

Business Jets Workshop 2025



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*Interpretation
harmonization addressing
Common Modes Errors in
Critical Systems in Part 25
Aircraft*

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Task Overview

- To seek harmonization regarding common mode failures and errors, the role of dissimilarity in risk mitigation and any remaining differences in the approach.
- The activities were grounded in the safety objective of CS 25.1309 / 14 CFR 25.1309 and discussed the principles and implementation of the no-single failure criterion, including how this is applied to errors versus failures.

Working-group work Plan

Milestone	Deadline	Status
Phase 1. Management decision to initiate the Tasking	February 2022	Complete
Phase 2. Definition of the Issue Statement & Work Plan Determination	June 2022	Complete
Phase 3. Each Authority presented in details their Approach and Policies (Mtgs 4-5)	August 2022	Complete
Phase 4. Harmonisation Discussions (Mtgs 6-14, F2F1&2) Partial agreements reached; Interim progress report issued and CMTS endorsement. Presentation to Industry (WG63 and S18) CMT Decision to extend the tasking and document the agreements	June 2023 (CMTS meeting)	Complete
	Jan 2024 (Industry meeting)	Complete
Phase 5. Harmonization Discussions Address remaining open topics, Presentation of the conclusions and recommendations to CMT Final report issuance Presentation and communication (internal and external)	July 2024 (CMTS meeting) Stage 5 closure	Complete
	Oct 2024	<ul style="list-style-type: none"> • Presentation to CMTS on 9th Oct • Presentation to CMTL on 29th Oct • Presentation to CMT/Industry on 31st Oct
	Jan 2025	<ul style="list-style-type: none"> • Presentation to EASA Business Jet workshop in January 2025 • Presentation to Industry technical WG in Q1 2025.

Harmonisation status overview

- Interim policy harmonisation results were presented to and endorsed by the CMTS in **June 2023**,
- Initial harmonisation results presented to industry at the SAE S-18 meeting in January 2024 and the EUROCAE WG-63 meeting in March 2024,
- Final harmonisation and recommendations were presented to the CMTS in **July 2024**,
- The final report is planned to be endorsed and published by Q1 2025.

Initial presentation of harmonisation outcome to US and EU System Safety joint meeting in Cologne.



Scope – Part 25 and focus on FBW

- The report addresses CS 25 / 14 CFR Part 25 / RBAC 25 / AWM 525.
- The CME TST recognizes that other product categories have similar ‘no single failure’ requirements, and therefore may be subject to similar concerns regarding common mode errors.
- While the framework presented in this report may be found useful for use on other product categories, the CME TST has no position on its applicability outside of CS 25 / 14 CFR Part 25 / RBAC 25 / AWM 525.
- Historically, most difficult compliance discussions regarding common mode errors have focused on electronic flight control systems. As a result, FBW systems were often used as practical examples in the CME TST deliberations, but as much as possible the group strived to develop a framework of general applicability to broadly address all systems having potentially catastrophic failure conditions.

Scope – Focus on the development errors

- Common Mode Errors include specification (requirements), design, implementation, installation, maintenance, and manufacturing errors.
- The CME TST agreed to limit the scope of the task and focus harmonization efforts on development errors, i.e. requirements, design and implementation errors, which have triggered the most difficulties on certification projects.
- However, it should not be inferred that other error sources are out of the common mode analysis' scope. In particular, some authorities noted an increasing concern about manufacturing errors.

Comparative review of the Regulatory Framework

- The CME TST performed a comparative review of the applicable certification requirements and confirmed that all authorities have equivalent requirements, as relevant to common mode error considerations for compliance.

Relevant regulations:
CS 25.1309b/14 CFR 25.1309b
CS 25.671c/14 CFR 25.671c

- The CME TST agreed that the advisory material associated with the primary applicable regulations was also equivalent for the purpose of addressing common mode errors for compliance.
- The 4 Authorities are recognising the same Industry-recommended practices:
 - SAE ARP4761A / EUROCAE ED-135
 - SAE ARP4754B / EUROCAE ED-79B
 - RTCA DO-178C
 - RTCA DO-254

Final report - Content

- CME TST developed a harmonized framework for evaluating flight critical systems on large transport aircraft with regard to common mode development errors, which will be presented in the final consensus report,
- The report:
 - Provides confirmation of the applicable regulations and guidance material;
 - Provides alignment on terminology;
 - Clarifies the compliance intent regarding common mode development errors;
 - Describes, at a high level, a methodology for performing Common Mode Error assessments;
 - Discusses various considerations relevant to performing a Common Mode Error assessment, and evaluating its results for acceptability.
 - Presents Conclusions and Recommendations

Example of consensus

- Consensus: Both error minimization **and** error tolerance are necessary to adequately address common mode development errors for compliance. One technique does not replace the other, they are complementary.
- Concepts of minimization and tolerance:
 - **Error minimization for compliance** refers broadly to the development assurance activities at the aircraft and system level, and to the design assurance activities at the item level. The intent of these activities is to provide a level of confidence that the system and items development have been accomplished in a sufficiently disciplined manner to limit the likelihood of development errors that could impact safety. Design simplicity also contributes to error minimization.
 - **Error tolerance for compliance** refers to protecting against exposure to a single development error potentially having catastrophic safety effects at the aircraft level. Design choices such as diversity (in requirements, design, implementation), architectural choices, and features such as monitoring which would provide containment or reduce the severity effects of a development error all contribute to error tolerance. Tolerance provides protection for 'unknowns'.

Harmonisation accomplished

- ✓ Common terminology was agreed upon when discussing and evaluating the qualitative subject of Common Mode Errors (CME),
- ✓ Application of development assurance for error minimization as well as the application of appropriate error tolerance established by a safety assessment was harmonized

Harmonisation accomplished



The CME Tolerance Assessment methodology is consistent with the overall CMA activities and is intended to augment the industry practices with additional content specifically targeted to evaluating common mode errors,



The necessary contents of an applicant's CME assessment was agreed upon, along with an example of the reporting format,



A harmonized scope of CME risk in airborne electronic hardware (AEH) components was agreed upon.

Consensus recommendations

- Agree that the outcome of the tasking will be presented to the relevant industry groups and in particular the joint S18/WG63 sub-group on Common cause errors. Industry would be able to play a key role in developing detailed practices supporting the work contained in the final report,
- Each authority to review and align their policies based on the outcome of this tasking,
- Each authority to recognise the ED135/ARP4761A and ARP4754B at the next opportunity as these form the basis for the consensus process proposed,
- After acceptance of the final report, consider removing the associated Safety Emphasis Item (SEI) for EASA/FAA validations.

Conclusions

- The harmonization improvements achieved will result in an efficiency gain for both authorities and applicants, in the context of type validation activities,
 - While this does not constitute a full harmonization (largely due to time constraints), a considerable improvement has been achieved,
 - Industry will be able to play a key role in further implementation of the guidance provided.
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- Next step: After publication of the final report, a detailed technical presentation will be delivered to industry in Q1 2025.



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