
**Space systems — Verification
programme and management process**



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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.

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).

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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 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

This verification programme document provides top-tier and overarching requirements in space programmes. Implementation will ensure thoroughly verified space systems in a timely and cost-effective manner for verification distributed among all participating organizations (see AIAA S-117).

Many space programmes are very complex systems consisting of numerous elements (such as spacecraft, launch and ground segments, systems, subsystems, units, interfaces). It is common for these elements to be distributed across many international/domestic contractors, subcontractors, and suppliers with little room for failure/mistakes in any part of a space system. This is what is meant as a distributed program in the context of this document. A critical function of any distributed verification programme is to ensure that a thorough and solid specification is established for each level of a system being developed. This is accomplished if the system developer for each level contractually takes responsibility/ownership of developing their specifications in coordination with their systems engineering organization. This approach ensures that requirements establishment and associated verification activities are well integrated. Additionally, cost constraints often require avoidance of additional verification due to late changes. Lack of detailed descriptions in specifications can cause costly late changes and/or post-launch failures. Mission success does not allow unrecoverable post-launch failures; as such, verification of space systems requires technical communication of verification means, data and data aggregation among all involved (system contractors, subcontractors and vendors).

This document ensures that requirements associated with space system missions, concept of operation (mission operation concept), contractual agreed normative references as well as each contractor's command media are thoroughly verified with the use of a distributed verification programme. It defines a standardized set of verification management processes for each element of a space system from the earliest to the latest phase and from the lowest to the highest level of their developments in order to acquire/deliver thoroughly verified systems.

The need for a distributed verification programme was identified based on the evaluation of over 130 space systems failures associated with international, commercial, and government space programmes (see INCOSE Journal).

Every element of a space system can be verified and tracked by each work breakdown structure based working group (WBS-WG; see ISO 21349) utilizing standardized verification management (VM) processes as follows:

- a) VM process 1: requirements flow-down and establishment of specification;
- b) VM process 2: verification cross-reference matrix (VCRM);
- c) VM process 3: integration and test (I&T);
- d) VM process 4: use of a specification verification ledger (SVL);
- e) VM process 5: acceptance/delivery reviews
- f) VM process 6: verification-related risk and issue/watch list management

This document also helps each space programme to integrate any heritage/commercial systems to new programmes by examining whether the applicability of these systems has been thoroughly verified. Appropriate modifications of any heritage/commercial systems for new/modified systems are systematically identified and verification accomplished by applying these uniform six verification management processes.

Space systems — Verification programme and management process

1 Scope

This document establishes a set of requirements for planning and executing verification programmes for commercial/non-commercial manned and unmanned space systems.

This document defines a distributed verification programme for each contractor that engages in the development of any element of a space system, starting from the lowest level (i.e. unit/piece part level) and the earliest phase (i.e. requirement phase) to the acceptance and the delivery review of a system's development as well as the launch site activities.

This document primarily addresses verification associated with space, launch, and ground segment acquisitions. Space support segments including range safety, ground support equipment, and launch operation facilities, which are not otherwise addressed in this document, can also benefit from the described verification programme and management processes.

2 Normative references

There are no normative references in this document.

3 Terms and 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 <https://www.electropedia.org/>

3.1.1

heritage system

system/item with from the original supplier that has maintained the great majority of the original service, design, performance and manufacturing and has already flown in space

3.1.2

late change

change to the space, launch, ground segments, or their interfaces, procedures or processes, which compromise or potentially invalidate previously executed verification approved at each system level preliminary design review (PDR) and/or critical design review (CDR)

3.1.3

mission critical failure

condition that meets one or more of the following criteria:

- a) failure leading to inability to meet/achieve mission objective (e.g. payload or spacecraft bus is no longer capable of supporting the mission objectives);
- b) inability to meet minimum performance specifications for primary mission;