
**Space systems - Debris mitigation
design and operation manual for
launch vehicle orbital stages**

*Systèmes spatiaux - Conception pour l'atténuation des débris et
manuel d'utilisation à étages orbitaux pour les véhicules de lancement*



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Foreword

The International Organization for Standardization (ISO) is a worldwide federation of national standards bodies (ISO member bodies). International Standards are generally prepared by ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to represent that committee. International organizations, both governmental and non-governmental, in liaison with ISO, also take part in the work.

ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to the conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT).

The committee responsible for this document is ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 14, *Space systems and operations*.

Introduction

Coping with debris is essential to preventing the deterioration of the orbital environment and ensuring the sustainability of space activities. Effective actions can also be taken to ensure the safety of those on the ground from re-entering objects that were disposed of from Earth orbit.

ISO 24113 “Space debris mitigation requirements,” and other ISO documents, introduced in Clause 4, were developed to encourage debris mitigation. Table 1 shows those requirements together with the recommendations in the United Nations Space Debris Mitigation Guidelines and the Inter-Agency Space Debris Coordination Committee (IADC) Space debris guidelines referred to in the United Nations (UN) guidelines.

[Table 1](#) lists the main debris mitigation requirements defined in the standards and compares them to equivalent recommendations published by the UN and the IADC.

In Clause 5, the main space debris mitigation requirements are reported and analyzed.

In Clause 6, the guidance for life-cycle implementation of space debris mitigation related activities are provided.

In Clause 7, the system level aspects stemming from the space debris mitigation requirements are highlighted; while in Clause 8, the impacts at subsystem and component levels are detailed.

In this document, where the content is not directly required by existing ISO Standards but considered relevant to launch vehicle orbital stages operations or design and debris mitigation, it is labelled as “[Information].”

Table 1 — Comparison of ISO debris-related documents with UN and IADC space debris mitigation guidelines

		Measures	ISO Standards (or Technical Reports)	UN Guidelines	IADC Guidelines
Limiting debris generation	Released objects	General measures for avoiding the release of objects	ISO 24113, 6.1.1	Recommendation-1	5.1
		Slag from solid motors	ISO 24113, 6.1.2.2, 6.1.2.3	--	--
		Combustion products from pyrotechnics	ISO 24113, 6.1.2.1 (Combustion Products < 1 mm)	--	--
Disposal at end-of-operations	On-orbit-al break-ups	Intentional destruction	ISO 24113, 6.2.1	Recommendation-4	5.2.3
		Accidental break-ups during operation	ISO 24113, 6.2.2 (Probability < 10 ⁻³)	Recommendation-2	5.2.2 (Monitoring)
		Post-mission break-up (Passivation, etc.)	ISO 24113, 6.2.2.3 (Detailed in ISO 16127)	Recommendation-5	5.2.1
Re-entry	GEO	Reorbit at end of operation	ISO 24113, 6.3.2 (Detailed in ISO 26872) 6.3.2.1: General Requirement 6.3.2.2: 235 km + (1 000•Cr•A/m), e < 0,003 6.3.1: Success Probability > 0,9	Recommendation-7 (No quantitative requirements) Note: ITU-R S.1003-1 recommends; 235 km + 1,000 Cr•A/M Here, A[m ²], M[kg], Cr[-]	5.3.1 235 km + (1 000•Cr•A/m), e < 0,003
		Reduction of orbital lifetime	ISO 24113, 6.3.3 (Detailed in ISO 16164, 16699) 6.3.3.1: Orbital lifetime after end of operation < 25 years 6.3.1: Success Probability > 0,9	Recommendation-6 (No quantitative requirements)	5.3.2 (Recommend 25 years)
		Transfer to out of protected region Other options	ISO 24113, 6.3.2 (f) (Guarantee 100 years of non-interference) ISO 24113, 6.3.3.2 (a) ~ (e)	Mentioned in Recommendation-6 --	5.3.2 5.3.2
Collision avoidance for large debris	Protection from the impact of micro-debris	Avoidance of ground casualties	ISO 24113, 6.3.4 (Detailed in ISO 27875) ISO/TR-16158 (for assessment only)	Included in Recommendation-6 Recommendation-3	5.3.2 5.4
			ISO 16126 (for assessment only)	--	5.4

Space systems - Debris mitigation design and operation manual for launch vehicle orbital stages

1 Scope

This document contains non-normative information on the design and operational practices for launch vehicle orbital stages for mitigating space debris.

This document can be used to guide engineers in the application of the family of space debris mitigation standards (see 4.2) to reduce the growth of space debris by ensuring that launch vehicle orbital stages are designed, operated, and disposed of in a manner that prevents them from generating debris throughout their orbital lifetime.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 10795:2011 and the other standards listed in 4.2, 4.3, and 4.4 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

4 Related documents and abbreviated terms and symbols

4.1 Overview of ISO debris-related standards

The requirements, recommendations, and best practices for mitigating debris generation and preventing other debris related problems are examined in this clause.

[Figure 1](#) shows a general diagram of major ISO documents related to debris.