
**Space systems — Simulation
requirements for control system**

*Systèmes spatiaux — Exigences de simulation pour le système de
contrôle*



This document is a preview generated by EKO



COPYRIGHT PROTECTED DOCUMENT

© ISO 2021

All rights reserved. Unless otherwise specified, or required in the context of its implementation, 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
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms, definitions and abbreviated terms	1
3.1 Terms and definitions	1
3.2 Abbreviated terms	3
4 Control system simulation	3
4.1 Simulation system scheme of control system	3
4.2 Objectives of control system simulation	4
4.3 Mathematical simulation and HITL simulation	5
4.4 Simulation in different phases	5
4.5 Simulation process	8
5 General requirements	8
5.1 General	8
5.2 Project level requirements	8
5.3 Simulation model requirements	9
5.4 Simulation facility requirements	10
5.5 Simulation operation requirements	10
5.6 Simulation result analysis requirements	11
5.7 Document requirements	11
5.7.1 Design report of simulation system	11
5.7.2 Simulation plan	11
5.7.3 Simulation report	12
6 Requirements of conceptual design phase simulation	12
6.1 General	12
6.2 Objective	13
6.3 Input	13
6.4 Output	13
6.5 Simulation model requirements	13
6.6 Simulation facility requirements	14
6.7 Simulation operation requirements	14
7 Requirements of detailed design phase simulation	14
7.1 General	14
7.2 Objective	14
7.3 Input	15
7.4 Output	15
7.5 Simulation model requirements	15
7.6 Simulation facility requirements	15
7.7 Simulation operation requirements	15
8 Requirements of prototype phase simulation	16
8.1 General	16
8.2 Objective	16
8.3 Input	17
8.4 Output	17
8.5 Simulation model requirements	17
8.6 Simulation facility requirements	17
8.6.1 Requirements of simulation devices	17
8.6.2 Requirements of simulation environment	18
8.7 Simulation Operation Requirements	18
9 Requirements of integrated system phase simulation	18

9.1	General.....	18
9.2	Objective.....	19
9.3	Input.....	19
9.4	Output.....	20
9.5	Simulation model requirements.....	20
9.6	Simulation facility requirements.....	20
9.7	Simulation operation requirements.....	20
Annex A (informative) Phase comparison between ISO 14300-1 and this document.....		21
Bibliography		22

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*.

This second edition cancels and replaces the first edition (ISO 16781:2013), which has been technically revised.

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

- the Introduction and the Scope have been revised; the scope is re-stated to concentrate on the simulation requirements of the flight control system of space system;
- the definition of “control system” in [3.1.2](#) has been revised;
- the title of [4.1](#) and [Figure 1](#) have been revised as “simulation system scheme of control system”;
- some statements have been added in [8.1](#) to explain the usage requirements of actual hardware devices for prototype phase simulation;
- the previous Annex B has been deleted;
- the Bibliography has been added.

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

Simulation is an important means to design, analyse and validate the space control system, and it is widely used in each phase of control system development. The objective of simulation is to demonstrate that the proposed or designed system will function as desired; and the simulation allows engineers and technical decision makers to evaluate the feasibility, validity and rationality of the design scheme more accurately.

This document provides space control system engineers, simulation engineers and customers with guidance for using simulation to support their system engineering tasks. This document is intended to help reduce the development time and cost of space control system design and also enhance its quality and reliability. This document focuses on the requirements and recommendations during simulation. It does not prescribe how the requirements are to be met, nor does it specify who the responsible team is for conforming to the requirements.

Space systems — Simulation requirements for control system

1 Scope

This document establishes the requirements for simulation of the space control system, including the objective, architecture and procedure, etc. This document is applicable to four phases of control system development, including conceptual design, detailed design, prototype and integrated system.

The control system referred to in this document is the flight control system for guidance, navigation and control (GNC) of space systems which include launch vehicle, satellite and spaceship, etc. This document establishes a minimum set of requirements for simulation of the flight control system, and provides guidance to engineers on what to simulate in each phase of control system development. The requirements are generic in nature because of their broad applicability to all types of simulations. Implementation details of the requirements are addressed in project-specific standards, requirements, and handbooks, etc.

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 terminological 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

accuracy

measure of how close a value is to the “true” value

[SOURCE: ISO 14952-1:2003, 2.1]

3.1.2

control system

system designed to give the controlled plant the specified control objectives, and including relevant functions of controller, sensor and actuator

Note 1 to entry: In this document, the word “controller” is used to designate the flight control computer which manages the flight dynamic behaviour of space system.

3.1.3

emulator

prototype of the flight equipment, which has the identical input/output interfaces as the flight equipment and has similar operating behaviour