Additive Manufacturing of Cabin Interiors an Authority view

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- What for?
- Challenges
- Realisation
- Certification
- Use

What for?

The potential bennefits that AM may provide for aircraft interior:

- Ad hoc realisation of „new“ interior parts for:
  - Prototyping
  - Production of low number of parts (in the future maybe even of high number of parts)
  - Production of special parts
  - Production of spare parts

Challenges

- Identify parts where AM makes sense
  - Number
  - Complexity
  - Costs
  - Material
  - Criticality
- Interior parts for AM will most probably be:
  Plastic parts of low criticality that are not immediately available or where the number of parts is low.

Challenges

- Identify the best suitable AM method based on
  - Reliability of method and parts
  - Meeting certification requirements (strength and flammability)
  - Providing the required life time of the AM part
  - Reasonable production costs
  - Reasonable design costs
  - Look and feel or additional work for the finish (sanding, filling, painting)

Realisation

- Production
  - In house or outsourced?
  - Mass production or single parts on demand?
  - Repair or spare part?
  - Form one?
- Design
  - Is the Design Organisation prepared for AM design?
  - Are the design engineers trained in the design of AM parts?
  - Are there procedures established to provide the design data to the production organisation / machine in a secure way?

Certification

- Classification of the change:
  - Major or minor because of new technology?
    - Same criteria as for other technologies. AM is not triggering the major classification. However, the DO may need to establish AM specific procedures.
- Applicable requirements?
  - Are there specific AM requirements in the certification specifications?
    - In general the applicable requirements are independant from AM.
    - Compliance demonstration my need to be adapted to AM

Certification

- Structural capabilities dependent on the:
  - Manufacturing process and raw material
  - The printing direction
  - The „3-D“ design, setup, orientation in the machine, etc.

- It would be useful to establish design, material and safety factors for 3D printed parts.
  This will ease the certification and compliance demonstration process for interior parts.

Certification

- Flammability?
  - May vary with the production process and design of the part.
  - Factors are:
    Thickness of the part and layer,
    density of the printed part or material,
    printing direction of the layers,
    surface quality.
    This will most likely require additional flammability tests.
- Industry is requested to define standards and guidance to ease the certification process for interior parts and to reduce the number of tests required (Flammability & Strength).

Use

- Examples of AM Parts for cabin interiors that have been accepted:
  - Cap in an armrest of a seat.
    - Minor change
    - No „real“ structural challenges apart from staying in place and not falling apart.
    - Solid part of one material and colour
    - Flamm testing for different printing directions
  - Lamp body for a VIP interior
    - Part of an STC (two pieces installed)
    - Load carrying internal metallic structure
    - Flamm testing of test sample

Authority view

- To make use of the possibilities introduced by AM for cabin interiors Industry and Authorities need to work together.
- We need to establish material and process values.
  - Currently we do not know the impact of colours in the material on strength and flammability,
  - we do not know the impact of variations (speed, temperature, orientation, etc.) in the production process,
  - we do not know the impact of post printing processes like tempering, sanding, painting, etc.

Open Questions

- How can AM be used in the repair process?
- How can a Maintenance Organisation make use of AM?
- Can spare parts be printed on site?
- How can such parts receive a „Form One“?

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Discussion /Questions

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