
**Space systems — Launch complexes
modernization process — General
requirements**

*Systèmes spatiaux — Processus de modernisation des complexes de
lancement spatial — Exigences générales*

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Foreword

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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).

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For an explanation on 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 the following URL: 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*.

Introduction

Technical innovations and developments in science and technology (new rockets and space vehicles) necessitate the modernization of equipment for launch complexes. Thus, countries with launch complex (LC) are upgrading launch support equipment (LSE) of these facilities.

However, due to obsolescence, the emergence of new technologies, new launch vehicles and requirements for the assembly and installation of spacecrafts, there is challenge to change the existing system configuration and upgrade.

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Space systems — Launch complexes modernization process — General requirements

1 Scope

This document specifies procedures in the preparation and carrying out of the modernization process of launch complexes and their components. These procedures are devised in case there is a need to make changes in existing configuration of launch complexes.

This document establishes the following:

- a) modernization stages;
- b) modernization performance requirements;
- c) functions of the main participants of the modernization process and their interactions.

The requirements specified in this document are used by organizations involved in the modernization of the launch complexes.

This document is directly aimed at increasing economic efficiency in terms of the modernization process in creating new vehicles or changing the specification of a launch complex by a service customer, etc., or whether or not there is a need to build a new launch complex.

This document is also aimed at providing safety and health requirements for LC personnel, since increased demand for launch complex safety may be one reason to modernize the facility.

This document offers a unified approach to the management of the modernization process (preparation and carrying out). Since there are no specific requirements and data, target dates for the carrying out of the modernization process can be flexible.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 14620-2:2011, *Space systems — Safety requirements — Part 2: Launch site operations*

ISO 17666, *Space systems — Risk management*

ISO 17689, *Space systems — Interface control documents between ground systems, ground support equipment and launch vehicle with payload*

ISO/TS 18667, *Space systems — Requirements of the management of capability-based safety, dependability and quality assurance (SD&QA) programme*

ISO/TR 17400, *Space systems — Space launch complexes, integration sites and other facilities — General testing guidelines*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1

launch complex modernization

LC modernization

set of works undertaken to improve and upgrade the performance characteristics and LC quality indicators by changing the design of the LC components

Note 1 to entry: Also includes replacement of individual items to newly created ones, as well as changes and additions to the existing design.

Note 2 to entry: Modernization also refers to upgrade in this document.

3.2

launch service customer

organization that made a contract with the *operator* (3.10) to perform *launch services* (3.3)

3.3

launch services

set of actions for the launch or attempted launch of a launch vehicle and payload, if any, to a sub-orbital trajectory of the Earth's orbit in outer space or in any other direction in space

3.4

manufacturer of modernized product item

organization that performs work on pre-production and production of the upgraded product item by working design documentation

3.5

customer

<modernization>organization which owns or manages an LC and makes a contract with the main executor for *launch complex modernization* (3.1) or its components

3.6

Executive Head

<modernization>organization that makes a contract with a *customer* (3.5) of the complex, coordinates the work of *subcontractors* (3.8) and is responsible for the implementation of *launch complex modernization* (3.1)

3.7

stage

<modernization>set of works characterized by planning and funding to obtain specific outcomes for the development, testing and conformity assessment of product performance to meet the requirements and get *customer* (3.5) acceptance

3.8

subcontractor

<modernization>organization that makes a contract with the *Executive Head* (3.5) or *customer* (3.5) to perform part of the *launch complex modernization* (3.1) and is responsible for its implementation

3.9

national regulations

set of official state laws, including the constitution, laws, decrees, administrative orders, codes of practice and regulations, instructions, etc.

3.10**operator**

governmental or non-governmental entities, international organization, or natural person carrying out a space operation independently and under its responsibility

[SOURCE: ISO 14620-2:2011]

3.11**state owner of the launch complex**

state that has jurisdiction over the launch complex

3.12**technical requirements****TR**

<modernization> document that establishes a set of technical requirements for the upgrade of the whole complex or a part thereof, as well as requirements for the content, scope and terms of modernization performance

4 Abbreviated terms

LC Launch complex

TR Technical requirements

5 General**5.1 Modernization need**

5.1.1 Modernization is conducted when it is necessary to:

- a) change the performance characteristics of the LC by demand from the launch service customer;
- b) modify the components of the LC and the introduction of new technologies to reduce costs (financial, manpower, energy, time);
- c) increase dependability and safety of the LC or other similar circumstances.

5.1.2 Modernization volume can be different depending on the volume of the new requirements.

There are several basic options for modernization (upgrading), which includes:

- a) modernization of the whole LC;
- b) modernization of the components of the LC;
- c) modernization of the elements and items of the components of the LC.

5.1.3 Generally, the upgrading process comprises the following procedures:

- a) Preparation and issuance of documents for the organization of the modernization process;
- b) Fulfilment of the modernization process;
- c) Acceptance of the work, the preparation and publication of documents on the completion of modernization.

5.2 Functions of the main participants in the modernization process

In order to organize and ensure the timely and quality implementation of the LC upgrade work, each participant in the modernization process (customer, Executive Head, subcontractor and manufacturer) is given specific functions (see [Figure 1](#)).

5.2.1 The customer carries out the following functions:

- a) approves and issues to the Executive Head of the LC the TR for modernization;
- b) approves the modernization costs and enters into a contract with the Executive Head (if necessary, with a co-executor) for the modernization fulfilment;
- c) approves the modernization activities with the state owner of the LC;
- d) monitors the implementation of the modernization process;
- e) reviews the modernization stages, evaluates the technical level and the effectiveness of the modernization results;
- f) participates in the testing.

5.2.2 The Executive Head performs the following functions:

- a) adheres to the TR for modernization provided by the customer;
- b) prepares the scope of modernization works, assesses the costs and presents the contract and related documents to the customer;
- c) represents the customer to the subcontractor if there is a need to upgrade components (negotiates price, signs agreement with subcontractors);
- d) carries out modernization works and process documentation, as well as takes part in the manufacture, revision and testing of modernized items;
- e) monitors the compliance of performed works, re-manufactured and modified item to the requirements, TR, documentation and clauses of the contract;
- f) organizes and conducts testing of modernized items in accordance with the documentation;
- g) develops, coordinates with stakeholders and approves modernization management plan, if necessary;
- h) coordinates and controls the subcontractors' works at all stages of modernization;
- i) ensures that customer license agreements for the use of intellectual properties is observed, presents the results of the modernization to the customer without infringing on the exclusive rights of third parties;
- j) compiles and prepares through all the stages of modernization the accounting documentation in accordance with TR and the contract, as well as provides the documentation to the customer in acceptance deadlines.

5.2.3 The subcontractor of the upgraded part of the LC performs the following actions:

- a) adheres to the TR for modernization of LC components;
- b) estimates the costs for upgrading LC components (when necessary) and coordinates with the Executive Head the preparation of relevant documents for presentation to the customer;
- c) participates in the tests carried out by the customer and the main executor (if necessary).

5.2.4 The manufacturer of modernized product item performs the following functions:

- a) estimates the costs for manufacturing products and components (when necessary) and coordinates with the Executive Head the preparation of relevant documents for presentation to the customer;
- b) negotiates rates and signs agreements with various components and materials suppliers;
- c) carries out preparations for production, including the production methods, testing and inspection;
- d) manufactures the product and/or component according to the terms of the TR, then supply the finished item to the LC;
- e) tests the manufactured item.

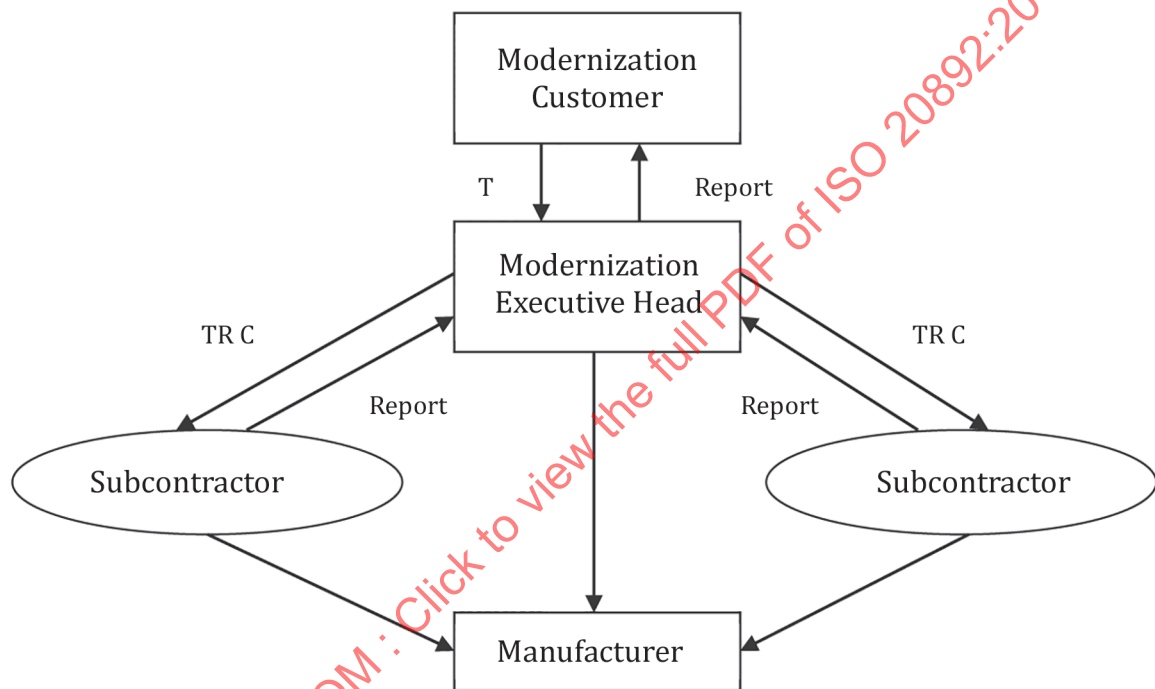


Figure 1 — Cooperation among participants of the modernization process

5.3 Modernization performance requirements

5.3.1 The Executive Head appoints the lead project manager in charge of the technical guidance of the modernization process.

5.3.2 The lead project manager is responsible for:

- providing the required technical expertise, the rationale and implementation timeline of the modernization process;
- ensuring the completeness and acceptability of testing and the quality of the project documentation;
- ensuring the timely execution of the work programs at every stage of modernization;
- ensuring the quality and completeness of the supplied products to the customer.

The lead project manager shall perform its functions and exercise its rights.