

October 2021

ICS 49.140; 35.240.99

English version

Space product assurance - Reuse of existing software

Assurance produit des projets spatiaux - Réutilisation
de logiciels

Raumfahrtproduktsicherung - Wiederverwendung
existierender Software

This Technical Report was approved by CEN on 13 September 2021. It has been drawn up by the Technical Committee CEN/CLC/JTC 5.

CEN and CENELEC members are the national standards bodies and national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



**CEN-CENELEC Management Centre:
Rue de la Science 23, B-1040 Brussels**

Table of contents

European Foreword	4
Introduction	5
1 Scope	6
2 References	7
3 Terms, definitions and abbreviated terms	9
3.1 Terms from other documents	9
3.2 Terms specific to the present document	9
3.3 Abbreviated terms	10
4 Overview of the handbook	11
4.1 Introduction	11
4.2 Relation to other ECSS Standards	12
4.2.1 General	12
4.2.2 Software engineering	12
4.2.3 Software product assurance	13
4.2.4 Project management	13
5 Software reuse approach	14
5.1 Introduction	14
5.2 Requirements phase	16
5.2.1 Overview	16
5.2.2 Requirements identification	16
5.2.3 Gap analysis	17
5.2.4 Derived requirements identification	18
5.3 Assessment phase	18
5.3.1 Overview	18
5.3.2 Assessment	18
5.3.3 Selection	20
5.4 Integration phase	21
5.4.1 Overview	21
5.4.2 Incoming inspections	21

5.4.3	Configuration management	22
5.4.4	Adaptation of the existing software.....	22
5.5	Qualification phase	24
6	Tool qualification	26
6.1	Introduction.....	26
6.2	Tool qualification level	26
6.3	Tool qualification.....	28
7	Techniques to support qualification when reusing existing software.....	32
7.1	Introduction.....	32
7.2	Verification techniques.....	33
7.2.1	Black box techniques	33
7.2.2	White box techniques.....	34
7.3	SW design techniques	39
7.4	Hardware architecture techniques	42
7.5	Reverse engineering.....	43
7.6	Product service history	44
7.7	Development process examination	46
Annex A	Content of Software Reuse File (SRF).....	47
Annex B	Content of the Product Service History file	52
Annex C	Risk management considerations.....	56
C.1	Introduction.....	56
C.2	Risk scenarios and mitigation actions	56
Figures		
Figure 4-1:	Organization of the handbook	12
Figure 5-1:	Specific reuse activities within project.....	15
Figure 6-1:	Tool qualification levels	27
Tables		
Table 6-1:	Example of combination of classes of methods	29
Table 7-1:	Example of combination of classes of methods	38
Table B-1 :	Anomaly rate estimation.....	54
Table B-2 :	Anomaly rate versus time.....	55

European Foreword

This document (CEN/CLC/TR 17602-80-01:2021) has been prepared by Technical Committee CEN/CLC/JTC 5 "Space", the secretariat of which is held by DIN.

It is highlighted that this technical report does not contain any requirement but only collection of data or descriptions and guidelines about how to organize and perform the work in support of EN 16602-80.

This Technical report (CEN/CLC/TR 17602-80-01:2021) originates from ECSS-Q-HB-80-01A .

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 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 TR covering the same scope but with a wider domain of applicability (e.g.: aerospace).

Introduction

This handbook provides guidance on the approach that can be taken when defining the implementation of activities for the reuse of existing software within a space project.

Existing software is defined in ECSS-Q-ST-80 as follows:

- Any software from previous developments that is used for the project development as is or with adaptation. It also includes software supplied by the customer for use in the project development.
- Any software including any software developed outside the contract to which ECSS software standards are applicable.
- Any software including products such as freeware and open source software products.

In the development of software systems or products, different types of existing software artefacts can be reused, such as:

- Requirements, when reused early in the software product requirements definition.
- Components, when reused early in the software product architecture definition.
- Modules, when reused at detailed design level.
- Libraries and source code, when reused at coding level.
- Documents, plans, tests, and data are other software items that can be reused.

This handbook adopts a broader interpretation of the term 'existing software', and assumes that it can comprise the 'reuse' of tools for the development of any space software product.

Furthermore, the effective reuse existing software is based on the possibility to fully understand it with respect to properties such as functionality, quality, performance, dependability or safety and to find and adopt it to the development faster than it otherwise can be constructed.

However, whatever is the level of reuse, the quality of the reused existing software is of utmost importance, as low quality can easily lead to system failure and thus loss of mission even for the lowest reuse level. Consequently, significant analyses should be carried out when using existing software. Furthermore, policies that favour reuse of existing software should be adopted with an understanding of the complex impacts of using the already available software.

1

Scope

This handbook provides recommendations, methods and procedures that can be used for the selection and reuse of existing software in space software systems.

This handbook is applicable to all types of software of a space system, including the space segment, the launch service segment and the ground segment software (including EGSEs) whenever existing software is intended to be reused within them.

This handbook covers the following topics:

- Software reuse approach including guidelines to build the Software Reuse File
- Techniques to support completion of existing software qualification to allow its reuse in a particular project
- Tool qualification
- Risk management aspects of reusing existing software

Existing software can be of any type: Purchased (or COTS), Legacy-Software, open-source software, customer-furnished items (CFI's), etc.

NOTE Special emphasis is put on guidance for the reuse of COTS software often available as-is and for which no code and documentation are often available.

Legal and contractual aspects of reuse are in principle out of scope; however guidelines to help in determine the reusability of existing software from a contractual point of view is provided in [ESA/REG/002].

Any organization with the business objective of systematic reuse may need to implement the organizational reuse processes presented in [ISO12207]. These processes will support the identification of reusable software products and components within selected reuse domains, their classification, storage and systematic reuse within the projects of that organization, etc. But these processes are out of scope of this handbook as the handbook is centred on the specific project activities to reuse an existing software product, not part of those organizational reuse processes more oriented to 'design for reuse' processes.

In addition, this handbook provides guidelines to be used for the selection and analysis of tools for the development, verification and validation of the operational software.

2 References

For each document or Standard listed, a *mnemonic* (used to refer to that source throughout this document) is proposed in the left side, and then the *complete reference* is provided in the right one.

EN Reference	Reference in text	Title
EN 16601-00-01	ECSS-S-ST-00-01	ECSS - Glossary of terms
EN 16602-80	ECSS-Q-ST-80	Space product assurance – Software product assurance
EN 16603-40	ECSS-E-ST-40	Space engineering – Software
	BSCC(2004)	ESA software Intellectual Property Rights and Licensing
	DO178B	Software considerations in airborne systems and equipment certification. RTCA DO178B/EUROCAE ED-12B. Radio Technical Commission for Aeronautics/European Organization for Civil Aviation Equipment. 1992.
TR 17602-80-04	ECSS-Q-HB-80-04	Space product assurance - Software metrication programme definition and implementation
TR 17602-80-02	ECSS-Q-HB-80-02	Space product assurance - Software process assessment and improvement
	ESA/REG/002	General clauses and conditions for ESA contracts (clauses 41-43).
	FAA-COTS	DOT/FAA/AR-01/26 COTS avionics Study, May 2001
	FAA-DOT-handbook	DOT/FAA/AR-01/116 Software Service History Handbook. January 2002. FAA.
	FAA-DOT-report	DOT/FAA/AR-01/125 Software Service History report. January 2002. FAA.
	FAA-N8110.91	FAA Notice N 8110.91. Guidelines for the qualification of software tools using RTCA/DO-178B. 16/01/2001
	GSWS	GAL-SPE-GLI-SYST-A/0092. Galileo Software Standard
	IEC 61508	Functional safety: safety-related systems. (Parts 1-7) Ed 2.0. 2010
	IEEE 1517	IEEE Standard for Information Technology - Software Life Cycle Processes-Reuse Processes
	ISO 12207	Systems and software engineering -- Software life cycle

EN Reference	Reference in text	Title
		processes. Edition: 2. 2008. ISO.
	ISO FDIS 26262	Road vehicles -- Functional safety. FDIS Parts 1-10. 2010. ISO.

This document is a preview generated by EVS