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Space systems — Stable operation requirements for spacecraft attitude and orbit control system

Systèmes spatiaux — Exigences de fonctionnement stable pour le système de contrôle de l'altitude et de l'orbite d'engins spatiaux

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Foreword

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Introduction

The spacecraft’s attitude and orbit control system (AOCS) is pivotal for executing the attitude and orbit management of the spacecraft, serving as a cornerstone for its basic functionalities, stable operation, and the success of spacecraft missions. This document delineates requirements and best practices for the AOCS to ensure that the spacecraft remains in a safe operational state under all circumstances, including emergencies and anomalies. It outlines the responsibilities and interactions between the ground segment and space segment, aiming to secure timely and effective detection, management, and resolution of on-board contingencies. By establishing a comprehensive framework for stable operation, this document supports mission success and enhances spacecraft safety and reliability, and equips the AOCS with the capacity to sustain or recover a stable operating state autonomously or with ground support amidst system anomalies or unforeseen failures in orbit. The ultimate goal, even under adverse conditions, is to prevent damage to the spacecraft's structure and ensure the security of its energy and propellant resources.

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Space systems — Stable operation requirements for spacecraft attitude and orbit control system

1 Scope

This document provides the criteria for stable on-orbit operation of the spacecraft's AOCS. It addresses the factors affecting the spacecraft's on-orbit stability by specifying principles and requirements for establishing the spacecraft AOCS's capability for stable on-orbit operation, which include:

— principles for judging data validity and the requisite procedures for handling such data;

— anomaly detection;

— management of software and hardware failures;

— safety boundary checks;

— activation protocols for emergency survival modes.

This document also establishes the functional interface between on-orbit autonomy and ground-based maintenance operations, ensuring that the spacecraft maintains its intended attitude and orbit.

This document is applicable to the attitude and orbit control systems of various types of spacecraft.

2 Normative references

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 terminology databases for use in standardization at the following addresses:

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

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

3.1
attitude and orbit control system
AOCS
spacecraft sub-system designed to control the attitude and the orbit by integrating its software and hardware based on predetermined rules or commands from ground control

3.2
stable on-orbit operation
state of operation where the *AOCS* (3.1) keeps the spacecraft's attitude and orbit within a bounded domain around a desired state or sequence of states, despite external disturbances, to ensure mission success

3.3
anomaly
gap between a current situation and an expected one

Note 1 to entry: An anomaly justifies an investigation that can lead to the discovery of a nonconformance, a defect or a “non-lieu” (deviation without impact, e.g. product peculiarity).

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