INTERNATIONAL STANDARD

**ISO 12208**

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# Space systems — Space environment (natural and artificial) — Observed proton fluences over long duration at GEO and guidelines for selection of confidence level in statistical model of solar proton fluences

*Systèmes spatiaux — Environnement spatial (naturel et artificiel) — Fluences de protons observées sur une longue durée au GEO et lignes directrices pour la sélection du niveau de confiance dans le modèle statistique des fluences de protons solaires*



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# Contents

Page

# 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*.

This first edition of ISO 12208 cancels and replaces ISO/TS 12208:2011.

# Introduction

This International Standard is intended for use in the engineering community.

It is well known that solar energetic protons (SEPs) damage spacecraft systems, i.e. electronics and solar cells, through ionization and/or atomic displacement processes. This results in single-event upsets and latch-ups in electronics, and output degradation of solar cells.

Solar cells of spacecraft are obviously one of the key components of spacecraft systems. Degradation of solar cells by energetic protons is unavoidable and causes power loss in spacecraft systems. Estimation of cell degradation is crucial to the spacecraft's long mission life in geosynchronous earth orbit (GEO). Therefore, an estimation of SEP fluences in GEO is needed when designing solar cell panels.

Solar cell engineers use a statistical model, the jet propulsion laboratory (JPL) fluence model for example, for estimating solar cell degradation. However, with regard to solar cell degradation, a statistical model predicts higher SEP fluences than the values actually experienced by spacecraft in GEO, especially seven years after the launch. Nowadays, spacecraft manufacturers are very conscious of minimum cost design of spacecraft because the lifetime of spacecraft is becoming longer (15 years to 18 years) and the cost of manufacturing spacecraft is increasing. Therefore, the aerospace industry requires a more accurate SEP fluence model for a more realistic design of solar cells.