



General Aviation – Structures Cert Memos and CRIs

Emily LEWIS
EASA Structures Expert

Pierre-Daniel JAMESON
EASA Junior PCM General Aviation

General Aviation Structures Workshop
16-17 October 2017





DISCLAIMER

- All information provided is of a general nature only and is not intended to address the circumstances of any particular individual or entity. Any time there is a conflict or discrepancy between the information provided in this presentation and information in an official regulation or agency document, the latter prevails.
- Despite every effort to ensure the accuracy of the information provided, it may contain occasional inadvertent inaccuracies or typographical errors. Any error brought to our attention (ttd@easa.europa.eu) will be promptly corrected. In no event shall EASA be liable for any incidental or consequential damages, even if EASA has been informed of the possibility thereof. The content may be subject to changes at any time without prior notice. Subsequent revisions or updates will not be provided. To the maximum extent permitted by law, EASA is not liable (whether in contract, negligence or otherwise) for any loss or damage arising from the use of these materials.
- The presentation provided by or on behalf of EASA are furnished on an "as-is" basis, without warranty of any kind, whether express, implied, statutory or otherwise especially as to its quality, reliability, currency, accuracy or fitness for purpose.
- Ownership of all copyright and other intellectual property rights contained within EASA material, including any documentation, data, technical information and know-how provided as part of the presentation, remain vested in EASA. None of the materials provided may be used, reproduced or transmitted, in any form or by any means, electronic or mechanical, including recording or the use of any information storage and retrieval system, without the written permission from EASA. All logo, copyrights, trademarks and registered trademarks in this presentation are the property of their respective owners.



Contents

- Certification Review Items (CRIs):
 - Overview
 - Generic CRIs for High Performance ($h > 25000\text{ft}$ or $M_D > 0.6M$)
 - Other Common General Aviation CRIs
- Certification Memos:
 - Explanation of Cert Memos
 - Current Structures Cert Memos related to General Aviation
 - Future Structures Cert Memos related to General Aviation
- Conclusion



Overview of CRIs

- Certification Review Items (CRIs):
 - Types of CRI:
 - Special Conditions
 - Equivalent Safety Finding (ESF)
 - Deviations
 - Interpretative Material or Means of Compliance
 - Special Condition, ESF and Deviation CRIs are listed on the TCDS
 - Special Conditions and ESFs raised during a TC may be applicable to STC
 - CRIs may be raised:
 - Certification issue which
 - Requires clarification and interpretation, or
 - Represents a major technical or administrative issue



Generic CRIs – High Performance

- Generic CRIs exist for the following high performances, bringing additional considerations (usually from CS 25):

Subject	Reference	Rationale
Vibration & Buffeting	25.251, 25.305(e), 25.427(d)	High speed , high altitude
Sonic Fatigue	25.571(d)	Turbine engine
Pressurisation into Non-pressurised Areas	25.365(e)	High altitude
Speed Margins	25.335(b) (Note: Commuter Category)	High Mach number, high altitude
Yawing Manoeuvre	23.441(b) (Note: Commuter Category)	For a/c equipped with powered flight controls
Dynamic Response	25.305(c)	Flexibility / dynamic response (e.g. swept wings)
Out-of-trim Conditions	25.331(a)	For a/c with trimmable horizontal stabilizer
Round-the-clock Gust	25.427(c)	For a/c equipped with T-tail
Ground Loads	Various	Use of CS-25 ground loads in lieu of CS-23 ground loads



Generic CRIs – High Performance

► Generic CRIs for high performance cont.:

Subject	Reference	Rationale
Flight Load Survey	25.301(b)	High speed, compressibility effects
Structural Stall Speed	25.333(b)	Interpretation of 23.333(d)
Bird Strike	23.775(h) / 25.631 / 25.775(c)	High speed
High Altitude Operation	25.841	High altitude
Windshields and windows	25.775(d)	High altitude
Fire Protection of Engine Mounts	25.865	Turbine Engine
Fuel Tank Installation	25.721	For a/c with high landing speeds / large amounts of fuel in locations vulnerable in an emergency landing
Uncontained Engine Debris	25.903(d)	Interpretation of AMC 20-128A
Interaction of Systems and Structures	25.302	For a/c equipped with EFCS, LAS, etc.

► These are typically special condition CRIs



Other common GA CRIs

➤ Other common CRIs include:

- Towbarless Towing
- Baggage Compartment*
- Fireproof and fire-resistant material*
- Aircraft Emergency Parachute System
- Ejection Seat
- Fatigue and Damage Tolerance (determination and the selection of the structural components for fatigue evaluation)*
- Flutter (control system failures)*
- Landing Gear Limit and Ultimate / Static and Dynamic Justification*
- CS 23 Appendix A Simplified Design Load Criteria *
- Proof of Structure*
- Seat Adapter Plate

* These topics will be discussed in other presentations during this Workshop



Explanation of Certification Memos

➤ What is the purpose of a Certification Memo:

- ✓ Clarify the EASA's general course of action on specific certification items
- ✓ Provide guidance on a particular subject
- ✓ May provide complementary information and guidance for compliance demonstration with current standards
- ✓ Provided for information purposes only
- x Are not intended to introduce new certification requirements
- x Do not modify existing certification requirements
- x Do not constitute any legal obligation



Explanation of Certification Memos

- Contents of the Certification Memoranda:
 - Applicability
 - Background
 - The Policy
 - Regulatory Requirement(s)
 - References: guidance material, related standards, EC Directives etc.
 - Contact information for questions concerning the technical content
- Draft Cert Memos are published on the EASA website for public consultation



Certification Memoranda Overview

Current Structures Cert Memos related to GA:

- CM-S-003: Standard Fasteners (nuts and bolts)
- CM-S-004: Composite Materials – Shared Databases
- CM-S-005: Bonded Repair Size Limits
- CM-S-006: Certification, Type Design Definition, Material and Process Qualification for Composite Light Aircraft
- CM-S-008 – Additive Manufacturing

Future Structures Cert Memos related to GA:

- Proposed CM-S-010: The Safe Design and Use of Monocoque Sandwich Structures in Critical Structure Applications



Certification Memoranda Overview

CM-S-003

CM–S-003: “Application of Standard Fasteners (nuts and bolts) ... to be used in Critical Installations”

- Issue 01, 26th February 2015
- This Cert Memo affects GA applicants who need to show compliance with CS-LSA, CS-VLA, CS-23
- CSVLX/2X.601, CSVLR/27/29.602, CSVLX/2X.603, CSVLX/2X.607, CS E 70, CS E 515, CS P 160, CS P 170
- Critical Installation Definition:
“A structural/mechanical assembly, which may include fasteners the failure of which (single or multiple due to common cause) is classified as hazardous or catastrophic.”
- Informs Design Approval Holders and applicants of the issue
- Provides guidance to help ensure that appropriate measures are considered for initial cert, including associated CAW aspects



Certification Memoranda Overview

CM-S-003

CM–S-003: “Application of Standard Fasteners (nuts and bolts) ... to be used in Critical Installations”

- Examples of what is potentially affected:
 - Wing to fuselage attachments
 - Horizontal stabiliser attachments
 - Engine Mounts
 - Control System
- Currently EASA will raise CRIs on new TC applications CS-23 commuter category products.
- EASA Safety Information Bulletin 2012-06R2
 - Defective Standard Hardware – MS21042, NAS1291 and LN9338 Self-Locking Nuts, and NAS626 Bolts



Certification Memoranda Overview

CM-S-004

CM-S-004: “Composite Materials – Shared Databases: Acceptance of Composite Specifications and Design Values Developed using the NCAMP Process”

- Issue 01, 14th January 2014
- This Cert Memo affects GA applicants who need to show compliance with CS-VLA, CS-22, CS-23
- CS2X.603, CS2X.605, CS2X.613, CS-E 70, CS-P 170
- Interim EASA position regarding acceptance of composite material data developed specifically using the National Centre for Advanced Materials Performance (NCAMP) shared database process
- See also paragraphs related to Shared Databases in CM-S-006



Certification Memoranda Overview

CM-S-005

CM-S-005: “Bonded Repair Size Limits in accordance with CS-23, CS-25, CS-27, CS-29 and AMC 20-29”

- Issue 01, 11th September 2015
- This Cert Memo affects applicants who need to show compliance with CS-23
- CS2X.571, CS2X.573
- Provides guidance regarding the determination of Bonded Repair Size Limits for composite (typically polymeric) and metallic (monolithic and sandwich) critical structures
- Primarily addresses certification associated with continued airworthiness
- Provides some background guidance to organisations engaged in repair activities regarding the possible reasons for some repair size limitations
- Policy is not intended for repairs finally determined to be minor



Certification Memorandum Overview

CM-S-006

Newest Structures Cert-Memo issued 13-Jul-17:

Certification, Type Design Definition, Material and
Process Qualification for Composite Light Aircraft

=> EASA CM-S-006



Certification Memorandum

EASA CM-S-006

- **What** => Interim position regarding acceptance of compliance demonstration for composite materials (for CS-22, CS-LSA, CS-VLA, ELA1)
Not CS-23 !
- **Why** => To bring together already acceptable means of compliance (Nothing New 😊)
- **How** => Highlight reference material (BR, CS's, AMCs, databases) provide a starting point...



Certification Memorandum

- **Who** => those needing to demonstrate compliance with structure and material requirements for composite structures of composite light aircraft !

- **Which** => (Airworthiness/EASA Certification Policy):
 - 21.A.31 – Type Design
 - 21.A.20(b)– Certification Program & Project Fam.
 - 21.A.4 – Coordination between Design & Production
 - 21.A.33 – Inspection and tests



Certification Memorandum

- EASA Certification Policy (Materials):
 - Material Properties and design allowables
 - Fatigue
 - Structural testing
 - Bonded joints
 - Environmental effects
 - Damage tolerance
 - Material and process changes



Certification Memorandum: An example

- Highlight Databases
- Outline Knock-down factors and their applicability

Table 1: Minimum test factors for ultimate load testing:

Pedigree				Safety Factor	
	Stat. Basis	Env.	Prod.	Test - Room Temperature	Test hot
1	A/B hot&wet Shared Database	EKDF	KDF	$1,5 \times \text{EKDF} \times \text{KDF}$	$1,5 \times \text{KDF}$
2	"LBA"	1,25	1,15	$1,5 \times 1,25 \times 1,15$ (2,156)	$1,5 \times 1,15$ (1,725)
3	no statistical data	No	No	$1,5 \times 1,5$ (2,25)	$1,5 \times 1,2^*$ (1,8) *moisture conditioned specimen

•N.B. LBA = based on Idaflieg

- Following test failure, it is not acceptable to repeat test without design change until a pass is achieved
- Important design of structure is in a conservative way



Certification Memoranda Overview

CM-S-008

CM-S-008: “Additive Manufacturing”

- Issue 01, 4th April 2017
- CS X.571, CS X.603, CS X.605, CS X.613, CS 25.853
- All Products (Aircraft, Rotorcraft and Propulsion) and Parts and Appliances subject to EASA Type Certification
- Provides complementary guidance for DOA, ADOA and POA Holders regarding the introduction and use of Additive Manufacturing (AM) technologies



Certification Memoranda Overview

Proposed CM-S-010

Proposed CM-S-010: “The Safe Design and Use of Monocoque Sandwich Structures in Critical Structure Applications”

- Published for Public Consultation in June 2016.
- CS2X.305, CS2X.307, CS2X.57X, CS23.573(a)(5), CS2X.601, CS27/29.602, CS2X.603, CS2X.605
- Primarily addresses CS23 – commuter, CS25, CS27 and CS29. Some content may provide useful guidance when addressing light aircraft.
- Provides guidance relating to the safe design and use of monocoque sandwich structures in critical structure application
- Following topics are discussed: Qualification of the manufacturing process, Process specifications, Material strength and determination of the design allowable, Damage tolerance and residual strength, Safety Management System, Instructions for Continued Airworthiness
- The final Certification Memo will be published once EASA internal review process is complete.



Conclusion

➤ CRI:

- Project CRIs may be issued due to specific design or operational details
- Generic CRIs for High Performance Aircraft ($h > 25000\text{ft}$ or $M_D > 0.6M$)
- Special Condition and ESF CRIs are listed on the TCDS and may be applicable to STC or Major Changes

➤ Certification Memos:

- Do not introduce new or modify current certification requirements
- They provide complementary information, guidance and clarification
- There are currently 5 Structures related Certification Memos that may be applicable to General Aviation Projects
- 1 additional Structures related Certification Memorandum has been published for public consultation

(Some CMs will need to be revised to address the CS 23 Amendment 5)



EASA

European Aviation Safety Agency

Thank you for your attention!

Any questions....?

Your safety is our mission.

An agency of the European Union

