

# EASA – Structures and Materials Safety

EASA – FAA AM

INDUSTRY – REGULATOR EVENT

(virtual meeting)

November 9<sup>th</sup> - INTRODUCTION

S.Waite, Senior Expert – Materials, Certification Directorate, EASA

M.Gorelik, Chief Scientific and Technical Advisor – Fatigue and Damage Tolerance, FAA

**Your safety is our mission.**

# EASA - AM

## EASA FAA AM Industry – Regulator Event 2021 – Detailed Agenda: Tuesday 9<sup>th</sup> Nov.

Day 2		Tuesday				
		Performance based regulation	Presentation intended to seed performance based regs/SDO panel thoughts Wednesday			
15:30-16:00			Standards at FDA &CDRH (Centre for Devices & Radiological Health)	Terry Woods	FDA (Food and Drug Administration)	30
		Computer Modelling and Simulation	Technical presentations to seed Computer/Modelling/Digital Twin framework discussion Wednesday			
16:00-16:20		Technical Presentation #1	Digital Twin & Digital Thread – Definition, Value & Relevance to Certification	Olivia Pinon Fischer	Georgia Tech	20
16:20-16:40		Technical Presentation #2	Simulation of additive Manufacturing Process	Pedro De la Calzada	ITP	20
16:40-17:00		Technical Presentation #3	Computationally Enhanced Probabilistic Fracture Mechanics for AM parts	Javier Gómez-Escalonilla Martín	AIRBUS	20
17:00-17:45		Keynote	'Thoughts on Fatigue Certification of Metal Additive Manufacturing for Aircraft Structures'	Loris Molent	Molent.com Consultant (DSTO - Australia (retired))	45
17:45-17:55		Break				10
17:55-19:30		WG Breakout sessions		WG Co-chairs		95
					Total	240

# EASA – Structures and Materials Safety

EASA – FAA AM

INDUSTRY – REGULATOR EVENT

(virtual meeting)

WORKING GROUP 1:

Qualification of Additive Manufacturing (AM) Parts of No, or Low, Criticality (for use in Certified products)

November 9, 11,&12/2021

S.Waite, Senior Expert – Materials, Certification Directorate, EASA

O. Kastanis, Propulsion Expert, Certification Directorate, EASA

M. Rife, Delta TechOps, Interiors

**Your safety is our mission.**

# EASA – Structures and Materials Safety

EASA – FAA AM

INDUSTRY – REGULATOR EVENT

(virtual meeting)

WORKING GROUP 1:

Qualification of Additive Manufacturing (AM) Parts of No, or Low, Criticality (for use in Certified products)

Tuesday November 9th

S.Waite, Senior Expert – Materials, Certification Directorate, EASA

O. Kastanis, Propulsion Expert, Certification Directorate, EASA

M. Rife, Delta TechOps, Interiors

**Your safety is our mission.**

# EASA - AM

**Agenda outline** (total 3 - 4hrs per day, starting 15:30hrs CET)

## Day 1 (Monday, November 8)

- Welcome (Rachel Daeschler - EASA Certification Directorate Director)
- Regulators (EASA, FAA) – Opening Remarks/Update
- **Keynote Speech:** (Loris Molent (DTSO (retired))) 'Thoughts on Fatigue Certification of Metal Additive Manufacturing for Aircraft Structures'
- Industry (EAAMIRG) – Opening Remarks/Update
- Working Group (WG) 1, 2, and 3 update and process introduction

## Day 2 (Tuesday, November 9)

- Presentations (preparation for Wednesday Sessions)
  - Performance based regulation
  - AM Modelling/Simulation (3 presentations)
- WG Parallel breakout sessions

- detailed WG1 preparation meeting 'catch-up' summary (approx. 2hrs)

# EASA - AM

**Agenda outline** (total 3 - 4hrs per day, starting 15:30hrs CET)

## Day 3 (Wednesday, November 10)

- Performance based regulation and the SDOs
  - Co-ordination / Collaboration across the SDOs
  - Data generation / databases / guidelines
- AM Modelling/Simulation (Mini Workshop - presentations and discussions):

## Day 4 (Thursday, November 11)

- **WG Parallel breakout sessions** (continued from Day 2) ←

- WG1 'WORKING MEETING' format (approx. 4hrs)  
see slides and preparation spreadsheet previously shared with WG1

## Day 5 (Friday, November 12)

- Technical presentations (3 presentations)
- **WG debriefs** ←
- Authorities panel
- Wrap-up

- WG1 Nov. 2021 summary and recommendations (20 mins)

# EASA – AM WG1

## WG1 – Meeting process:

- attendees to use webex link identified for the WG selected during the registration process (Tuesday and Thursday)

### Tuesday (approx. 2hrs):

- **Co-chairs - process reminder from Monday** (Simon Waite, EASA - 5 mins)
- **Co-chairs – WG1 Introduction/Catch-Up slides (WG1 preparation ‘Working Meeting’ discussions)** (Simon Waite, EASA - 15 mins)
- **‘Criticality’ – developing discussion ASTM F42/EAAMIRG – WG1 Aspects** (Charles Park, John Van Airbus Boeing – 15 mins)
- **Potential Scaled Criticality/Degree of Rigor Certification Guidance** (Cindy Ashforth, Linda Jahner, FAA – 20 mins)
- **Selected Examples** (10 mins each):
  - **Structure:** GKN – Nacelle Access Panel Hinges (structure – propulsion) (Jean Luc Belon, Mark Bosman, Chris Dordlofva)
  - **Systems:** LIEBHERR - NLG Sensor Bracket (system - structure) (Andre Danzig)
  - **Interiors:** MATERIALISE – Dado Panel (interiors) (Erik deZeeuw, Gert Brabants)/Expleo (Konrad Lehmann, Henryk Bork)
  - **Interiors – Seats:** SAFRAN – Interiors Seat Parts (interiors) (Muhammad Khan, Mehdi. Bolaky)
  - **Propulsion:** Title TBD (system – propulsion) (Jan Nelle, Rob Van den Bosch)
  - **Propulsion:** SAFRAN – Compliance Strategy To CS-E 510 (application to AM parts) (system-propulsion) (Hacene Cherouali)

# EASA – AM WG1

## WG1 – Meeting process:

### Thursday (approx. 3hrs20 mins): **'Working Meeting' process - Potential Guidance Content and Location**

- **Potential no/low criticality guidance - Simple Content Outline/Content** (Simon Waite, EASA – 5 mins)
- **FHA/RAS** (simplified - certification proportionality) (Michael Weiler, Simon Waite, EASA – 10 mins)
  - need to consider more than the part, but the broader system/functionality and safety outcome
- **SAE AM SEATS** (Thomas Rees-Gralton, Safran – 10-15 mins)
- **Other developing related draft SAE documents** (Roger Eybel, Safran Landing Systems - 10-15 mins)
  - step through content with no/low criticality in mind
  - **ARP 7041 'Standard Practice for Production, Distribution, and Procurement of Additively Manufactured (AM) Parts/Preforms'**
  - **ARP 7042 'Recommended Practice: Development Planning for Design of Additive Manufactured Components in an Aircraft System'**
  - **ARP 7043 'Additive Manufacturing (AM) Checklist for Designing/Repairing Aircraft Components that were developed from an ARP 7042'**
- **SAE AM-Repairs** (Dave Abbot, GE – 10-15 mins)
  
- **STEP THROUGH SLIDES and SPREADSHEET – see email shared with WG1 prior to this meeting (WG1)**

# EASA – AM WG1

WG1 – Meeting process Thursday:

WG1 Preparation Slides and Spreadsheet:

- sent to WG1 prior to this meeting
- spreadsheet questions linked to slide numbers
- to be used to encourage identification of potential no/low criticality document content (format, bullet point themes etc) during the Thursday ‘working Meeting’
- Reminder: this is a ‘Working Meeting’. Process can be continued at following meetings
  
- **PLEASE USE THE SPREADSHEET DURING THE THURSDAY ‘WORKING MEETING’** to support discussion/recording of:
  - agreement/disagreement with intent and discussion
  - to propose alternatives etc

**PLEASE RETURN COMPLETED WG1 SPREADSHEET TO S. Waite**

**by Friday 19<sup>th</sup> November 2021**

# EASA – AM WG1

## WG1 – Meeting process:

### Friday:

- **WG1 outcomes (Powerpoint),**
  - **bullet points from meeting**
  - **spreadsheet development**
    - initial notes from meeting (WG1 input returned by 19<sup>th</sup> Nov. to be processed accordingly)
  - **recommendations for**
    - **WG1 progress**
    - **development of guidance content, e.g. SDO documents and/or CM revision**
- **Co-chairs to provide 1-2 page written summary of Event WG outcomes within 2 weeks of the end of this Event for publication with the proceedings on the regulator web-sites**

# EASA – AM WG1

Qualification of Additive Manufacturing (AM) Parts of No, or Low, Criticality (for use in Certified products)

**WG1 BACKGROUND INFORMATION 2021**

**CONTEXT FOR THESE WG1 MEETINGS**

# EASA – AM WG1

## Qualification of Additive Manufacturing (AM) Parts of No, or Low, Criticality (for use in Certified products) – Background:

- ‘proportionate’ certification is not new... an established ‘case by case’ practice for some products of no/low criticality, e.g. repair by replacement, using conventional methods, but little guidance or consistent documentation... and typically not statistically rigorous
- ideally, manufacturing should not define ‘criticality’ (should be material agnostic)
- new Advanced Materials and Processes (AMPs), e.g. AM, potentially introduce new and competing failure modes, some difficult to detect, and greater variability in some engineering property data
- integrated complex parts have potential to impact several disciplines, e.g. strength, functionality etc - structures-systems etc
- potential exists for an Hazard Analysis to have not considered all possibilities if based upon conventional considerations for previous similar applications, particularly for those in small complex supply chains or not in the original TCH supply chain

# EASA – AM WG1

## Qualification of Additive Manufacturing (AM) Parts of No, or Low, Criticality (for use in Certified products) – Background:

- therefore, potential exists for the manufacturing method to influence damage modes, sequences, variability, and safety outcome (aeroplane or pax level)... i.e. ‘criticality’
- furthermore, regulators are moving towards ‘Performance Based Regulation, increasing reliance upon other guidance processes
- **WG1 Theme - Problem Statement:** In response to industry interest in the potential for a safe and viable business model for AM applications of no/low criticality, is there benefit from developing some more formalised regulator and/or industry ‘level playing field’ guidance regarding the approach to determination of criticality and use of associated qualification processes?

- understanding ‘criticality’, see EAAMIRG action ‘Part Classification and Authority Engagement’?
- need for **Functional Hazard Analysis (FHA)** thought process?
- use of standards, see EAAMIRG action ‘Standardisation: understanding and use of ‘standards’?

# EASA – AM WG1

Criticality: CM–S-008 Issue 01: Additive Manufacturing – Draft Revision Outline:

New para. – Parts of No Criticality, main points :

- **What is ‘Criticality’?** (PART 21 AMC 21.B.100(a) ‘Level of Involvement’ (LoI))... as defined in context of LoI:  
*‘... measure of **the potential impact of a non-compliance with part of the certification basis on product safety** or on the environment’*

The supporting guidance continues:

*‘...The **potential impact** of a non-compliance within a Compliance Demonstration Item (CDI) should be **classified as critical if**, for example: ...a function, component or system is introduced or affected where the **failure of that function, component or system may contribute to a failure condition that is classified as hazardous or catastrophic at the aircraft level ...’***

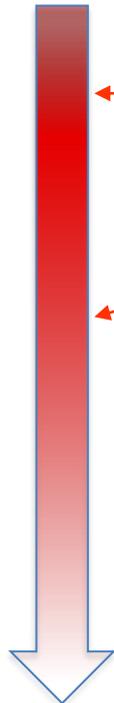
- **any application with any such potential criticality clearly would be expected to fully comply with all requirements** (noting the novelty and complexity aspects of AM, such applications are unlikely to be considered by EASA, other than under experienced TCH control supported by an appropriate ‘step by step’ approach)

Today’s discussion addresses applications at levels of criticality well below those defined above.... and intends to help ensure that AM use does not challenge this.

# EASA – AM WG1

## 2/ Reminder - Generic Examples

### – Parts potentially of no/low Criticality:



#### SAFETY:

CS2x.571,603, 605, 613 etc

- Critical Parts, PSEs, Primary Structure etc
- fatigue, static, dynamic regulations

less critical? ('established practice' - reducing statistical rigour – 'not standardised')

- historically - parts of no/minimal criticality 'engineering judgement' driven certification effort... 'not standardised'
  - commercial, durability and/or marketing driven design

(often coincidentally addressing safety need... not well defined from safety perspective)

**Example:** part with redundant static function, e.g. small mass attachments – change of failure mode wrt conventional configs?

**Example:** small engine access panel, ...part departing aircraft, debris - engine ingestion?

**Example:** rotorcraft door handle, not part of emergency escape route – sharp edges, pax. abuse loads?

**Example:** cup holder or tray on seat: need to consider flammability and potential for sharp edges (undamaged and damaged state) potentially preventing egress in case of otherwise survivable crash  
Need for cert process proportionate to criticality beyond simple rational assessment?

**Example:** single small item of mass  $< 0,45$  kg (1lb) (or  $< 0,15$  kg (1/3lb) if attached to a seat, ref. AC 25.562-1) from CS25.561 not requiring a 1.33 'wear and tear' factor... but needs 25.561 load cases consideration (9g FWD etc)!... for AM consider risks, e.g. no potential for changed debris definition (wrt conventional) to jam other equipment functionality etc – typically not a design driver/large margins!

**Example:** coat hanger in cupboard (not including any access issues, e.g. to safety equipment etc... )

**Example:** Simple small non-safety related instruction placard - commercial (cosmetic/marketing) not safety issues: **No need for cert process beyond recording simple rational assessment of 'part of no criticality'?**

# EASA – AM WG1

Criticality: Other related regulatory activities

AOB: Opinion 07/2019 RMT.0018

***‘Installation of parts and appliances that are release without an EASA Form 1 or equivalent’***

Decision planned for 2021/Q3 (from EASA presentation AEA European conference Jan 2020)

Applicable to: ‘for any other aircraft’ (other than ELA1 or 2):

- has no effect on the operational or functional capabilities of the aircraft nor on its safety margins;
- has no physical discomfort on occupants; nor
- does not increase the workload of the flight crew nor requires the use of emergency procedures.

# EASA – AM WG1

## Criticality: Other related regulatory activities

EASA CS-STAN\*: contains design data, acceptable methods, techniques, and practices for Standard Changes/Standard Repairs (SCs/SRs).

- ... **not subject to an approval process**
- ... **can be embodied in an aircraft iaw conditions set out relevant paragraphs of Part 21\*\* for SCs/SRs**
- ... **must not conflict with TCH information/limitations. Some SCs/SRs carry restrictions relative to some product types, and are typically for use with smaller aircraft**

\***criteria: negligible safety impact in case of non-conformity**

\*\* see also 'new part 21, implementation of Lol for Alternative Procedures (AP) to DOA and Minor changes/repairs (note: typically GA)

<https://www.easa.europa.eu/newsroom-and-events/news/new-easa-approach-definition-level-involvement-loi>

# EASA – AM WG1

Changing technology... and supply chain knowledge management

**Other relevant regulations and regulatory activities: support/awareness PART145 activities, e.g. Point145.A.42(b)(iii) , CAO.A.20(c) or M.A. 603(c)**

## FABRICATION OF PARTS FOR INSTALLATION

- (a) ... fabrication of parts by the **approved maintenance organisation** should be formalised through the approval of a detailed procedure ...
- (b) Fabrication, inspection, assembly and test should be **clearly within the technical and procedural capability of the organisation.**
- (c) All necessary data to fabricate the part should be approved either by the Agency or the type certificate (TC) holder, or Part 21 design organisation approval holder, or supplemental type certificate (STC) holder.**
- (d) Items... fabricated by an approved under Part-145 may **only be used by that organisation in the course of overhaul, maintenance, modifications, or repair o... performing work at its own facilities ... does not constitute approval for manufacture, or to supply externally, and the parts do not qualify for EASA Form 1 certification.**
- (f) The data specified in (c) **may include repair procedures that involve the fabrication of parts.** ... Care should be taken to ensure that the data include details of part numbering, dimensions, materials, processes, and any special manufacturing techniques, **special raw material specification and/or incoming inspection requirement,**... Where special processes or inspection procedures are defined in the approved data which are not available at the organisation, the organisation cannot fabricate the part unless the TC/STC holder gives an approved alternative.

- safety impact upon baseline structure and functionality across products and disciplines?
- need for Functional Hazard Analysis (FHA) thought process?

# EASA – AM WG1

Changing technology... and supply chain knowledge management

**Other relevant regulations and regulatory activities: support/awareness PART145 activities, e.g. Point145.A.42(b)(iii) , CAO.A.20(c) or M.A. 603(c)**

## FABRICATION OF PARTS FOR INSTALLATION

(g) Examples of fabrication within the scope of a Part-145 approval may include but are not limited to the following:

- (1) fabrication of bushes, sleeves and shims;
- (2) fabrication of secondary structural elements and skin panels;
- (3) fabrication of control cables;
- (4) fabrication of flexible and rigid pipes;
- (5) fabrication of electrical cable looms and assemblies;
- (6) formed or machined sheet metal panels for repairs.

**All the above-mentioned fabricated parts should be in accordance with the data provided in the overhaul or repair manuals, modification schemes and service bulletins, drawings, or should be otherwise approved by the competent authority.**

Note: It is not acceptable to fabricate any item to pattern unless an engineering drawing of the item is produced which includes any necessary fabrication process and which is acceptable to the competent authority.

(h) Where a TC holder or an approved production organisation is prepared to make available complete data which is not referred to in the aircraft manuals or service bulletins but provides manufacturing drawings for items specified in parts lists, the fabrication of these items is not considered to be within the scope of an approval unless agreed otherwise by the competent authority in accordance with a procedure specified in the exposition.

# EASA – AM WG1

Qualification of Additive Manufacturing (AM) Parts of No, or Low, Criticality  
(for use in Certified products)

## BACKGROUND - PREPARATION ‘WORKING MEETINGS’ 2021

- 1/ 29<sup>th</sup> April 2021 (initial meeting – define objectives and priorities)
- 2/ 27<sup>th</sup> May 2021 (develop 29<sup>th</sup> April objectives and priorities)
- 3/ 16<sup>th</sup> September 2021 (priority theme ‘**criticality**’)
- 4/ 13<sup>th</sup> October 2021 (priority theme ‘**examples**’)
  
- 5/ 8-12<sup>th</sup> November 2021 (share with broader audience/gather input for deliverable, e.g. CM revision, SDO content etc?)

See support slides for further information

# EASA – AM WG1

## Qualification of Additive Manufacturing (AM) Parts of No, or Low, Criticality (for use in Certified products) – Outline:

**WG1 Scope:** **metallic** and **non-metallic AM parts** (of no/low criticality), AM repairs (including repair by replacement), as applicable to a **range of products** (airframe, systems, cabin safety, propulsion etc)

**Who is this for?** - Decision makers, typically in the supply chain beyond Type Cert Holder:

Reminder: Decision makers/designers exist in a **diverse range of organisations with a broad range of capabilities and experience supporting a broad range of approvals...** impact upon safety may not be clear to some of these organisations

- Supplemental Type Cert Holders
- Design Organisation Approval (DOA) Holders supporting MROs etc, e.g. under minor change approval, provided all aspects of the change meet the requirements for minor classification.
- ETSO/TSOs
- PART 145 organisations interpreting PART 145 etc (for information - allows repair by replacement)
- Stakeholders new to aviation, e.g. AM Machine Manufacturers.
- Regulators (in order to help define a 'level playing field' for industry)

# EASA - AM

## WG1 'Qualification of AM Parts of No, or Low, Criticality'

27<sup>th</sup> MAY 2021 'WORKING MEETING' – Criticality discussion started

'Criticality' review of industry and regulator references, '5 minute' presentations by:

EAAMIRG Action update – Criticality Table: J. Van Doeselaar (Airbus)

AC 43-18 'Fabrication of Aircraft Parts by Maintenance Personnel' - includes CPL, Classification Categories guidance (B. Grant - FAA)

SAE STD 'Modifications and Alterations Affecting Composite Parts or Composite Structure' (C. Ashforth - FAA)

F42 Part Classification: (C. Park - Boeing)

NASA 6030 (S. Corder - NASA)

Risk Assessment Specification (RAS) RAS (D. Kerman - FAA)

CS2x.1309 FHA M. Weiler (EASA)

- any significant inconsistencies across the existing definitions?

# EASA - AM

## WG1 'Qualification of AM Parts of No, or Low, Criticality' 16<sup>th</sup> September 2021 'WORKING MEETING' – 'Criticality continued'

Presentations given by:

- EAAMIRG - Action Item 'Criticality' Update (J. Van Doeselaar - Airbus)
- F42 Update (C. Park - Boeing)
- EASA Systems - 'Simplified' FHA Update (M. Weiler)
- EASA – Cabin Safety\* (F. Negri)
- EASA – Propulsion (O. Kastanis)
- SAE AM – Repairs (D. Abbot - GE)
- Thales Experience (S. Catt – Thales)

\* to be presented at a later WG1 meeting

### WG1 – Conclusions 16/09/21 'criticality':

- 'work in progress' across various organisations – no common standard
- commonality is a challenge across product ranges, but a common grouping (**3 or 4 criticality groups?**) might have some value, ref. **EAAMIRG Action Item/F-42** etc... TBC
- 'examples' discussion might help to progress the 'criticality' discussion to be continued at this November Meeting

# EASA – AM WG1

## WG1 ‘Qualification of AM Parts of No, or Low, Criticality’

### Examples: Continued

#### Examples - Presentations:

- EASA - Example Table Summary
- GKN (J. Belon, M. Bosman, C. Dordlofva)
  - Nacelle Access Panel Hinges (structure)
  - Antenna Fairing (structure – aerodynamic)
  - Cable Guide (system - structure)
- Thales (P. Eloj, M. Genc) - Stand Monobloc (system)
- Liebherr (A. Danzig) - NLG Sensor Bracket (system - structure)
- Airfrance (F. Becel, E. Bodin) - Panels – 2 examples (interiors)
- LHT (J. Nelle, R. Van den Bosch) – Duct O-ring (system – propulsion)
- SAFRAN (M. Khan, M. Bolaky) – Interiors Seat Parts (interiors)
- MATERIALISE (E.deZeeuw, G. Brabants) – Dado panel (interiors)
- Expleo (K. Lehmann) - Dado panel (interiors)

#### WG1 – Conclusions 13/10/21 ‘criticality’:

- FHA or RAS important part of process
- good supply chain communication important
- need to support ‘shared database’ approach for QA purposes, if not design values?  
... to be continued at this November meeting

# EASA – AM WG1

Further to the slides and spreadsheet shared prior to this meeting:

Please come to the WG1 meeting ready to discuss:

- **'criticality'** definitions
- **'examples'**
- **FHAs/RASs**
- content needed for a useful guidance document addressing AM Parts of no/low criticality

# Questions?

[easa.europa.eu/connect](https://easa.europa.eu/connect)



**Your safety is our mission.**

An Agency of the European Union 

# Support Slides

[easa.europa.eu/connect](https://easa.europa.eu/connect)



**Your safety is our mission.**

An Agency of the European Union 

# EASA - AM

## WG1 'Qualification of AM Parts of No, or Low, Criticality'

### 29<sup>th</sup> April 2021 'INITIAL WORKING MEETING' – Potential Discussion Items

1/ Open meeting - Regulation framework guidance (very brief reminder)

- EASA AM CM-S-008 'Additive Manufacturing' **draft revision progress**
- WG1 (brief reminder of scope etc... '**step by step**' approach to AM introduction into aviation)

2/ What is 'criticality' and how can guidance be developed to ensure AM parts of 'no criticality' remain SO? - develop CM list (ref. other documents etc)?

3/ Regulations to be addressed 'proportionate' to criticality – develop a list/simplified text or checklist?

4/ Guidance format...

- AMC 20-29/AC 20-107B, AIA AM Guidance

5/ Add examples of existing certifications to guidance text?

6/ Location for guidance (CM is a transient document) ?

- SDO document?, CMH-17?, EASA CS-STAN?, Other?

**Meeting Objective:** slides intended to seed discussion supporting definition and development of content for **safe**, and practical, **industry 'level playing field' guidance** and good common practice relating to '**parts of no/low criticality**'  
... recognising need for a **viable business model**

# EASA - AM

## WG1 'Qualification of AM Parts of No, or Low, Criticality'

27<sup>th</sup> MAY 2021 'WORKING MEETING' – Potential Discussion Items

Priorities defined from 'INITIAL MEETING', 'Criticality' discussion started

1/ 'Criticality': Brief presentations (5 mins each + questions, including classification criteria, process, 'effect of defects', emphasis upon parts of no/low criticality)

2/ 'Examples': (industry to propose potential examples across product range to encourage discussion of practical applications and potential content for a guidance document)

**Generic concept examples**

**Specific cert examples**

3/ **Guidance content and format:** ('Strawman' discussion – not developed due to time limitations)  
develop format relative to AMC 20-29/AC 20-107B paragraph titles + AM specific issues in appendix?

# EASA - AM

## WG1 'Qualification of AM Parts of No, or Low, Criticality'

### 13<sup>th</sup> October 2021 'WORKING MEETING' – 'Examples'

Generic concept examples:

- Identify potential generic concept examples for applications of no or low criticality for inclusion in the guidance, particularly across the product ranges.

Specific cert examples:

- Identify potential specific certification examples (completed/in progress) for applications of no or low criticality for inclusion in the guidance.

Product scope:

- Airframe

- Propulsion

- Systems

- Cabin Safety (including seats)

# EASA - AM

## WG1 'Qualification of AM Parts of No, or Low, Criticality'

### 13<sup>th</sup> October 2021 'WORKING MEETING' – 'Examples' continued potential discussion points

- brief description of the item, including
  - approx.. dimensions, mass (or total weight if the item is an attachment supporting other mass etc)
  - material and process (also original material and process if replacing a more conventional item)
  - dominant **concept defining design**, e.g. static strength, dynamic impact, flammability, system function
- the assessment of the **criticality** (including the reference for the assessment/criteria used), including
  - original OEM documents referenced (e.g. existing item classification available?)
  - any regulations or regulatory guidance referenced
- **type and extent of substantiation**,
  - test v analysis used, and reason for selected decision
  - test numbers
  - key parameters identified and criteria used to define them
  - dominant failure modes
- any other information of significance to the WG1 discussion

# EASA – AM WG1

## Reminder: 21.A.91 Classification of changes to a type certificate (TC)

*‘Changes to a type-certificate are classified as minor and major. A “minor change” has no appreciable effect on the mass, balance, structural strength, reliability, operational characteristics, operational suitability data, or other characteristics affecting the airworthiness of the product or its environmental characteristics. Without prejudice to point 21.A.19, all other changes are “major changes” under this Subpart. Major and minor changes shall be approved in accordance with points 21.A.95 or 21.A.97, as appropriate, and shall be adequately identified.’*

## GM 21.A.91 Classification of changes to a type certificate (TC)

### 1. PURPOSE OF CLASSIFICATION

*‘Classification of changes to a type certificate (TC) into MAJOR or MINOR is to determine the approval route...’*

# EASA – AM WG1

## GM 21.A.91 Classification of changes to a type certificate (TC)

### 3.4 Complementary guidance for classification of changes

A change to the TC is judged to have an **'appreciable effect'** on the mass, balance, **structural strength, reliability, operational characteristics... airworthiness etc**

- (a) ... requires an adjustment of the type-certification basis or the OSD certification basis (special conditions or equivalent safety findings)
- (b) ...new interpretation of the certification specifications used for the type certification basis or the OSD not been published as AMC material or otherwise agreed with the Agency;
- (c) ...**compliance uses methods that have not been previously accepted as appropriate for the nature of the change**
- (d) ... **extent of new substantiation data** necessary to comply with the applicable certification specifications and the degree to which the original substantiation data **has to be re-assessed and re-evaluated is considerable**;
- (e) ...alters the airworthiness limitations or the operating limitations;
- (f) where the change is made mandatory by an airworthiness directive or the change is the terminating action of an airworthiness directive (ref. **21.A.3B**), see Note 1; and
- (g) ... **design change introduces or affects functions where the failure effect is classified as catastrophic or hazardous.**

Note 1: A change previously classified as minor and approved prior to the airworthiness directive issuance decision needs no reclassification. However, EASA retains the right to review the change and reclassify/reapprove it if found necessary.

# EASA - AM

Basic Regulation (EU) 2018/1139 – safety of third parties on the ground:

When assessing Parts of No Criticality, BR requires:

## **Article 4 – Section 2:**

The measures taken under this Regulation shall correspond and be proportionate to the nature and risk of each particular activity to which they relate. In preparing and enacting such measures, the Commission, the Agency and the Member States shall take into account, as appropriate for the activity concerned: [...]

(b) to what extent third parties or property on the ground could be endangered by the activity;

## **Annex II - 2. AIRWORTHINESS ASPECTS OF PRODUCT OPERATION**

2.1. The following must be shown to have been addressed to ensure safety for those on board or on the ground during the operation of the product:

(a) the kinds of operation for which the aircraft is approved must be established and limitations and information necessary for safe operation, including environmental limitations and performance, must be established; [...]

# EASA – Structures and Materials Safety

EASA – FAA AM

INDUSTRY – REGULATOR EVENT

(virtual meeting)

WORKING GROUP 1:

Qualification of Additive Manufacturing (AM) Parts of No, or Low, Criticality (for use in Certified products)

Thursday November 11<sup>th</sup>

‘Working Meeting’

S.Waite, Senior Expert – Materials, Certification Directorate, EASA

O. Kastanis, Propulsion Expert, Certification Directorate, EASA

M. Rife, Delta TechOps, Interiors

**Your safety is our mission.**

# EASA – AM WG1

## Thursday – ‘Working Meeting’ – Objective:

In response to industry interest, start to define potential guidance document (industry and/or regulator?)  
- outline and content for AM applications of no/low criticality, using existing document references when appropriate

Note: Much of this discussion will be material and process agnostic. However, in order to ensure that the potential for manufacturing sensitivity to adversely impact ‘criticality’ is minimised, e.g. due to changed failure modes etc, such document content may be beneficial for AM to be accepted... TBD

# EASA – AM WG1

## WG1 – Meeting process:

- attendees to use webex link identified for the WG selected during the registration process (Tuesday and Thursday)

INSERT CURRENT SIMPLIFIED THURSDAY AGENDA – FROM MASTER ON  
9<sup>th</sup> Nov.

- start presentations

# EASA – AM WG1

WG1 – Meeting process: Please use previously shared spreadsheet to prepare for meeting.

WG1 No/Low Criticality AM DOCUMENT DEVELOPMENT - OUTLINE AND CONTENT THEMES				
VERY SIMPLIFIED CONTENT INTENDED			Please: respond to questions add bullet point themes considered worthy of document content	
Please co-ordinate with attached slides				
Slide	Questions	y	n	Other comments/suggestions
1	AM no/low criticality document content to follow AMC 20-29/AC 20-107B format? If not, propose alternative (other SDO document format etc)	?	?	?
	Do you agree that no/low criticality can be managed under a common document for airframe, systems, propulsion, interiors (including seats?) If not, propose alternative	?	?	
	Do you agree that no/low criticality items would benefit from a separate industry document supporting regulatory intent? If not, propose alternative	?	?	?

**PLEASE RETURN COMPLETED  
WG1 SPREADSHEET TO S. Waite  
by Friday 19<sup>th</sup> November 2021**

# EASA – AM WG1

**PLEASE GO TO YOUR  
SPREADSHEET IF YOU WISH TO  
COMMENT**

**PLEASE RETURN TO  
Simon Waite  
simon.waite@easa.europa.eu  
by Friday 19<sup>th</sup> November**

# Questions?

[easa.europa.eu/connect](https://easa.europa.eu/connect)



**Your safety is our mission.**

An Agency of the European Union 

# Support Slides

[easa.europa.eu/connect](https://easa.europa.eu/connect)



**Your safety is our mission.**

An Agency of the European Union 