris by the Numbers*, [https://www.esa.int/Our\\_Activities/Space\\_Safety/Space\\_Debris/Space\\_debris\\_by\\_the\\_numbers](https://www.esa.int/Our_Activities/Space_Safety/Space_Debris/Space_debris_by_the_numbers) (last visited Aug. 1, 2019).

<sup>2</sup> Caleb Henry, *Contact Lost With Three Starlink Satellites, Other 57 Healthy*, SPACENEWS, July 1, 2019, <https://spacenews.com/contact-lost-with-three-starlink-satellites-other-57-healthy/>.

<sup>3</sup> See Amy Thompson, *SpaceX Launches 60 Starlink Satellites on Thrice-Flown Rocket, Sticks Landing*, SPACE.COM, May 24, 2019, <https://www.space.com/spacex-launches-60-starlink-internet-satellites.html>; Paul Brinkmann, *Communication Satellite Firm OneWeb Plans to Start Monthly Launches in December*, UPI, July 22, 2019, [https://www.upi.com/Top\\_News/US/2019/07/22/Communications-satellite-firm-OneWeb-plans-to-start-monthly-launches-in-December/7901563812391/](https://www.upi.com/Top_News/US/2019/07/22/Communications-satellite-firm-OneWeb-plans-to-start-monthly-launches-in-December/7901563812391/).

**STATEMENT OF  
COMMISSIONER BRENDAN CARR**

Re: *Streamlining Licensing Procedures for Small Satellites*, IB Docket No. 18-86.

Last month marked the 50th anniversary of the Apollo 11 moon landing. At 10:56 PM eastern time on July 20, 1969, Neil Armstrong descended from the lunar module and stepped onto the surface of the moon, uttering the immortal words: “That’s one small step for a man, one giant leap for mankind.” It’s estimated that half a billion people watched that event live—one out of every seven people on Earth at the time. And this Commission played a small and often overlooked role in that historic moment. The FCC authorized and managed the communications between Apollo 11 and stations back on Earth that not only allowed the world to see Armstrong’s historic first steps, but also ensured that communications with NASA’s Houston center remained intact.

In the intervening years, communications technology has gotten much smaller and much more powerful. Apollo’s guidance computer weighed about 70 pounds, and it had less computing power than a modern pocket calculator. The geostationary satellites of old were often as big as a school bus. Today, we’re seeing an uptick in launches of small satellites, or small sats, which are often so small you could fit one in the palm of your hand.

Now, it’s perfectly fine to be nostalgic about previous generations of technology. But our regulations need to move on. As technology evolves—as it gets smaller and more cost efficient—it is incumbent on us, as regulators, to ensure that our rules are “right sized”—that they are tailored to reflect the costs and impacts associated with new innovations. We’ve seen time and again that outdated regulations designed for the products and services of decades past can be a barrier to deploying the technology of the future. Back here at ground level, for instance, we saw that regulations designed for large macro towers threatened to stifle the deployment of new small cells and undermine U.S. leadership in 5G. So we exempted small wireless facilities from those regulatory procedures. And this one step helped enable the private sector in the U.S. to build out the world’s largest 5G network.

Similarly, the FCC’s part 25 approach for processing satellite applications was designed for the school bus-sized satellites that first launched decades ago. But that approach and its regulatory costs can prevent the business case for small sats from ever getting off the ground. So I’m glad that in today’s Order, we adopt a Rocket Docket for small sats. Our record shows that a streamlined process for small sats will encourage use cases from predicting crop yields with artificial intelligence to collecting data from sea vessels to aid in fishing operations.

By taking unnecessary regulatory costs out of the system, we can encourage investment and innovation in small sats while continuing to protect against harmful interference. An oversized regulatory burden should never be what stands between entrepreneurs and progress, so I’m pleased to support this Order. I want to thank the staffs of the International Bureau and the Wireless Telecommunications Bureau for their work on this item. It has my support.

**STATEMENT OF  
COMMISSIONER JESSICA ROSENWORCEL**

Re: *Streamlining Licensing Procedures for Small Satellites*, IB Docket No. 18-86.

If you were asked to design a spaceship, I'm willing to bet that the last thing you would draw is the lunar module that brought astronauts Neil Armstrong and Buzz Aldrin to the surface of the moon. It's the most unlikely contraption ever to invade the sky. Imagine a completely non-aerodynamic, multi-sided box with gangly legs jutting out in all the wrong places. It had neither symmetry nor grace. But to this day, that aluminum box, code-named Eagle, represents one of our country's crowning achievements.

Just days ago we marked the fiftieth anniversary of Apollo 11. Five decades on, we still are awed by humanity's first steps on another world. It's an anniversary that draws our curiosity back to the wonder of the heavens. But I want to draw attention to one of the most important and least understood successes of the Apollo mission—and that involves digital technology.

The National Aeronautics and Space Administration played a big role in helping develop the digital technologies all around us. When the race to the moon began, integrated circuits, or computer chips, were not a proven technology. But NASA saw that they would be essential to real-time computing, where answers from machines had to follow just seconds after questions were asked. So it was NASA that drove this technology, buying huge volumes of early computer chips. Moreover, it was NASA's uncompromising standards that drove these early chips to 100 percent reliability, making it possible to fly lunar landers and over time power your smartphone, carry out calculations that support Global Positioning Systems, and so much more.

In fact, for fifty years space-driven technologies have been improving daily life and creating new possibilities right here on the ground. That includes everything from robotics that offer new surgical capabilities to lithium-batteries powering electric cars to wetsuits to protect deep-sea divers to cameras that make panoramic photography a snap. The first space age was an incredible source of innovation.

Now a new space age beckons. It means more satellites, more possibilities for exploration, and more opportunities for entrepreneurial activity in our skies. It is inspiring a new generation of innovators and already we are seeing rockets for space tourism and new constellations that can expand broadband to the furthest reaches of the globe.

Today's decision takes steps to reform our satellite licensing for this new era. For constellations of up to ten small satellites, we adopt a new framework for authorization. It provides greater certainty than our experimental regime under Part 5 of our rules while cutting red tape in our traditional Part 25 rules. In other words, we fill a gap in our policies in order to expand the deployment of small satellite-based services in the United States.

This is important. Count me as excited that the Chairman has brought this decision before us today. It has my full support. But this is only a small part of the reforms we need for the new space age. A bigger challenge awaits us, still—namely, how can the Federal Communications Commission help reignite the spirit of innovation that culminated in the Apollo 11 mission to help meet our biggest challenges today?

To do so, I think there are three things we need to do now.

First, we need to protect the new space age by addressing orbital debris. In the past year, the FCC has approved over 13,000 new satellites for launch. That is nearly three times as many satellites currently in orbit right now. But we have not done anything new to address orbital debris. When you consider the size of new constellations and the extraordinary number of objects headed to space, you realize we need to address junking up our skies and we need to do it sooner rather than later. That's why more than a year ago I called for a comprehensive review of our orbital debris policies in order to mitigate collision risks and ensure space sustainability. We can't keep kicking this can down the road or insisting it is the province of other agencies that lack authority over commercial systems. We need to get it done now.

Second, we need to enable the new space age with spectrum for commercial launches. Remember, space missions used to be limited to the prowess of our superpowers. This was for good reason—going to space was out-of-this-world expensive. Missions were awe-inspiring but rare. But the new space age is different. That’s because new technologies and business models are dramatically bringing down the cost of space launches. The industry is moving toward new launch vehicles, new re-entry vehicles, and commercial spaceports. But it has been six years since we began a proceeding to explore the spectrum needs of the new commercial space launch industry and I think it’s time to work with our federal partners to conclude this effort.

Third, we need to coordinate in the new space age. Right now, the National Space Council is considering policy changes to promote the growth of the commercial space industry. Their work includes everything from reforming export controls to streamlining licenses. The membership of this group includes the Secretary of State, Secretary of Defense, Secretary of Transportation, Secretary of Homeland Security, and Director of National Intelligence. Representatives from the Office of Management and Budget, NASA, and the Joint Chiefs of Staff, among others, also serve on this council. It’s an impressive list. But the FCC should have a seat at the leadership table. We are the agency with licensing authority over commercial systems. Cutting the FCC out of this discussion is a mistake—and it deserves a fix.

Our minds have always reached above the clouds—and with the second space age here, I believe we can do these things and help recharge the innovative spirit that resulted in Apollo 11 fifty years ago. Let’s get to it.

**STATEMENT OF  
COMMISSIONER GEOFFREY STARKS**

Re: *Streamlining Licensing Procedures for Small Satellites*, IB Docket No. 18-86.

Less than two weeks ago, we celebrated the 50<sup>th</sup> anniversary of Apollo 11 and humanity's first trip to the moon. That mission capped the first Space Race, which began 12 years earlier with the Soviets' launch of the world's first artificial satellite, Sputnik. Today we are at the beginning of a new Space Race – only this time the race involves advanced launch capabilities, small satellites, and the possibility of innovative new services, including the provision of broadband to billions of people around the world. Unfortunately, while regulatory reform efforts are underway, many of our current satellite rules still date from the dawn of the space age. Today's order is a good start, but the FCC must continue to update its policies to encourage American leadership in this new golden age of space exploration.

American space companies are innovating in dramatic ways. Improvements in technology and the use of reusable launch vehicles have changed the nature of the launch industry. After years where the number of American launches barely cracked the mid-teens, last year we saw over 30 US launches, with the promise of far greater increases to come. While some of these launches involve traditional, large geostationary satellites in high orbits, an increasing number represent a wave of smaller next-generation satellites that will go into low orbits and cost only a fraction of their larger counterparts, using faster and smaller state-of-the-art processors.

These satellites will provide a wide-variety of services, ranging from national security missions, to position, navigation and timing, to weather and environmental sensing. But the area that I'm most excited about is the potential for these satellites to help address one of our toughest problems – improving rural America's access to broadband.

As industry continues to deploy the next generation of communications technologies in our urban centers, at least 21 million Americans currently do not have access to home broadband, a necessity in our modern world. This persistent digital divide has real-world consequences in terms of opportunities for employment, education and civic engagement, and is hardening into a state of internet inequality. We must address this problem before it gets worse.

Congress has charged those of us at the Federal Communications Commission with ensuring that all Americans have affordable access to quality communications services. But the most remote areas of the US represent a huge challenge. I have heard over and over from the industry that when only a few people live in a large geographic area, companies cannot make the business case to deploy fiber connections or high-speed wireless service. And while this agency and others continue to subsidize rural services to the tune of billions of dollars per year, the basic economics in the most remote areas of our country do not change.

It's certainly true that traditional geostationary satellite operators have and will continue to offer valuable services to these remote areas. But, as I explained last week in an op-ed in the Orlando Sentinel, this new golden age in space may provide a path forward on the issue of rural internet inequality. A new generation of operators promise high-speed service via constellations of thousands of satellites in low-Earth orbit. These new providers promise widespread high-speed coverage while reducing latency to the tens of milliseconds – fast enough to support voice and other critical services. And because they don't have the same economic constraints with deploying to rural areas as terrestrial providers, they can focus on the people most likely to need their service – those in rural parts of the US and around the world.

This new era of spaceflight is still unfolding, and many questions remain. But the FCC cannot afford to fall behind these developments – the risk is too high. The potential benefits of these innovative broadband services should cause us to reexamine our satellite rules to determine whether they help or hinder our goal of ensuring broadband access to rural America. We must adopt policies that both encourage investment in the networks we've already authorized, while leaving room for new players who

will provide new competition and new services. By doing so, we will strengthen American leadership in the new Space Race and establish the US regulatory approach as a model for other nations.

Here are three things that the FCC can do to accomplish these goals. First, we need to encourage all operators to develop more spectrally efficient systems. As launch has become more frequent, we're trying to cram more satellites into fewer and fewer frequencies. To relieve this increasing pressure we must drive all operators—old and new—to utilize advanced technologies to use spectrum efficiently.

The FCC has repeatedly recognized that, because spectrum is a limited resource, parties must utilize it as efficiently as possible. In the satellite context, new technologies like phased array antennas and adaptive beam-forming will permit satellites to target narrow coverage areas more precisely and reuse spectrum many times over to maximize throughput.

Today's order takes some small, but significant steps in this direction. The FCC should consider a system's spectrum efficiency as part of future satellite policymaking initiatives, including its review of applications in future NGSO processing rounds. Doing so will encourage applicants to use the most innovative technology available, while increasing the amount of spectrum available for new entrants and new services.

Second, to encourage further deployments, we must make launch as accessible as possible. While many people may not be aware of it, the FCC has a critical role in authorizing commercial launches. Commercial operators currently use spectrum licensed to Federal users to communicate with and track their launch vehicles. Because of the Federal allocation of this spectrum, operators must work with Commission staff to obtain a Special Temporary Authorization for each launch. Parties file their STA applications, then our staff engages with federal stakeholders through emails and phone calls to negotiate access to the federal spectrum for each launch. If any details of the launch change over time – which they often do – the launch operator must ask the Commission to go through this process again to rework the authorization.

This approach may have made sense in an earlier age of spaceflight, when the entire US launch industry launched less than 20 times per year, but we are rapidly approaching a period when a single operator could stage a launch each week. The Commission anticipated this problem more than six years ago, when it issued a Notice of Proposed Rulemaking proposing several ways to provide spectrum for communications during commercial space launches.<sup>1</sup> Since then, however, this proceeding has laid dormant. Given the increasing pace of launches, we need to reenergize that rulemaking and move forward as soon as possible.

Third and finally, the Commission should proceed with its orbital debris rulemaking. As this item recognizes, the issue of orbital debris is a critical one, particularly given the growing potential for thousands of small satellites in low-earth orbit. Because of their numbers, small size and low orbit, these satellites present fundamentally different risks than traditional satellites, yet our rules have not been updated since 2004. Last year the Commission issued a Notice of Proposed Rulemaking on this important issue.<sup>2</sup> We need to move forward with final orbital debris rules to protect satellite safety and provide certainty to the rapidly growing satellite industry.

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<sup>1</sup> See *Amendment of Part 2 of the Commission's Rules for Federal Earth Stations Communicating with Non-Federal Fixed Satellite Service Space Stations; Federal Space Station Use of the 399.9-400.05 MHz Band; and Allocation of Spectrum for Non-Federal Space Launch Operations*, Notice of Proposed Rulemaking and Notice of Inquiry, 28 FCC Red 6698 (2013).

<sup>2</sup> *Mitigation of Orbital Debris in the New Space Age*, Notice of Proposed Rulemaking, 33 FCC Red 11352 (2018).

Rural internet inequality persists throughout America despite billions of dollars in state and federal government investment. But the new era of satellite service could help address this problem. Encouraging this promising industry takes more than uplifting statements. Like the federal government leaders that brought the success of Apollo 11, the Commission needs enact policies that ensure that America wins this new Space Race.

My thanks to the International Bureau for their work on this item.