



BSI Standards Publication

Space systems — Design guidelines for multi-geo spacecraft collocation

National foreword

This Published Document is the UK implementation of [ISO/TR 22639:2021](#).

The UK participation in its preparation was entrusted to Technical Committee ACE/68, Space systems and operations.

A list of organizations represented on this committee can be obtained on request to its committee manager.

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

This publication is not to be regarded as a British Standard.

© The British Standards Institution 2021
Published by BSI Standards Limited 2021

ISBN 978 0 580 51065 6

ICS 49.140

Compliance with a Published Document cannot confer immunity from legal obligations.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 31 August 2021.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------

TECHNICAL REPORT

**ISO/TR
22639**

First edition
2021-07-07

Space systems — Design guidelines for multi-geo spacecraft collocation



Reference number
ISO/TR 22639:2021(E)

AVA Documents
Document Sharing Hub
© ISO 2021



COPYRIGHT PROTECTED DOCUMENT

© ISO 2021, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms, definitions and abbreviated terms	1
3.1 Terms and definitions.....	1
3.2 Abbreviated terms.....	4
4 Collocation design process	4
5 Basic contents of collocation design process	6
5.1 Considerations.....	6
5.2 Initial collocation strategy design.....	6
5.2.1 Fundamental principle of separation strategy.....	6
5.2.2 The available separation strategy.....	6
5.2.3 Selection of collocation strategy.....	7
5.2.4 Simulation Evaluation of Collocation Strategy.....	7
5.3 Final collocation strategy.....	7
5.4 Collocation agreement.....	7
Annex A (informative) Fundamental principle of available separation strategy	10
Annex B (informative) Characteristics of separation strategy	15
Annex C (informative) Fundamental principle of separation strategy	17
Annex D (informative) Sample of collocation evaluation strategy	19
Annex E (informative) Common collocation cases and strategies	20
Bibliography	21

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 14, *Space systems and operations*.

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.

Introduction

With the wide application of geostationary orbit in spacecraft navigation, spacecraft communication and remote sensing, there comes a dramatic increase in the number of geostationary spacecraft while the orbit position of geostationary spacecraft is limited. In order to solve this problem, it is often necessary for spacecraft operators to collocate their spacecraft with spacecraft operated by other agencies in order to deliver their services.

This page deliberately left blank

Space systems — Design guidelines for multi-geo spacecraft collocation

1 Scope

This document addresses the design process of a collocation and the basic contents of collocation design process which include considerations, initial collocation strategy design, simulation evaluation of collocation strategy, optimal collocation strategy selection and collocation agreement.

This document gives guidelines for multi-geo spacecraft collocation, and it applies in particular to multi-geo constellation.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviated terms

3.1 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 <http://www.electropedia.org/>

3.1.1

orbit maintenance

orbit control for maintaining the spacecraft's orbit in certain prediction error around the nominal orbit

3.1.2

inclination vector

vector which points to the ascending node and which is measured from the vernal equinox

Note 1 to entry: The x and y components of the vector can be expressed as [Formulae \(1\)](#) and [\(2\)](#).

$$i_x = \sin i \cos(\Omega) \quad (1)$$

$$i_y = \sin i \sin(\Omega) \quad (2)$$

where

i is the magnitude of the inclination vector;

Ω is the raan in J2000 *geocentric equatorial coordinate system* ([3.1.5](#));

i_x is the x component of the inclination vector coordinate;

i_y is the y component of the inclination vector coordinate.

Note 2 to entry: [Figure 1](#) shows the definition of the inclination vector.