



FCC Orbital Debris Mitigation (ODM) Checklist

Last Updated: February 2024

This checklist may be helpful for applicants in preparing their orbital debris mitigation plans and ensuring that all orbital debris mitigation requirements are addressed in their submissions. The checklist incorporates not only items specifically addressed in the Commission's rules, but also additional recommendations for submission by applicants, drawn from common information requests made by Commission staff during the application review process. In addition to this document, applicants may find it helpful to use the FCC's Orbital Debris Mitigation (ODM) Plan Worksheet.

I. Mission Overview and Spacecraft Information

- A statement describing the extent of satellite maneuverability, including whether or not the space station design includes a propulsion system. [§ 25.114\(d\)\(14\)\(iv\)\(A\)\(4\)](#). Indicate the components required for the propulsion system to operate reliably, including communications with the satellite.
- A statement describing the accuracy, if any, with which orbital parameters will be maintained, including apogee, perigee, inclination, and the right ascension of the ascending node(s). **If 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. [§ 25.114\(d\)\(14\)\(iv\)\(A\)\(4\)](#)
- A statement addressing the **trackability of the space station(s), including whether the smallest dimension of the spacecraft is 10 cm or larger**. Space station(s) operating in LEO will be presumed trackable if each individual space station is 10 cm or larger in its smallest dimension, excluding deployable components. [§ 25.114\(d\)\(14\)\(v\)](#)
- A statement describing how the operator plans to **identify the space station(s) following deployment and whether space station tracking will be active or passive**. Active tracking involves the use of instruments or devices that emit signals or radiation which are detected by sensors on the space station or other tracking systems. Passive tracking relies on detecting naturally occurring emissions or reflections off the surface of the space station or radio signals emitted by the station itself. Operators should also indicate if they plan to use enhanced tracking services and whether the information gathered by such services will be available to other operators. [§ 25.114\(d\)\(14\)\(v\)\(A\)](#)
- A statement indicating whether, prior to deployment, the space station(s) will be registered with the **18th Space Control Squadron (<http://www.space-track.org/>) or successor entity**. [§ 25.114\(d\)\(14\)\(v\)\(B\)](#)
- A statement describing 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. [§ 25.114\(d\)\(14\)\(v\)\(C\)](#)

II. Satellite Operations and Collision Risk

For non-geostationary satellites, a statement identifying the **characteristics of the space station(s)' orbits that may present a collision risk, including any planned and/or operational space stations in those orbits**. This statement must 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.

[§ 25.114\(d\)\(14\)\(iv\)\(A\)\(2\)](#). If the space station operator is relying on coordination with another system, the statement must indicate what steps have been taken to contact and ascertain the likelihood of successful coordination of physical operations with the other system. [§ 25.114\(d\)\(14\)\(iii\)](#)

For geostationary satellites, 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. [§ 25.114\(d\)\(14\)\(iii\)](#). If relevant, the statement must include the identities of those parties and the measures that will be taken to prevent collisions. [§ 25.114\(d\)\(14\)\(iv\)\(B\)](#)

A certification **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. [§ 25.114\(d\)\(14\)\(iv\)\(A\)\(5\)](#)

A. Collisions with Large Objects

A statement that the space station operator has assessed and limited **the probability of the space station becoming a source of debris by collisions with large debris or other operational space stations**. [§ 25.114\(d\)\(14\)\(iii\)](#), [§ 25.114\(d\)\(14\)\(iv\)](#)

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 (DAS) or a higher fidelity assessment tool. To obtain DAS, one must [request](#) NASA's Debris Assessment Software. Please ensure ample time to receive DAS and that you are using the latest version of DAS. [§ 25.114\(d\)\(14\)\(iv\)\(A\)\(1\)](#)

The collision risk may be assumed zero for a space station during the period of time when the satellite or space station is able to effectively conduct avoidance maneuvers. As a guideline, effective avoidance maneuvers reduce the probability of collision (P_c) by at least 1.5 orders of magnitude from the mitigation threshold (recommended to be $1E-4$) while not creating any additional conjunctions with a P_c value above the mitigation threshold. The [NASA Spacecraft Conjunction Assessment and Collision Avoidance Best Practices Handbook](#) utilizes this metric and can serve as a useful resource. In individual cases where there is evidence that a particular system or operator is unable to effectively conduct avoidance maneuvers or is only maneuvering at a risk threshold that raises reasonable questions about its ability to meet the 0.001 collision risk threshold, this assumption will not be applied, and further analysis would be necessary. [§ 25.114\(d\)\(14\)\(iv\)\(A\)\(1\)](#)

- If there is a planned tether deployment**, an assessment of large object collision risk with the tether deployment, the impact on deorbit time, and a statement as to whether the tether can be retracted.

B. Collisions with Small Objects

- A statement that the operator has **assessed and limited the probability of the space station becoming a source of debris by collisions with small debris or meteoroids** that could cause loss of control that would prevent post mission disposal. A statement about whether **this probability for an individual space station is 0.01 (1 in 100) or less**, as calculated using the NASA DAS or a higher fidelity assessment tool. [§ 25.114\(d\)\(14\)\(i\)](#), [§ 25.114\(d\)\(14\)\(ii\)](#)

C. Proximity Operations

Satellites conduct proximity operations when they are intentionally located or maneuvering near another spacecraft or other large objects in space.

- 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. [§ 25.114\(d\)\(14\)\(vi\)](#)

D. Debris Released and Intentional Breakup

- A statement that the space station operator has **assessed and limited the amount of debris released in a planned manner during normal operation**. [§ 25.114\(d\)\(14\)\(i\)](#)
- Where applicable, this statement must include an orbital debris mitigation disclosure **for any separate deployment devices** (such as rings or other deployment vehicles, sometimes referred to as “free-flyers,” but not including launch vehicles) used to deploy the spacecraft. [§ 25.114\(d\)\(14\)\(i\)](#)

E. Explosion Risk and End of Life Passivation

- A statement that the operator **has assessed and limited the probability of accidental explosions during and after the completion of mission operations**. [§ 25.114\(d\)\(14\)\(ii\)](#), [§ 25.114\(d\)\(14\)\(iii\)](#)
 - 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. [§ 25.114\(d\)\(14\)\(ii\)](#), [§ 25.114\(d\)\(14\)\(iii\)](#). The Space Bureau generally will consider as sufficient a statement that the operator has assessed and limited the probability of accidental explosions during mission operations by means of a failure mode verification analysis or similar process.
 - This statement 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. [§ 25.114\(d\)\(14\)\(ii\)](#), [§ 25.114\(d\)\(14\)\(iii\)](#)

A statement about whether the spacecraft will contain any **liquids that if released either intentionally or unintentionally will persist in droplet form**. In particular, the operator should identify any ionic liquids. If the operator identifies any such liquids that would not evaporate or sublime if released, the statement should also address the length of time such liquid would remain in orbit, any natural processes that would result in dispersion of the droplets, how effectively the liquid is contained, and whether the propulsion system is shielded from micrometeoroid and debris strikes that may result in leakage are all relevant considerations and the type of information that could be included as part of this disclosure. [§ 25.114\(d\)\(14\)\(iii\)](#)

III. Post-Mission Disposal

A statement detailing the **disposal plans for the space station, including the quantity of fuel, if any, that will be reserved for disposal maneuvers**. [§ 25.114\(d\)\(14\)\(iv\)](#), [§ 25.114\(d\)\(14\)\(vii\)](#)

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**. [§ 25.114\(d\)\(14\)\(vii\)\(A\)](#)

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. [§ 25.114\(d\)\(14\)\(vii\)\(B\)](#). Please note whether re-entry of the spacecraft will be completed as soon as practicable, **but no later than five years following completion of the mission**. [§ 25.114\(d\)\(14\)\(vii\)\(D\)\(1\)](#)

For non-GSO satellites and satellites NOT terminating operations in an orbit in or passing through the low-Earth orbit region below 2,000 km altitude, 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. [§ 25.114\(d\)\(14\)\(vii\)\(C\)](#)

For non-GSO satellites, a statement demonstrating 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**. [§ 25.114\(d\)\(14\)\(vii\)\(D\)\(1\)](#)

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 ISS, 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. [§ 25.114\(d\)\(14\)\(iv\)\(A\)\(3\)](#)

A disclosure indicating whether the atmospheric re-entry will be an **uncontrolled re-entry or a controlled targeted re-entry**. [§ 25.114\(d\)\(14\)\(vii\)\(D\)\(2\)\(i\)](#)

A. Atmospheric Re-Entry Hazard

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

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 that the calculated **casualty risk for an individual spacecraft** using the NASA DAS or a higher fidelity assessment tool **is less than 0.0001 (1 in 10,000)**. *§ 25.114(d)(14)(vii)(D)(2)(ii)*. If the estimated human casualty risk is not zero, applicants should address whether design-for-demise approaches as well as other measures like targeted re-entry away from landmasses to further reduce re-entry human casualty risk were considered.

Non-U.S. Licensed Space Stations

For non-U.S.-licensed space stations seeking market access, 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. Market access applicants must provide supporting documentation for such a demonstration, including detailed information concerning the regulatory process, information reviewed by the national licensing authority, regulations and criteria utilized in reviewing debris mitigation plans, and governing law (translated into English if necessary). Applicants may also provide the same basic orbital debris mitigation information as provided by U.S. licensees and provision of such information can support a showing of direct and effective regulatory oversight if such information is also provided to the national licensing authority. Such submissions are particularly encouraged in instances where such information is provided to but not routinely made publicly available by the non-U.S. regulator. *§ 25.114(d)(14)(v)*, *§ 25.114(d)(14)(viii)*

Note on Rule Citations:

Applicable rules are **bolded in blue** text at the end of each point. Rules that are *italicized* have been adopted but are not yet effective.