
Federal Communications Commission

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

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

ERRATUM

Released: May 22, 2020

By the Chief, International Bureau:

On April 24, 2020, the Commission released a Report and Order and Further Notice of Proposed Rulemaking (*Order and FNPRM*), FCC 20-54, in the above captioned proceeding. This Erratum amends the *Order and FNPRM*, as described below:

1. In paragraph 173, in the first sentence, replace “0.001” with “0.0001”.
2. In footnote 635, replace “*See Appendix A, Final Rules*” with “*See proposal above*”.

This Erratum also amends the Final Rules in Appendix A of the *Order and NPRM* as indicated below:

3. In paragraph 2 under part 5, § 5.64(b), replace the “* * *” following (b) with the following text to reflect that the introductory text to § 5.64(b) is unchanged:

“Except where the satellite system has already been authorized by the FCC, applicants for an experimental authorization involving a satellite system must submit a description of the design and operational strategies the satellite system will use to mitigate orbital debris, including the following information:”

4. Replace paragraph 2 under part 25 with the following text¹:
“2. Amend § 25.114 by revising paragraph (d)(14) to read as follows:

§ 25.114 Applications for space station authorizations.

* * * * *

(d) * * *

(14) A description of the design and operational strategies that will be used to mitigate orbital debris, including the following information:

¹ Although paragraph 2 under part 25 of the Final Rules in Appendix A of the Order and FNPRM will now set out the entire text of § 25.114(d)(14), we note that the errors in paragraph 2 that we are correcting with this Erratum consist only of the inadvertently omitted introductory text to § 25.114(d)(14), and the inadvertently omitted § 25.114(d)(14)(viii), which, prior to the Order and FNPRM, had been codified under a different section number (*i.e.*, as § 25.114(d)(14)(v)).

(i) A statement that the space station operator has assessed and limited the amount of debris released in a planned manner during normal operations. Where applicable, this statement must include an orbital debris mitigation disclosure for any separate deployment devices, distinct from the space station launch vehicle, that may become a source of orbital debris;

(ii) A statement indicating whether the space station operator has assessed and limited the probability that the space station(s) will become a source of debris by collision with small debris or meteoroids that would cause loss of control and prevent disposal. The statement must indicate whether this probability for an individual space station is 0.01 (1 in 100) or less, as calculated using the NASA Debris Assessment Software or a higher fidelity assessment tool;

(iii) A statement that the space station operator has assessed and limited the probability, during and after completion of mission operations, of accidental explosions or of release of liquids that will persist in droplet form. This statement must include a demonstration that debris generation will not result from the conversion of energy sources on board the spacecraft into energy that fragments the spacecraft. Energy sources include chemical, pressure, and kinetic energy. This 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;

(iv) A statement that the space station operator has assessed and limited the probability of the space station(s) becoming a source of debris by collisions with large debris or other operational space stations.

(A) Where the application is for an NGSO space station or system, the following information must also be included:

1. A demonstration that the space station operator has assessed and limited the probability of collision between any space station of the system and other large objects (10 cm or larger in diameter) during the total orbital lifetime of the space station, including any de-orbit phases, to less than 0.001 (1 in 1,000). The probability shall be calculated using the NASA Debris Assessment Software or a higher fidelity assessment tool. The collision risk may be assumed zero for a space station during any period in which the space station will be maneuvered effectively to avoid colliding with large objects.
2. The statement must identify characteristics of the space station(s)' orbits that may present a collision risk, including any planned and/or operational space stations in those orbits, and indicate what steps, if any, have been taken to coordinate with the other spacecraft or system, or what other measures the operator plans to use to avoid collision.
3. If at any time during the space station(s)' mission or de-orbit phase the space station(s) will transit through the orbits used by any inhabitable spacecraft, including the International Space Station, the statement must describe the design and operational strategies, if any, that will be used to

minimize the risk of collision and avoid posing any operational constraints to the inhabitable spacecraft.

4. The statement must disclose the accuracy, if any, with which orbital parameters will be maintained, including apogee, perigee, inclination, and the right ascension of the ascending node(s). In the event that a system is not able to maintain orbital tolerances, *e.g.*, its propulsion system will not be used for orbital maintenance, that fact must be included in the debris mitigation disclosure. Such systems must also indicate the anticipated evolution over time of the orbit of the proposed satellite or satellites. All systems must describe the extent of satellite maneuverability, whether or not the space station design includes a propulsion system.

5. The space station operator must certify that upon receipt of a space situational awareness conjunction warning, the operator will review and take all possible steps to assess the collision risk, and will mitigate the collision risk if necessary. As appropriate, steps to assess and mitigate the collision risk should include, but are not limited to: contacting the operator of any active spacecraft involved in such a warning; sharing ephemeris data and other appropriate operational information with any such operator; and modifying space station attitude and/or operations.

(B) Where a space station requests the assignment of a geostationary orbit location, it must assess whether there are any known satellites located at, or reasonably expected to be located at, the requested orbital location, or assigned in the vicinity of that location, such that the station keeping volumes of the respective satellites might overlap or touch. If so, the statement must include a statement as to the identities of those satellites and the measures that will be taken to prevent collisions;

(v) A statement addressing the trackability of the space station(s). Space station(s) operating in low-Earth orbit will be presumed trackable if each individual space station is 10 cm or larger in its smallest dimension, excluding deployable components. Where the application is for an NGSO space station or system, the statement shall also disclose the following:

(A) How the operator plans to identify the space station(s) following deployment and whether space station tracking will be active or passive;

(B) Whether, prior to deployment, the space station(s) will be registered with the 18th Space Control Squadron or successor entity; and

(C) The extent to which the space station operator plans to share information regarding initial deployment, ephemeris, and/or planned maneuvers with the 18th Space Control Squadron or successor entity, other entities that engage in space situational awareness or space traffic management functions, and/or other operators.

(vi) A statement disclosing planned proximity operations, if any, and addressing debris generation that will or may result from the proposed operations, including any planned release of debris, the risk of accidental explosions, the risk of accidental collision, and measures taken to mitigate those risks.

(vii) A statement detailing the disposal plans for the space station, including the quantity of fuel—if any—that will be reserved for disposal maneuvers. In addition, the following specific provisions apply:

(A) For geostationary orbit space stations, the statement must disclose the altitude selected for a disposal orbit and the calculations that are used in deriving the disposal altitude.

(B) For space stations terminating operations in an orbit in or passing through the low-Earth orbit region below 2,000 km altitude, the statement must disclose whether the spacecraft will be disposed of through atmospheric re-entry, specifying if direct retrieval of the spacecraft will be used. The statement must also disclose the expected time in orbit for the space station following the completion of the mission.

(C) For space stations not covered by either (A) or (B), the statement must indicate whether disposal will involve use of a storage orbit or long-term atmospheric re-entry and rationale for the selected disposal plan.

(D) For all space stations under (B) or (C), the following additional specific provisions apply:

1. The statement must include a demonstration that the probability of success of the chosen disposal method will be 0.9 or greater for any individual space station. For space station systems consisting of multiple space stations, the demonstration should include additional information regarding efforts to achieve a higher probability of success, with a goal, for large systems, of a probability of success for any individual space station of 0.99 or better. For space stations under (B), successful disposal is defined as atmospheric re-entry of the spacecraft within 25 years or less following completion of the mission. For space stations under (C), successful disposal will be assessed on a case-by-case basis.

2. If planned disposal is by atmospheric re-entry, the statement must also include:

a. A disclosure indicating whether the atmospheric re-entry will be an uncontrolled re-entry or a controlled targeted reentry.

b. An assessment as to whether portions of any individual spacecraft will survive atmospheric re-entry and impact the surface of the Earth with a kinetic energy in excess of 15 joules, and demonstration that the calculated casualty risk for an individual spacecraft using the NASA Debris Assessment Software or a higher fidelity assessment tool is less than 0.0001 (1 in 10,000).

(E) Applicants for space stations to be used only for commercial remote sensing may, in lieu of submitting detailed post-mission disposal plans to the Commission, certify that they have submitted such plans to the National Oceanic and Atmospheric Administration for review.

(viii) For non-U.S.-licensed space stations, the requirement to describe the design and operational strategies to minimize orbital debris risk can be satisfied by demonstrating that debris mitigation plans for the space station(s) for which U.S. market access is

requested are subject to direct and effective regulatory oversight by the national licensing authority.

* * * * *

5. Replace paragraph 4 under part 25 with the following text²:

“4. Amend § 25.122 by revising paragraphs (c) and (d) to read as follows:

§ 25.122 Applications for streamlined small space station authorization.

* * * * *

(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;

² Although paragraph 4 under part 25 of the Final Rules in Appendix A of the Order and FNPRM will now set out the entire text of §§ 25.122(c) and (d), we note that the errors in paragraph 4 that we are correcting with this Erratum consist only of the incorrectly numbered §§ 25.122 (c)(13) and (c)(14) (which had appeared as §§ 25.122 (c)(8) and (c)(13), respectively), and the inadvertently omitted § 25.122(d)(10), which, prior to the Order and FNPRM, had been adopted by the Commission in FCC 19-81 under a different section number (*i.e.*, as § 25.122(d)(6)). See *Streamlining Licensing Procedures for Small Satellites*, Report and Order, FCC 19-81, 34 FCC Rcd 13077, 13130-32 (2019). The rules adopted in FCC 19-81 are pending publication in the Federal Register.

- (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;
- (13) The probability that any individual space station will become a source of debris by collision with small debris or meteoroids that would cause loss of control and prevent disposal is 0.01 (1 in 100) or less; and
- (14) Upon receipt of a space situational awareness conjunction warning, the licensee or operator will review and take all possible steps to assess the collision risk, and will mitigate the collision risk if necessary. As appropriate, steps to assess and mitigate the collision risk should include, but are not limited to: contacting the operator of any active spacecraft involved in such a warning; sharing ephemeris data and other appropriate operational information with any such operator; and modifying space station attitude and/or operations.

(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) If at any time during the space station(s)' mission or de-orbit phase the space station(s) will transit through the orbits used by any inhabitable spacecraft, including the International Space Station, a description of the design and operational strategies, if any, that will be used to minimize the risk of collision and avoid posing any operational constraints to the inhabitable spacecraft shall be furnished at the time of application;
- (5) A statement identifying characteristics of the space station(s)' orbits that may present a collision risk, including any planned and/or operational space stations in those orbits, and indicating what steps, if any, have been taken to coordinate with the other spacecraft or system, or what other measures the licensee plans to use to avoid collision;
- (6) A statement disclosing how the licensee or operator plans to identify the space station(s) following deployment and whether space station tracking will be active or passive; whether the space station(s) will be registered with the 18th Space Control Squadron or successor entity prior to deployment; and the extent to which the space station licensee or operator plans to share information regarding initial deployment, ephemeris, and/or planned maneuvers with the 18th Space Control Squadron or successor entity, other entities that engage in space situational awareness or space traffic management functions, and/or other operators;
- (7) A description of the design and operation of maneuverability and deorbit systems, if any, and a description of the anticipated evolution over time of the orbit of the proposed satellite or satellites;
- (8) If there are planned proximity operations, a statement disclosing those planned operations, and addressing debris generation that will or may result from the proposed operations, including any planned release of debris, the risk of accidental explosions, the risk of accidental collision, and measures taken to mitigate those risks;
- (9) A demonstration that the probability of success of disposal is 0.9 or greater for any individual space station. Space stations deployed to orbits in which atmospheric drag will, in the event of a space station failure, limit the lifetime of the space station to less than 25 years do not need to

provide this additional demonstration; and

(10) 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).”

6. In paragraph 5 under part 25, in the amendatory language, replace “revising” with “adding” and “(b)” with “(b)(11)”.

7. In paragraph 2 under part 97, in the amendatory language, replace “(g)” with “(g)(1)”. Also replace the “* * *” following §97.207(g)(1) with the following text, to reflect that the introductory text to § 97.207(g)(1) is unchanged:

“A pre-space notification within 30 days after the date of launch vehicle determination, but no later than 90 days before integration of the space station into the launch vehicle. The notification must be in accordance with the provisions of Articles 9 and 11 of the International Telecommunication Union (ITU) Radio Regulations and must specify the information required by Appendix 4 and Resolution No. 642 of the ITU Radio Regulations. The notification must also include a description of the design and operational strategies that the space station will use to mitigate orbital debris, including the following information:”.

FEDERAL COMMUNICATIONS COMMISSION

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