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**Space systems — Early operations —**

Part 1:

**Spacecraft initialization and  
commissioning**

*Systèmes spatiaux — Opérations initiales —*

*Partie 1: Initialisation et prise en mains du véhicule spatial*

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## 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 10784-1 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*

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## Introduction

The three parts of ISO 10784 provide spacecraft (SC) manufacturers and operators with a specific form and format for writing SC initialization plans and commissioning reports required to configure and verify the SC to perform normal mission operations. Often, SC manufacturers and operators have defined these plans and reports uniquely for each programme, or regional, national and corporate organizations have unique initialization plans and 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 of initialization and commissioning activities.

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# Space systems — Early operations —

## Part 1: Spacecraft initialization and commissioning

### 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 initialization plan and 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 10784-3:2011, *Space systems — Early operations — Part 3: Commissioning report*

ISO 17566, *Space systems — General test documentation*

ISO 24113:2011, *Space systems — Space debris mitigation requirements*

### 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 an initialization plan or commissioning report

### 4.1 General

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

### 4.2 Overall sequence of initialization events

This subclause of the introductory clause shall summarize the overall sequence of functional and operational sequences conducted to demonstrate the initial operational status of the spacecraft with respect to the operational environment and shall explain how the test in question fits into this sequence. The starting mode of the spacecraft shall be the same as the launch mode. The ending mode of the spacecraft shall be the initial operational mode.

### 4.3 Overall relations of commissioning functions

This subclause shall summarize the minimum overall relations and status of spacecraft functions demonstrated to verify the initial operational capability of the system.

### 4.4 Orbital-debris considerations in spacecraft initialization and commissioning

#### 4.4.1 General

Orbital-debris generation is a major consideration during spacecraft initialization and will impose limitations. It is possible that limitations might be placed on both the spacecraft and the launch vehicle in this phase.

#### 4.4.2 Hardware retention

Hardware retention requirements relevant during spacecraft initialization shall be addressed (see ISO 24113:2011, Subclause 6.1).

#### 4.4.3 Avoiding damage

This subclause shall summarize the retention measures taken to avoid the release of hardware into space (see ISO 24113:2011, Subclause 6.1). Failure to control separation of space objects might result in later contact with, and damage to, the spacecraft.

#### 4.4.4 Collision avoidance

This subclause shall summarize the measures taken for avoiding collisions. Collision avoidance recommendations relevant during spacecraft initialization are contained in the *IADC Space Debris Mitigation Guidelines*, Revision 1 (September 2007), Subclause 5.4.



#### 4.4.5 Conjunction analysis

This subclause shall summarize the conjunction analysis performed for the purpose of collision avoidance. Conjunction analysis recommendations relevant during spacecraft initialization are contained in the *IADC Space Debris Mitigation Guidelines*, Revision 1 (September 2007), Subclause 5.4.

## 5 Objectives of spacecraft initialization and commissioning

### 5.1 General

This clause shall detail the general and specific objectives in the context of the spacecraft and payload initialization. A minimum set of objectives for successful initialization shall be identified.

It is possible to conceive of simple spacecraft and missions and more complex spacecraft and missions. The user determines the number of operational phases for their unique programme. For example, a multi-phase mission to another planet might have an initialization and commissioning strategy matrix for the spacecraft initial earth orbit, another for the interplanetary phase and a third for insertion into orbit around the target planet.

### 5.2 Spacecraft initialization and commissioning strategy matrix

The strategy matrix shall define the strategies that will be used to demonstrate compliance with the SC operator's requirements related to the spacecraft in general and the payload in particular.

The required format for the strategy matrix is shown below with a notional sequence of events.

Table 1 — Initialization and commissioning strategy matrix

Event	Time	Operational requirement	SC or PL procedure	Prerequisites or constraints	Notes
<b>Pre-launch</b>					
Pre-1			Apply power to SC		
Pre-2			Load SC processor with flight software		
Pre-3			Upload separation orbit data		Orbit data should be in Earth-centred, Earth-fixed (ECEF) coordinates
Pre-4			Upload contact information		Upload at least three days of contact information
Pre-5			Verify count of commands on SC processor		
Pre-6			Verify that SC battery is fully charged		
Pre-7		Safe SC and PL for launch	Verify LAUNCH mode		
Pre-8			Remove power from SC		Unpowered launch
<b>Post-launch</b>					
1	Separation (S)	Record LV separation time and separation orbit data			Retrieve from launch service provider as soon after launch as possible