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Space systems — Survivability of unmanned spacecraft against space debris and meteoroid impacts for the purpose of space debris mitigation

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, 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 document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 14, *Space systems and operations*.

This second edition cancels and replaces the first edition (ISO 16126:2014), which has been technically revised.

The main changes are as follows:

— the provision of new impact risk analysis requirements and procedures aimed specifically at satisfying the high-level impact risk requirements defined in the top-level International Standard on space debris mitigation, ISO 24113;

— the provision of new informative annexes to assist in the implementation of the impact risk analysis procedures.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

The purpose of this document is to help satisfy two of the high-level requirements defined in the top-level International Standard on space debris mitigation, ISO 24113. Specifically, this document aims to maximise the survival of critical equipment required to perform post-mission disposal of an unmanned spacecraft, and to limit the possibility of an impact-induced break-up of the spacecraft. The analysis procedures in this document are consistent with those defined in References [1] and [2].

In principle, this document can also be used to assess the impact survivability of an unmanned spacecraft in support of other mission objectives. However, careful adaptation of the document can be necessary if put to such use.

This document is part of a set of International Standards that collectively aim to reduce the growth of space debris by ensuring that spacecraft are designed, operated, and disposed of in a manner that prevents them from generating space debris throughout their orbital lifetime. All of the primary space debris mitigation requirements are contained in ISO 24113. The remaining International Standards, of which this is one, provide supporting methods and procedures to enable compliance with the primary requirements.

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Space systems — Survivability of unmanned spacecraft against space debris and meteoroid impacts for the purpose of space debris mitigation

1 Scope

This document defines requirements and procedures for analysing the risk that an unmanned spacecraft fails as a result of a space debris or meteoroid impact.

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.

ISO 24113, *Space systems — Space debris mitigation requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 24113 and the following apply.

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

— IEC Electropedia: available at https://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1
ballistic limit
threshold of impact-induced failure of a structure

Note 1 to entry: A common failure threshold is the critical size of an impacting particle at which perforation occurs. However, depending on the characteristics of the item being hit, failure thresholds other than perforation are also possible.

3.2
catastrophic break-up
event that completely destroys an object and generates space debris

3.3
critical equipment
item(s) on a spacecraft whose failure would prevent the completion of one or more essential functions, such as post-mission disposal

3.4
high-energy SD/M
space debris or meteoroid object whose impact kinetic energy exceeds the threshold necessary to cause the *catastrophic break-up* (3.2) of a spacecraft

Note 1 to entry: The threshold is usually expressed in terms of the kinetic energy of an SD/M impact relative to the mass of the spacecraft, i.e. an energy-to-mass ratio (EMR). A typical value for the EMR threshold is 40 J/g.

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