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Space systems — Space debris mitigation design and operation guidelines for spacecraft

Systèmes spatiaux — Conception de mitigation des débris spatiaux et lignes directrices de manoeuvre de la navette

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Contents

Foreword

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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 must also be taken to ensure the safety of those on the ground from re-entering objects that were disposed of from low-Earth orbit.

Recently, the orbital environment has become so deteriorated by debris that action must be taken to prevent damage due to the impact. Collision avoidance manoeuvres should be taken to avoid large debris (larger than 10 cm, for example), which can be observed from the ground. Spacecraft design should protect against micro-debris (even smaller than 1 mm) that can cause critical damage to vulnerable components.

The following ISO standards and technical reports cover these issues: ISO 24113, *Space systems — Space debris mitigation requirements*; ISO/TR 16158, *Space systems — Avoiding collisions with orbiting objects*; ISO 16126, *Space systems — Assessment of the survivability of unmanned spacecraft against space debris and meteoroid impacts to ensure successful post-mission disposal*. Other ISO documents, introduced in Clause 2, are currently being developed to encourage debris mitigation and protection from debris impact. 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 UN guidelines.

Reliability and quality shortfalls have resulted in fragmentation events that generated thousands of fragments. ISO 24113 and other debris-mitigation guidelines make the assumption that space hardware quality and reliability issues have been addressed by other management programs. But for low-cost or low-criticality missions, spacecraft of reduced quality have been developed. The failure of such spacecraft may not pose critical damage to their owners but they may adversely affect the environment and impair the sustainability of space activities. This Technical Report suggests activities that can improve reliability and quality sufficiently to avoid this problem. This aspect of space-debris mitigation is particularly important for micro-satellites developed by universities and newcomers to space activities.