



# SLOVENSKI STANDARD

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SIST EN 14160:2004

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### Vesoljska tehnika - 40. del: Programska oprema

Space engineering - Part 40: Software

Raumfahrttechnik - Teil 40: Software

Ingénierie spatiale - Partie 40: Logiciel

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#### **ICS:**

35.080	Dokumentiranje razvoja programske opreme in sistemov (sistemska dokumentacija)	Software development and system documentation
49.140	Vesoljski sistemi in operacije	Space systems and operations

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**Space engineering - Part 40: Software**

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## Foreword

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This document (EN 16603-40:2014) has been prepared by Technical Committee CEN/CLC/TC 5 "Space", the secretariat of which is held by DIN.

This standard (EN 16603-40:2014) originates from ECSS-E-ST-40C.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2015, and conflicting national standards shall be withdrawn at the latest by February 2015.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 14160:2001.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

This document has been developed to cover specifically space systems and has therefore precedence over any EN covering the same scope but with a wider domain of applicability (e.g. : aerospace).

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

## Introduction

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This Standard defines the principles and requirements applicable to space software engineering. ECSS-Q-ST-80 defines the principles and requirements applicable to space software product assurance.

The formulation of this Standard takes into account the existing ISO 9000 family of documents, and the ISO/IEC 12207 standard.

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# 1 Scope

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This software engineering Standard concerns the “product software”, i.e. software that is part of a space system product tree and developed as part of a space project.

This Standard is applicable, to the extent defined by the tailoring process, to all the elements of a space system, including the space segment, the launch service segment and the ground segment.

This Standard covers all aspects of space software engineering including requirements definition, design, production, verification and validation, transfer, operations and maintenance.

It defines the scope of the space software engineering processes and its interfaces with management and product assurance, which are addressed in the Management (–M) and Product assurance (–Q) branches of the ECSS System, and explains how they apply in the software engineering processes.

This Standard reflects the specific methods used in space system developments, and the requirements for the software engineering processes in this context. Together with the requirements found in the other branches of the ECSS Standards, this Standard provides a coherent and complete framework for software engineering in a space project.

This Standard is intended to help the customers to formulate their requirements and suppliers to prepare their responses and to implement the work.

This Standard is not intended to replace textbook material on computer science or technology, and such material is avoided in this Standard. The readers and users of this Standard are assumed to possess general knowledge of computer science.

The scope of this Standard is the software developed as part of a space project, i.e. “Space system product software”. This Standard also applies to the development of non-deliverable software that affects the quality of the deliverable product.

This Standard may be tailored for the specific characteristics and constraints of a space project in conformance with ECSS-S-ST-00.

## Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this ECSS Standard. For dated references, subsequent amendments to, or revision of any of these publications do not apply. However, parties to agreements based on this ECSS Standard are encouraged to investigate the possibility of applying the more recent editions of the normative documents indicated below. For undated references, the latest edition of the publication referred to applies.

EN reference	Reference in text	Title
EN 16601-00-01	ECSS-S-ST-00-01	ECSS system - Glossary of terms
EN 16603-10-11	ECSS-E-ST-10-11	Space product assurance – Human factors engineering
EN 16601-10	ECSS-M-ST-10	Space project management – Project planning and implementation
EN 16601-10-01	ECSS-M-ST-10-01	Space project management – Organization and conduct of reviews
EN 16601-40	ECSS-M-ST-40	Space project management – Configuration and information management
EN 16602-80	ECSS-Q-ST-80	Space product assurance – Software product assurance

## Terms, definitions and abbreviated terms

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### 3.1 Terms for other standards

For the purpose of this Standard, the terms and definitions from ECSS-ST-00-01, in particular for the following terms:

**acceptance test**

**software product**

NOTE The terms and definitions are common for the ECSS-E-ST-40 and ECSS-Q-ST-80 Standards.

### 3.2 Terms specific to the present standard

#### 3.2.1 automatic code generation

generation of source code with a tool from a model  
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#### 3.2.2 code coverage

percentage of the software that has been executed (covered) by the test suite

#### 3.2.3 competent assessor

person who has demonstrated the necessary skills, competencies and experience to lead a process assessment in conformance with ISO/IEC 15504

NOTE Adapted from ISO/IEC 15504:1998, Part 9.

#### 3.2.4 condition

boolean expression not containing boolean operators

#### 3.2.5 configurable code

code (source code or executable code) that can be tailored by setting values of parameters

NOTE This definition covers in particular classes of configurable code obtained by the following configuration means:

- configuration based on the use of a compilation directive;

- configuration based on the use of a link directive;
- configuration performed through a parameter defined in a configuration file;
- configuration performed through data defined in a database with impact on the actually executable parts of the software (e.g. parameters defining branch structures that result in the non-execution of existing parts of the code).

### 3.2.6 COTS, OTS, MOTS software

for the purpose of this Standard, commercial-off-the-shelf, off-the-shelf and modified-off-the-shelf software for which evidence of use is available

### 3.2.7 critical software

software of criticality category A, B or C

NOTE See ECSS-Q-ST-80 Table D-1 – Software criticality categories.

### 3.2.8 deactivated code

code that, although incorporated through correct design and coding, is intended to execute in certain software product configurations only, or in none of them

[adapted from RTCA/DO-178B]-40:2014  
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### 3.2.9 decision

boolean expression composed of conditions and zero or more boolean operators that are used in a control construct.

NOTE 1 For example: “if.....then .....else” or the “case” statement are control construct.

NOTE 2 A decision without a boolean operator is a condition.

NOTE 3 If a condition appears more than once in a decision, each occurrence is a distinct condition.

### 3.2.10 decision coverage

measure of the part of the program within which every point of entry and exit is invoked at least once and every decision has taken “true” and “false” values at least once.

NOTE Decision coverage includes, by definition, statement coverage.

### 3.2.11 existing software

any software developed outside the business agreement to which this Standard is applicable, including software from previous developments provided by the

supplier, software from previous developments provided by the customer, COTS, OTS and MOTS software, freeware and open source software

### 3.2.12 integration testing

testing in which software components, hardware components, or both are combined and tested to evaluate the interaction between them

[IEEE 610.12:1990]

### 3.2.13 logical model

implementation-independent model of software items used to analyse and document software requirements

### 3.2.14 margin philosophy

rationale for margins allocated to the performance parameters and computer resources of a development, and the way to manage these margins during the execution of the project

### 3.2.15 metric

defined measurement method and the measurement scale

NOTE 1 Metrics can be internal or external, and direct or indirect

NOTE 2 Metrics include methods for categorising qualitative data

[ISO/IEC 9126-1:2001]

### 3.2.16 migration

porting of a software product to a new environment

### 3.2.17 mission products

products and services delivered by the space system

NOTE For example: Communications services, science data.

### 3.2.18 modified condition and decision coverage

measure of the part of the program within which every point of entry and exit has been invoked at least once, every decision in the program has taken “true” and “false” values at least once, and each condition in a decision has been shown to independently affect that decision’s outcome

NOTE A condition is shown to independently affect a decision’s outcome by varying that condition while holding fixed all other possible conditions.

### 3.2.19 operational

for the purpose of this Standard, related to the software operation

NOTE It is not related to the spacecraft operation.