INTERNATIONAL STANDARD

ISO 17851

First edition
2016-09-01

Space systems — Space environment simulation for material tests — General principles and criteria

Systèmes spatiaux — Simulation de l'environnement spatial pour les essais de matériaux — Principes généraux et critères

Reference number
ISO 17851:2016(E)

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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

In outer space environment, spacecraft materials are subjected to various factors that may cause damage and deterioration of their service properties. In addition, there are several objective reasons to require improvements in the forecasting of spacecraft material durability in relation to outer space environment impact. The most important reasons are the following:

— increase of spacecraft lifetime;

— development of new spacecraft designs (non-hermetic spacecraft, microsatellites, etc.);

— application of new materials, including nanomaterials;

— complexity and sensitivity improvement of spacecraft on-board equipment;

— development of new orbits in the near-Earth space;

— implementation of new space projects (manned flight to Mars, building of manned bases on the Moon, etc.).

Material durability forecast in relation to space environment impact is based on results of ground tests and mathematical modelling of processes of space environment effects on materials and on-board experiments. For high-precision forecasts, it is necessary

— to choose correctly the set of space environment components which affect a spacecraft in various space regions, and to define their characteristics authentically,

— to select the principle and minor physical and chemical processes causing the material degradation under the space environment impact, including possible synergistic effects,

— to define the requirements to conditions of the ground-based material tests and to applied physical and mathematical models,

— to define the criteria for structural and functional material durability to the space environment impact, and

— to select the correct methods of material durability forecasting for different spacecraft lifetimes in various space regions.

This International Standard considers the items above as a unified system. It does not detail specific questions but only determines general principles and criteria for space environment simulation during material tests. Thus, this International Standard does not replace existing International Standards on specific types of space material tests. The basic purpose of this International Standard is to describe the general test methodologies using the most correct and full initial data on the space environment. Development of a general methodology will

— determine the role of each existing International Standard on space materials tests more precisely,

— help understand how existing International Standards provide the general system of space materials tests, and

— determine tests types for which development of new International Standards is necessary.