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Space systems — Orbit determination and estimation — Process for describing techniques

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TECHNICAL REPORT

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Space systems — Orbit determination and estimation — Process for describing techniques

Systèmes spatiaux — Détermination et estimation de l'orbite — Processus pour la description des techniques

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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*.

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Introduction

This Technical Report prescribes the manner in which satellite owners/operators describe techniques used to determine orbits from active and passive observations and the manner in which they estimate satellite orbit evolution.

The same data inputs lead to different predictions when they are used in different models. Satellite owners/operators shall often accept orbit descriptions developed with physical models that others employ. The differences in orbit propagation as a result of using different physical models and numerical techniques can be significant. Safe and cooperative operations among those who operate satellites demand that each satellite owner/operator understand the differences among their approaches to orbit determination and propagation.

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Space systems — Orbit determination and estimation — Process for describing techniques

1 Scope

This Technical Report prescribes the manner in which orbit determination and estimation techniques are to be described so that parties can plan operations with sufficient margin to accommodate different individual approaches to orbit determination and estimation. This Technical Report does not require the exchange of orbit data nor does it prescribe a method of performing orbit determination. It only prescribes the information that shall accompany such data so that collaborating satellite owners/operators understand the similarities and differences between their independent orbit determination processes.

All satellite owners/operators are entitled to a preferred approach to physical approximations, numerical implementation, and computational execution of orbit determination and estimation of future states of their satellites. Mission demands should determine the architecture (speed of execution, required precision, etc.). This Technical Report will enable stakeholders to describe their techniques in a manner that is uniformly understood. Implementation details that can have proprietary or competitive advantage need not be revealed.

2 Symbols and abbreviated terms

— BDRF Bidirectional Reflectance Function

— FPA Flight Path Angle

— GPS Global Positioning System

— HEO High Earth Orbit

— IOD Initial Orbital Determination

— LEO Low Earth Orbit

— LS Least Squares

— OD Orbital Determination

— RAAN Right Ascension of the Ascending Node

— RMS Root Mean Square

— SP Sequential Processing

— TLE Two-line Elements

— UTC Coordinated Universal Time

3 Background

3.1 General

Satellite orbit determination (OD) estimates the position and velocity of an orbiting object from discrete observations. The set of observations includes external measurements from terrestrial or space-based sensors and measurements from instruments on the satellite itself. Satellite orbit propagation estimates the future state of motion of a satellite whose orbit has been determined from past observations. Though

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