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Space data and information transfer systems — Orbit data messages

Systèmes de transfert des informations et données spatiales — Messages pour données d'orbites

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Foreword

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This document was prepared by the Consultative Committee for Space Data Systems (CCSDS) (as CCSDS 502.0-B-3, Apil 2023) and drafted in accordance with its editorial rules. It was assigned to Technical Committee ISO/TC 20, *Aircraft and space vehicles,* Subcommittee SC 14, *Space systems and operations* and adopted under the “fast-track procedure”.

This second edition cancels and replaces the first edition (ISO 26900:2012), which has been technically revised.

The main changes compared to the previous edition are as follows:

— Changes in the messages:

  — The OCM was added to provide better support for ISO Technical Committee 20, Subcommittee 14 objectives (see section 6).

  — MESSAGE_ID was added to the OPM, OMM, and OEM to provide better satisfaction of requirement P10 (identification and annotation of messages).

  — EPHEMERIS_TYPE was updated in the OMM to reflect currently used numbering scheme.

  — BSTAR and MEAN_MOTION_DDOT fields are paired with BTERM and AGOM parameters to support the SGP and SGP4 propagators as well as the new SGP4-XP propagator, respectively.

— Changes in the document:

  — A new CCSDS repository for normative keyword values for navigation messages has been created at the SANA Registry, accessible on the Internet at: https://sanaregistry.org/r/navigation_standard_normative_annexes/. (See annex B for details on the affected keywords and links to the content.)

  — Several annexes were added. Some are required by CCSDS rule changes, and some are for the provision of supplementary material.

  — Examples for OPM, OMM, and OEM that formerly appeared in sections 3, 4, and 5, respectively, have been moved to an informative annex.

  — The 'Checklist ICD' that was added in ODM Version 2 has been discontinued. This Checklist ICD, intended to convey information that the OPM, OEM, and OMM did not address, such as third-body perturbations, solar pressure model, solid tides, ocean tides, Earth albedo, and polar motion, has now been replaced by the material that can be specified in the Orbit Comprehensive Message.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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1 INTRODUCTION

1.1 PURPOSE AND SCOPE

This Orbit Data Messages (ODM) Recommended Standard specifies four standard message formats for use in transferring spacecraft orbit information between space agencies and commercial or governmental spacecraft operators: The Orbit Parameter Message (OPM), the Orbit Mean-Elements Message (OMM), the Orbit Ephemeris Message (OEM), and the Orbit Comprehensive Message (OCM). Such exchanges are used for:

a) pre-flight planning for tracking or navigation support;

b) scheduling tracking support;

c) carrying out tracking operations (sometimes called metric predicts);

d) performing orbit comparisons;

e) carrying out navigation operations such as orbit propagation and orbit reconstruction;

f) assessing mutual physical and electromagnetic interference among satellites orbiting the same celestial body (primarily Earth, Moon, and Mars at present);

g) performing orbit conjunction (collision avoidance) studies; and

h) developing and executing collaborative maneuvers to mitigate interference or enhance mutual operations.

This Recommended Standard includes sets of requirements and criteria that the message formats have been designed to meet. For exchanges in which these requirements do not capture the needs of the participating agencies and satellite operators, another mechanism may be selected.

The ODM Recommended Standard is an international standard published under the auspices of CCSDS and International Standards Organization (ISO) Technical Committee 20, Subcommittee 13, developed jointly and in concert with the ISO TC20/SC14. As such, this CCSDS standard is also properly labeled as ISO 26900.

The recommended Orbit Data Message format is ASCII (reference [4]).

This ODM document describes both ‘Keyword = Value Notation’ (KVN) as well as Extensible Markup Language (XML) (reference [5]) formatted messages. Selection of KVN or XML format should be mutually agreed between message exchange partners.

NOTE – As currently specified, an OPM, OMM, or OEM file is to represent orbit data for a single spacecraft, and the OCM is to represent orbit data for either a single spacecraft or single parent spacecraft of a parent/child spacecraft deployment scenario. It is possible that the architecture may support multiple spacecraft per file; this could be considered in the future.