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Space environment (natural and artificial) — Process-based implementation of meteoroid and debris environment models (orbital altitudes below GEO + 2 000 km)

Environnement spatial (naturel et artificiel) — Lignes directrices pour une mise en œuvre fondée sur les processus des modèles environnementaux des météoroïdes et des débris (altitudes d'orbite inférieures à GEO + 2 000 km)

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Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative reference **1**
3 Terms and definitions **1**
4 Abbreviated terms **2**
5 Procedures for the selection and implementation of meteoroid and space debris environment models **3**
5.1 General 3
5.2 Selection procedure 3
5.3 Implementation procedure 4
6 International project **4**
Annex A (informative) **Capability of some meteoroid environment models** **5**
Annex B (informative) **Capability of some space debris environment models** **8**
Bibliography **13**

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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 documents 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 14200:2012), which has been technically revised.

The main changes compared to the previous edition are as follows:

— removal of impact risk assessment requirements;

— in Annexes A and B, information on space debris environment models has been updated (SDEEM 2015 and SDEEM 2019);

— debris flux models: The latest version of each model is briefly described. Descriptions of historical models have been moved to NOTEs or deleted;

— since this document now focuses on models that have been developed primarily for impact flux assessment, those models whose main purpose is to study the long-term evolution of the space debris environment have been deleted.

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

Every spacecraft in an Earth orbit is exposed to a certain flux of micrometeoroids and man-made space debris. Collisions with these particles take place with hypervelocity. Many meteoroid and space debris environment models have been studied and developed which describe populations of meteoroids and/or space debris. Those models can be used for estimation the impact flux required when selecting the spacecraft operation orbit, evaluation the impact flux in a specific orbit, prediction of the frequency of collision avoidance operations, and estimate of the impact flux required for protection design. However, there are different methods in existence for reproducing the observed environment by means of mathematical and physical models of release processes, for propagating orbits of release products, and for mapping onto spatial and temporal distributions of objects densities, transient velocities, and impact fluxes. Until a specific standard for the space debris environment is defined, a common implementation process of models should be indicated.

This document specifies a common implementation process for meteoroid and space debris environment models. In the first edition, requirements were also included relating to impact risk assessment. However, with the publication of ISO 16126 in 2014, such requirements were no longer necessary in this document, and so they have been removed. The second edition now focuses on models used for estimating the impact flux.

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Space environment (natural and artificial) — Process-based implementation of meteoroid and debris environment models (orbital altitudes below GEO + 2 000 km)

1 Scope

This document specifies a common process for selecting and implementing meteoroid and space debris environment models used in the impact flux assessment for design and operation of spacecraft and other purposes. This document provides guidelines and requirements for the process.

2 Normative reference

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

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

3.1
impact flux
number of impacts per unit area per unit time

3.2
mass density
mass per unit volume

3.3
meteoroid
small celestial body of natural origin

Note 1 to entry: Generally, a meteoroid is a solid, rocky object of a size considerably smaller than an asteroid and considerably larger than an atom.

Note 2 to entry: It is thought that most meteoroids result from the disintegration and fragmentation of comets and asteroids orbiting the sun, whereas others are collision impact debris ejected from bodies such as the Moon or Mars.

3.4
meteoroid environment model
type of analysis model that computationally simulates the *meteoroid* (3.3) population orbiting the sun

Note 1 to entry: Typically, this type of model is used to predict the flux of meteoroids on a target object in space, such as a spacecraft.

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