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Space systems — Early operations —

Part 3: Commissioning report

Systèmes spatiaux — Opérations initiales —

Partie 3: Rapport d'engagement

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Contents

Page

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 10784-3 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 14, *Space systems and operations*.

ISO 10784 consists of the following parts, under the general title *Space systems — Early operations*:

— *Part 1: Spacecraft initialization and commissioning*

— *Part 2: Initialization plan*

— *Part 3: Commissioning report*

Introduction

The three parts of ISO 10784 provide spacecraft (SC) manufacturers and operators with a specific form and format for writing SC commissioning reports required to configure and verify the SC to perform normal mission operations. Often, SC manufacturers and operators have defined these reports uniquely for each programme, or regional, national and corporate organizations have unique commissioning reports. The three parts of ISO 10784 aim at establishing a common language and form for SC stakeholders. The use of one form and format will simplify stakeholder understanding and comprehension of initialization and commissioning activities.

Space systems — Early operations —

Part 3: Commissioning report

1 Scope

A general definition of initialization is that it begins at separation of the spacecraft (SC) from the launcher. In some cases, a more exact definition will be that initialization begins in flight, upon planned change in mode or state of the SC from the launch configuration. Commissioning is completed when the SC, including its payload, is certified for initial mission operations. Prior to certification for mission operations, the SC is described as a test article in the three parts of ISO 10784. ISO 10784 does not include a requirement for contingency plans, but does include a statement of the need for contingency planning.

This part of ISO 10784 outlines general descriptive information for SC initialization and commissioning as might be appropriate for programme management, project engineering or programme test documentation. Since the SC is considered a test article at this phase of its operational life, ISO 17566 is used as a normative reference in constructing the commissioning report. It provides SC manufacturers, SC operators and other stakeholders with a common language and form to verify and document spacecraft initialization and commissioning prior to normal SC mission operations.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 10784-1, *Space systems — Early operations — Part 1: Spacecraft initialization and commissioning*

ISO 17566, *Space systems — General test documentation*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1
commissioning
certification of a spacecraft as ready for mission operations

3.1.2
early operations
period from initialization to commissioning for mission operations

3.1.3
initialization
Initial functional and operational checkout of a spacecraft following separation from the launch vehicle

3.2 Abbreviated terms

LV launch vehicle

PL payload

SC spacecraft

4 Introduction clause of the commissioning report

4.1 General

This clause shall provide general information about the technical content of the commissioning report of interest. It shall include a brief description of the initialization sequence events. The overall initialization objective shall be described, and the criteria for SC certification shall be stated.

4.2 Overall sequence of events

This subclause shall summarize the overall sequence of tests conducted to demonstrate the acceptance status of the SC with respect to the launch environment and shall explain how the test in question fits into this sequence.

The following types of test shall be considered, if applicable to the SC initialization programme: functional tests and operational tests.

5 Referenced documentation clause of the commissioning report

5.1 General

This clause shall contain a list of documents to which reference is made in the commissioning report of interest. The documentation list may include normative references, applicable references or informative references.

5.2 Normative references

Normative references are published standards and specifications which provide requirements or constraints for initializing the SC. The required format for the list of normative references is shown below.

Document number	Document description	Revision level/Release date

5.3 Applicable references

Applicable references are programme-related documents which provide requirements or constraints for initializing the SC. The required format for the list of applicable references is shown below.

Document number	Document description	Revision level/Release date

5.4 Informative references

Informative references are documents included for information only. Such references amplify or clarify the document content but do not contain requirements applicable to initialization or commissioning. The required format for the list of informative references is shown below.

Document number	Document description	Revision level/Release date

6 Nomenclature

The terms and definitions subclause shall define the specific terms used in the commissioning report. In some cases, a project dictionary or glossary may be referenced.

The symbols subclause shall give a list of the symbols used in the commissioning report. Unless there is a need to list symbols in a specific order to reflect technical criteria, all symbols shall be listed in alphabetical order.

The abbreviations subclause shall define the abbreviations used in the commissioning report.

7 Objective

7.1 General

This clause shall detail the general and specific initialization sequence objectives in the context of the SC design and launch environment test requirements of the launch service provider.

7.2 Initialization strategy matrix

The required format for the strategy matrix is defined in ISO 10784-1. The commissioning report shall contain the strategy matrix as executed during initialization.

Event	Time	Operational requirement	SC or PL procedure	Prerequisites or constraints	Notes

8 Spacecraft configuration

8.1 General

This clause shall describe the general spacecraft article configuration, including the corresponding reference frame definition and mass properties, and provide relevant figures or the references of relevant drawings. When necessary, it shall document how the configuration supports the overall initialization objectives.

8.2 Identification and general configuration matrix

All major pieces of hardware, software and equipment, and all the critical launch-environment structural elements (including, but not limited to, the primary structure, platforms, supporting struts, propellant tanks and associated support structures and fastenings, pressure vessels, solar panels and related mechanisms, battery

packs, reflectors, antennas and the critical payload package) shall be listed in the configuration matrix and identified as flight-standard or other. The required format for the configuration matrix is shown below.

Item	Flight-standard	Flight-representative	Simulated

8.3 Deviations from planned initialization configuration

Deviations from the planned flight configuration critical for the verification of the spacecraft with respect to the launch environment shall be identified (see 8.2). The verification logic with respect to the overall system verification of those items that are not in the flight-standard category shall be explained.

8.4 Functional configuration

The state of the physical systems of the SC shall be described and compared to the expected spacecraft launch configuration. Any change of functional configuration in the course of initialization shall be mentioned. The functional configuration addresses the operational mode of the SC and the state of the major electrical systems, including, but not limited to, radio-electrical, pyrotechnic, attitude control, and thermal subsystems.

9 Operations facility configuration

9.1 General

This clause shall describe the overall control facility configuration as run during initialization. In addition, the control facility, its location, and the test date(s) shall be indicated.

9.2 Pre-mission configuration

9.2.1 General configuration

The general initialization set-up shall be briefly outlined, including relevant figures or the references of relevant drawings. This outline shall include concise information about the test equipment, instrumentation, interfaces to the SC, environmental conditions, data acquisition system and any specific infrastructure required for initialization.

9.2.2 Interface configuration

Special emphasis shall be given to the description of the interface between the control facility and the SC during initialization. In this case, the commissioning results clause (see Clause 11) shall explain how the characteristics of the interface affect the results.

9.2.3 As-run configuration

If the planned initialization configuration is modified as the sequence of events develops, the resulting changes, their causes and the potential effects on the initialization procedure or initialization results (see Clause 11) shall be explained.

9.3 Facility constraints and limitations

Potential constraints related to operational or safety limitations of the control facility shall be indicated when these limitations have an effect on the initialization objectives. The nature of these limitations shall be explained in the initialization description clause (see Clause 10) and in the commissioning results clause (see Clause 11).

10 Initialization description

10.1 General

This clause shall provide a description of the initialization, initialization flow, prediction analyses, input data and instrumentation.

10.2 Approach and methodology

A description of the logic behind the initialization approach and of the methods used shall be provided.

10.3 Sequence of events

The various steps of initialization shall be listed, together with the corresponding levels and durations relative to the nominal initialization goal (full level, nominal duration).

10.4 Supporting analyses

A general description of the analyses performed in support of the initialization execution shall be provided, together with the references of the corresponding documentation.

10.5 Input parameters, tolerances and limits

For each step, the actual input data shall be provided in numerical and/or in tabular form, as appropriate. The corresponding tolerances and limits related to the performance of the control facility and the associated control system shall be clearly indicated (including alarm levels and abort limits).

10.6 Instrumentation

A complete list of the measurement devices used during initialization shall be provided, together with the following characteristics: identification, measurement type, calibration method, measurement range and tolerances, and exact location with respect to the reference frame of the SC. When useful, a drawing of the arrangement of the measurement devices shall be provided.

10.7 Success criteria

The criteria for success of the initialization shall be listed, and their applicability shall be defined for each step.

11 Results

11.1 Spacecraft initialization

11.1.1 Modes

The spacecraft modes shall be presented in the format shown below.

SC mode	Initialization activity identification	Mode exercised successfully	Notes

11.1.2 Systems

The spacecraft subsystems shall be presented in the format shown below.