

SEATS



SAE SEAT COMMITTEE ADDITIVE MANUFACTURING WORKING GROUP

11th November 2021





SAE Seat Committee Additive Manufacturing WG

■Objective:

- Develop ARP to cover Process Control, Quality Control and Qualification Requirements of parts manufactured using AM techniques for the following:
 - ◆ Seats and associated furnishings
 - ◆ Transport Airplane, Normal & Transport Rotorcraft and Normal, Utility, Acrobatic & Commuter General Aviation aircraft

■History:

- Proposed in SAE Seat Committee meeting in March 2021
 - ◆ WG formed from across the interiors industry – ca. 25 participants (6 seat/part manufacturers, regulators, airframe manufacturers, consultants)
 - ◆ Draft document created
 - ◆ 1st WG meeting held November 2021



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■ Proposed Scope of AM ARPXXXX at Kick-off

- ARP to closely follow format of ARP 6337 Design, Manufacturing and Performance Standard for Composite Materials Used on Aircraft Seat Structures.
 - ◆ AM & Composites are similar in that
 - Special manufacturing processes
 - The final properties of the material are directly related to the quality and control of the manufacturing process

- Propose to utilise ARP6337 as a framework for the document
 - ◆ Similar considerations
 - ◆ Sections and titles are broadly applicable
 - ◆ Details will be different

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■ Proposed Scope of AM ARPXXXX at Kick-off

> Covering the following performance criteria:

- ◆ Compliance to FAR/CS
 - FAR/CS 2().561, 562, 601, 603, 605, 613, 785, 853 etc.
- ◆ Heat Release Special Conditions
- ◆ Environmental Conditions
 - RTCA DO-160
- ◆ Impact Performance
 - ARP 5526D
- ◆ Cyclic / Endurance Performance
- ◆ etc.

> Procedural Criteria:

- ◆ Requirements for Material Selection
- ◆ Requirements for Material Handling
- ◆ Requirements for Machine Control
- ◆ Requirements for Manufacturing Control
- ◆ Quality Control of the Product
- ◆ Design Guidelines / Requirements
- ◆ Process Call-outs on Drawings
- ◆ Training of Manufacturing Staff
- ◆ etc.

> Other Criteria:

- ◆ Database of Mechanical Properties of Materials?
- ◆ Development of Allowables?
- ◆ Additional Load Factors Required (similar to casting factor?)
- ◆ Residual Strength?

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1. SCOPE

1.1 Purpose

This SAE Aerospace Recommended Practice (ARP) defines the additional documentation, environmental considerations, *[in-service damage limits – is this necessary for AM?]*, test and evaluation criteria necessary to support certification of aircraft seats and associated furnishings manufactured using additive manufacturing techniques, in addition to requirements in AS8049 and ARP5526. This document is guidance material to be used in conjunction with the regulatory documents/requirements and is applicable to aircraft seats and furnishing parts manufactured using additive manufacturing techniques which are **used in low-criticality and non-critical applications**.

- > Decided to concentrate on non-critical and low criticality parts as a starting point
- > But retained the scope to expand to critical parts in later revisions of the document

The initial release of this document will cover parts of no or low criticality, later revisions may expand the scope to include critical parts.

- > Some of the performance criteria may no longer be applicable

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- > Initial attempt to define a critical part as applied to parts within scope of the document

A critical application is where the part is in the primary loadpath from the occupant to the attachments of the seat to the aircraft or is directly influencing occupant injury [should we be more specific here? – 2().562(c)5 and 2().785(b) (others?) furniture foot fittings? could we include exceptions? e.g. proven redundant load paths]

- > Suggestion to make it more 'generic' – maybe look to definition of critical castings in AC25.621-1?

Non-critical – includes secondary structure – cast parts definition? – cast parts ARP? Redundant load paths

[From AC25.621-1:] "A casting [part] whose failure could preclude continued safe flight and landing of the airplane or could result in serious injury to occupants is considered a critical casting [part]. Examples of castings [parts] that may be critical are structural attachment fittings; ~~parts of flight control systems; control surface hinges and balance weight attachments;~~ seat, berth, and safety belt supports and attachments; *[are there other examples we could use?]* ~~fuel and oil tank supports and attachments; pressurized doors; and cabin pressure valves.~~" *[this is from AC – What, if any, is the policy for quoting or borrowing text from regulatory / guidance material?]*

- > Other suggestion to utilise classification of criticality 'levels'
- > Use of examples to define criticality?



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■ Next Steps

- Focus on and agree criticality definition (as it applies to the scope of the ARP)
- Allows us to appropriately frame the structure of the document and focus on the applicable requirements

ANY QUESTIONS?