

SOFTWARE PROCESS, DESIGN, DEVELOPMENT, AND PRODUCTION IN THE NEW SPACE CONTEXT

SOFTWARE PRODUCT ASSURANCE CONFERENCE 2025
22-25 September | ESA ESTEC | The Netherlands

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INTRODUCTION

- /// Space sector is evolving quickly, with more private companies getting involved and new technologies lowering down the entry barriers, opening doors for space start-ups and small companies as well.
- /// In this work, we propose a software standard that adapts existing Software Product Assurance and Software Engineering processes to guarantee an appropriate level of quality within this novel and dynamic environment.
- /// We report the approach adopted by Thales Alenia Space JV (TAS) in defining the New TAS Software Standard for the so called “Next Space” missions.



NEW SPACE MARKET: NEW REQUIREMENTS APPROACH

Software Requirement Simplification Applicability

Precondition for application:

- The full ECSS flow-down is not requested by the Customer.

- There are not safety consequences in case the SW failure.

NOTE: No reduction of requirements is allowed in case the SW failure could lead to catastrophic or critical safety consequences.

Requirements for “New Space” are highly dependent on Customer expectations and “Mission Classification”

New software ranking with associated levels of simplifications.

Software Levels (SWL) are applied through a “correlation matrix” with the type of mission (Mission Class).

Each Software Level (SWL) is characterized by its corresponding level of ECSS standard applicability and an associated degree of simplification.

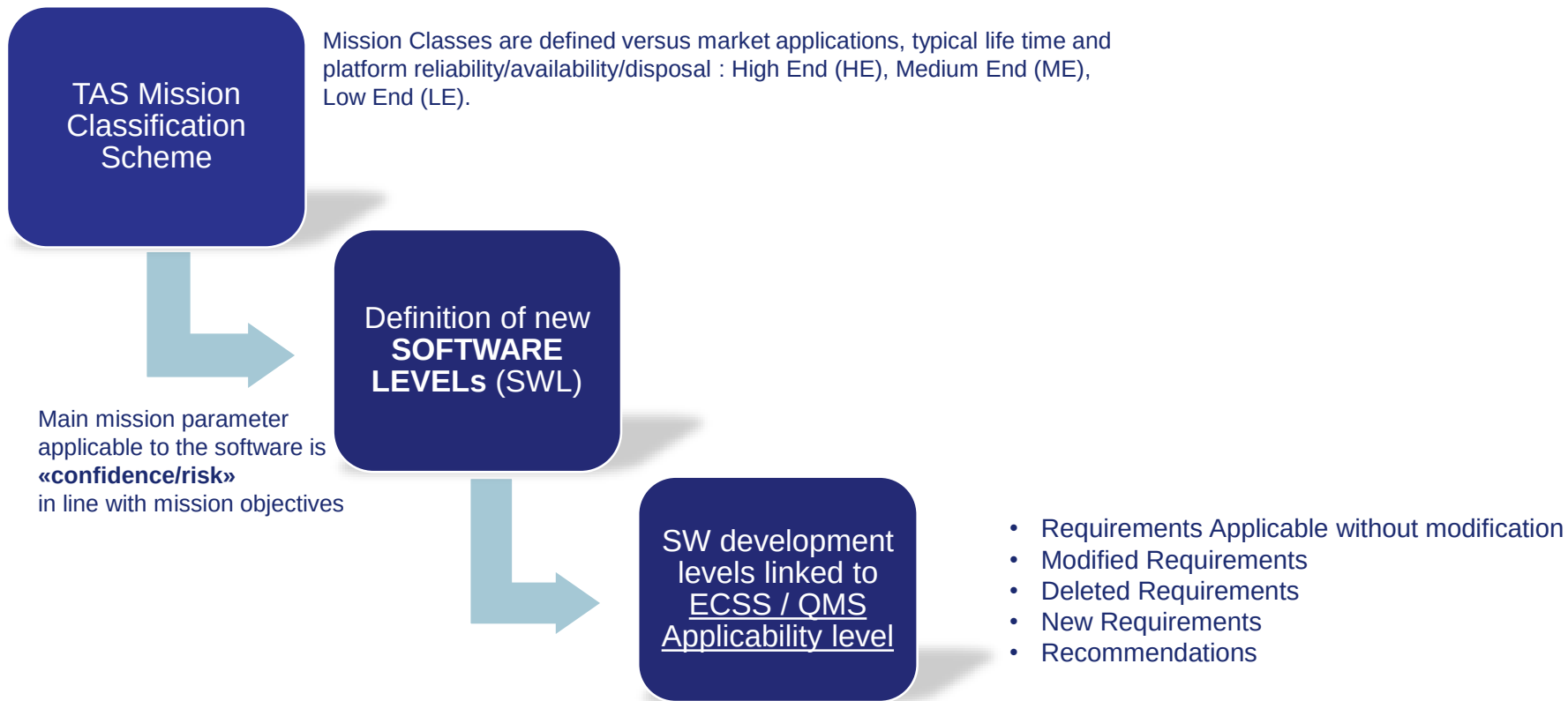
Requirements Simplification

Standards is obtained by simplification of the applicable ECSS/QMS standards.

The concept of simplification is fundamental: critical review of the applicable standards.

STANDARD COMPANY PRODUCT ASSURANCE
AND ENGINEERING REQUIREMENTS
FOR SOFTWARE

SOFTWARE RANKING



SYSTEM-LEVEL SOFTWARE DEPENDABILITY CONSIDERATIONS

Dependability Analyses will identify the SW Product criticality according to ECSS-Q-ST-40 clause 6.5.6.3, and ECSS-Q-ST-30 clause 5.4

System Dependability Analyses

SCAR will be performed starting from the system level product criticality to assign software components criticality

SCAR / software-level criticality classification

No changes in the process

Software criticality ranking applies to each software component

In case the SW product is ranked in SW Crit. A and B “Safety”, the requirements simplification approach is not allowed

Software involved in **Non-Safety Critical Functions**

Requirements simplification application

Requirements simplification approach is not allowed

SW can be developed and validated in line with the Software Levels applied according to the **Correlation Matrix**

ECSS Criticality Level	High End Missions	Medium End Missions	Low End Missions
B	SWL ..	...	...
C	SWL ..	...	...
D	SWL ..	...	...

CORRELATION MATRIX

/// Software involved in **Non-Safety Critical Functions** can be developed and validated according to the following Software Levels.

/// After the completion of the software components criticality assignment (B, C, D) the Correlation TABLE of Software Levels (SWL) to TAS Mission classification and to ECSS SW criticality is applied.

ECSS Criticality Level	High End Missions	Medium End Missions	Low End Missions
B	SWL ..	...	...
C	SWL ..	...	...
D	SWL ..	...	...

Each Mission is composed by a combination of software development levels Identified trough the correlation matrix.

/// Note: SW criticality definitions (for A, B, C, D) are unchanged wrt definitions provided in Q-30.

/// The SWL-x ranking applies to each SW Component, not to the overall SW according to the ECSS ranking process.

SOFTWARE STANDARD SYNTHESIS

Simplification vs Software levels		
ECSS-Q-ST-80C rev1	Applicability of requirements to Software engineering processes	After the completion of the software components criticality assignment (B, C, D) the Correlation Matrix of Software Levels (SWL) to TAS Mission classification and to ECSS Software criticality is applied to all processes, Software Quality and Software Engineering, through the Software Levels.
	Software Review Process	Simplification of the software review process and of the specific Quality Model depending on the SW levels.
ECSS-E-ST-40C	Software Architecture	Simplification of the requirements for the Architecture design according to the SWLs.
	Software Testing	Simplification of the requirements for software test according to the SWLs.
	Traceability	Simplification of the requirements for traceability according to the SWLs.
	Verification of the code	Simplification of the requirements for code verification according to the SWLs.
	New Requirements	New requirements and recommendations for all SW levels: SW re-use, cybersecurity, automation of SW development processes.

The simplification is also applied to each single DRD (document requirements definition).

Two checklists have been specified for Medium-End (ME) and Low-End (LE) missions. They are finalized at getting a set of answers from Suppliers before they produce the formal compliance to the ME/LE Simplified Requirements.

CONCLUSION

The “New Space”

Requirements are highly dependent on customer expectations and “Mission Classification”.

Need to adapt existing processes to guarantee an appropriate level of quality.

**TAS
solution**

New Software Standard

A single standard document for each type of mission classification.

Complete set of requirements for Software Quality and Software Engineering through simplification levels (SWL).

SWLs are applied according to a Correlation Matrix with respect to the Mission Classification.

New requirements have been introduced.

**Future
works**

Next Steps

Return of Experience from first applications of the standard.

Exploration of disruptive approaches on S/W production processes.

Investigation on feedbacks from New Space manufacturers.

Automation of software production phases and intensive and automatic testing.

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THANK YOU !

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