



EASA

European Aviation Safety Agency

Additive Manufacturing: Meeting Summary

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Workshop feedback to draft CM

Existing DOA
privileges for
changes and
repairs

Complex,
process driven
production is
nothing new

No need to include
traditional well proven
technologies (e.g weld
build up repairs - blades)



Workshop feedback to draft CM

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The main message of the CM on AM is to encourage design organisations to engage with EASA on AM

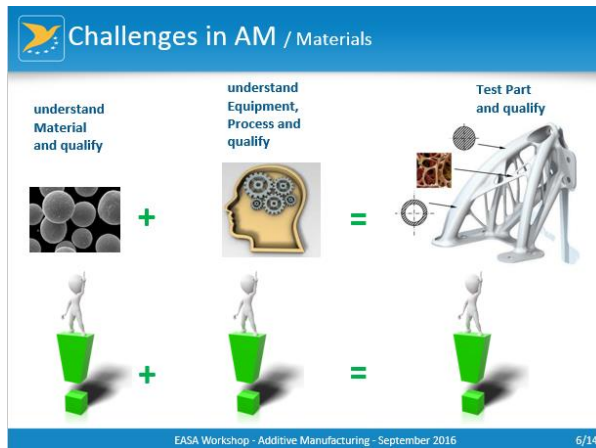
- 21.A.91 Changes, GM21.A.435 Repairs – Major / Minor – the extent of new substantiation
- First introduction of AM (material / process type) =
 - qualification -> extent of substantiation data
- AM process is relatively new and will need special attention in the preliminary implementation phase for each manufacturer.



Workshop feedback to draft CM

The main message of the CM on AM is to encourage design organisations to engage with EASA on AM!

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- EASA focus is on understanding material characterisation and resultant mechanical properties, not the uniqueness of AM



Workshop feedback to draft CM

The EASA CM is not attempting to address traditional, well established processes e.g weld build up!



If in doubt.....

No need to include traditional well proven technologies (e.g weld build up repairs - blades)



Messages from the meeting - requirements

- Both agencies : the base requirements CS-25, CS-E / FAR 25, FAR 33 are adequate to accommodate AM, policy material (AC / CM) may emerge with AM implementation and increasing criticality. Function of criticality, focus qualification
 - Material / fabrication rules are robust
 - Note from EASA – language between CS's varies - opportunity to standardise language between CS codes
- EASA CM & FAA memo are the starting point for discussion with applicants
- Importance of DOA – POA integration, but also importance of Cert – Production oversight integration. EASA's engagement with NAA's required
 - Further discussion needed
 - Material Network initiated
- For authorities end component condition remains our spec criteria - definition of acceptable



Messages from the meeting - requirements

- Challenged by the lack of definition for AM – what is included, what is not included.
Common perception found re AM, but open to misinterpretation.
- Any new guidance should not simply be the sum of past guidance e.g composites, casting factors, engine rotor integrity damage tolerance, but.....
- Should learn from past experience



Messages from the meeting DOA/145

- Implications on the DOA - experience (capability) of implementing and the existence of procedures for introducing new materials and processes
- Major / Minor categorisation
 - Implications on Part 21
 - Implications on Bilateral and product release
- Part 145 importance of spec approval
- Fabrication and the use of subcontracting
 - Integrity of part and process control remains the driver
 - Subcontracting – maintenance organisation must be competent to oversee activity



Messages from the meeting - standards

- Standards bodies acting in an integrated manner – common approach
 - Good for industry and agencies
- First generation of standards and audit checklists are imminent
- Standards are an enabler for AM



Messages from the meeting – dev > prod

- Understanding the failure drivers of your processes and their effects on the final product – porosity, fusion, anisotropy, location specific properties
 - Manufacture needs to be controlled within design assumptions –eliminate “features” (including process variation) or demonstrate how the design can accommodate such features – Qualification, Qualification, Qualification
 - Use of knock down factors for the unknowns?
 - Importance of zoning in loaded structures
- Know your design space, validating your design space – process monitor to stay within it
 - FMEA, PFMEA
 - Engineering plan, manufacturing plan – ensure conformity and data control, data integrity
 - Fixed process and change control (including the operator!)
 - Challenges (opportunities) of volume production - monitoring key parameters with material age and powder degradation
- Importance of machine calibration, maintenance and powder processing routines
- Training for all, intelligent user, intelligent customer (includes the regulator)



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Questions?

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