



PUBLIC NOTICE

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International Bureau Satellite Division Information

Orbital Debris Mitigation:

Clarification of 47 C.F.R. Sections 25.143(b), 25.145(c)(3), 25.146(i)(4) and 25.217(d)
Regarding Casualty Risk Assessment for Satellite Atmospheric Re-entry

Sections 25.143(b), 25.145(c)(3), 25.146(i)(4) and 25.217(d) of the Commission's Rules require applicants requesting certain satellite authorizations to submit a narrative statement describing the design and operational strategies, if any, that they will use to mitigate orbital debris. These rules specifically require applicants to submit a casualty risk assessment if planned post-mission disposal involves atmospheric re-entry of the spacecraft.¹

To date, the assessments submitted for those cases in which disposal of a spacecraft by atmospheric re-entry is contemplated have generally been inadequate to permit completion of Commission consideration. Consequently, in this Public Notice, we clarify the minimum information that must be submitted to the Commission to satisfy this requirement. All casualty risk assessments must include the following information:

1. A statement as to whether the atmospheric re-entry of the satellite will be controlled or uncontrolled.
2. For controlled re-entry, the projected geographic region of the debris field of the surviving components/fragments, if any, and any measures taken to forewarn people who are likely to be in the geographic region during the time period of the re-entry.
3. For uncontrolled re-entry:
 - a. An estimate of the number of components/fragments, and their estimated dimensions and mass, likely to survive to the Earth's surface.
 - b. An estimate of the probability of human casualty resulting from surviving components/fragments of the satellite.²

¹ The Commission has proposed to consolidate these "service-by-service" requirements into a single rule applicable to all space stations. See *Mitigation of Orbital Debris, Notice of Proposed Rulemaking*, 17 FCC Rcd 5586, 5607 (2002). This Public Notice is intended to provide guidance for applicants under any Commission rule requiring submission of a casualty risk assessment.

² One method for making this estimate is to derive the total casualty area for the reentry, and from that figure derive the probability of casualty. The total casualty area can be defined as the sum of the casualty areas for each

- c. A full description of the assumptions and parameters used in developing the estimates.

In the event the information on the satellite design characteristics, satellite components and satellite ground track during re-entry are not yet known, the applicant must provide the above required information based on assumptions and parameters of a "worst-case" scenario.

In preparing such exhibits, applicants may find guidance in the U.S. Government Orbital Debris Mitigation Standard Practices³ and in a related Safety Standard developed by the National Aeronautics and Space Administration.⁴ Further, the software tools at the NASA website may prove useful in completing the debris mitigation statements, including the casualty risk assessment.⁵

Applicants with space station applications pending before the Commission must provide this information on or before **July 19, 2004**, if the applicant plans or is contemplating post-mission disposal by atmospheric re-entry. Failure to do so shall result in the dismissal of the application as incomplete.

Applicants filing new space station applications must also provide this information as part of their application, if the applicant plans or is contemplating post-mission disposal by atmospheric re-entry. Failure to do so shall result in the dismissal of the application as incomplete.

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component/fragment, where the casualty area of each component/fragment is the squared sum of the square root of the cross-sectional area of a person and the square root of the cross-sectional area of the surviving component/fragment of the satellite, i.e., $[(\text{Cross-sectional Area of a Person})^{1/2} + (\text{Cross-sectional Area of Fragment surviving re-entry})^{1/2}]^2$, summed for all surviving components/fragments. The probability of casualty may then be calculated, as follows: Probability of Casualty = $1 - (1 - P_0)^N$ where $P_0 = [\text{Average Casualty Area} \times \text{Average Population Density, (people per m}^2\text{)}]$ that may potentially be struck by the surviving components/fragments of the satellite; N is the number of surviving components/fragments. The average casualty area is defined as the total casualty area divided by N, the number of surviving components/fragments. One source for information regarding population density for different geographic regions of the Earth is available at: <http://sedac.ciesin.columbia.edu/plue/gpw/index.html?main.html&2>.

³ http://www.orbitaldebris.jsc.nasa.gov/library/USG_OD_Standard_Practices.pdf.

⁴ National Aeronautics and Space Administration Safety Standard 1740.14. http://orbitaldebris.jsc.nasa.gov/library/NSS1740_14/nss1740_14-1995.pdf.

⁵ <http://www.orbitaldebris.jsc.nasa.gov/reentry/reentry.html>