

# EASA Additive Manufacturing Workshop 2018

Cologne, 28<sup>th</sup> June 2018

## Opening Presentation of subgroup 3a

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**Lufthansa Technik**

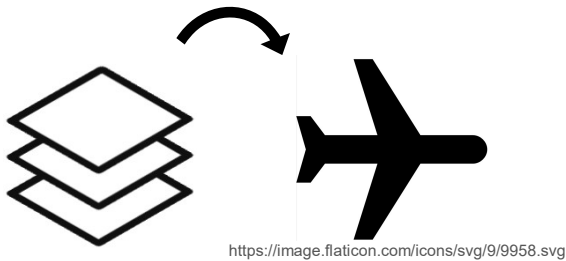
# Who's Who in subgroup 3a

## Field of activity and Approvals

AM Industry					
POA					  
non-TCH DOA					  
MRO					  
Airline Operator					  

# What is our focus in the field of AM?

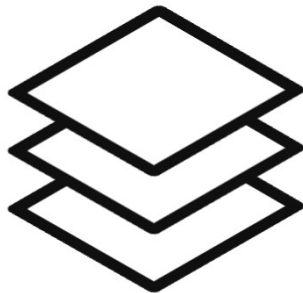
Application of  
flying AM Parts



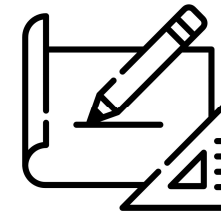
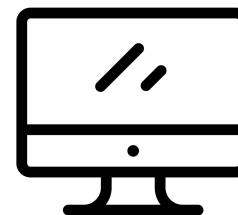
Repair with AM



Produce AM Parts

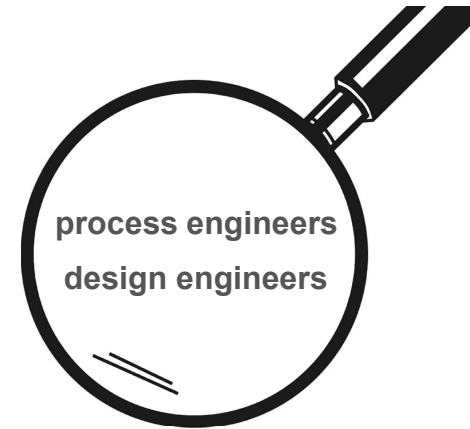


Design of AM Parts



# Questions for AM Equipment manufacturers

- Training
  - high demand for training over the whole process chain
- AM Machines qualified for aerospace
  - provide a machine transfer proof of concept and show limitations
- Communication
  - better documentation regarding upgrades
    - to understand the effect on machine and AM Process
    - frozen machine configuration!
  - Direct communication (without sales agents)
  - perspective of machines types already installed but are meanwhile out of production
- Safety and personal safety equipment ➡ aligned guidelines!



<http://www.tbac.co.za/communication-outcome-based-team-building.htm>

# Questions for AM Equipment manufacturers

- In-situ Process Monitoring

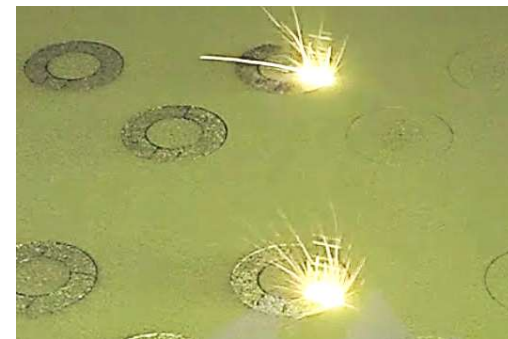
- Roadmap for coming developments and improvements
- Publication of a catalogue of process errors and their correction
- Publication how to correlate measurements to part quality
- Aligned quality reporting



[https://as1.ftcdn.net/jpg/01/27/54/20/500\\_F\\_127542043\\_bEMINRZeMAuoazYJSfamAexdyk5fwSMN.jpg](https://as1.ftcdn.net/jpg/01/27/54/20/500_F_127542043_bEMINRZeMAuoazYJSfamAexdyk5fwSMN.jpg)

- AM Hardware

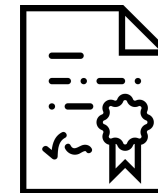
- detailed information about machine componentry / gas flow / optics  
    ➡ estimation of equipment for users!
- maintenance according to the effective usage and not regarding time intervals
- laser beam position accuracy
  - Single / multi-laser
  - coming improvements?



[https://www.youtube.com/watch?v=sbPpFHZL\\_cU](https://www.youtube.com/watch?v=sbPpFHZL_cU)

# Questions for Type Certificate Holders

- Producing of AM parts by suppliers
  - eligibility criteria for AM part suppliers
  - Harmonization of AM specific requirements?
  - Roadmap and framework for a part and a process qualification
  - preferred AM standards of TCHs
- Documentation and interfaces
  - specific AM content of CoC and Form1 / additional documentation?
  - aligned template for a PO/DO arrangement between TCH and PO
- Selection of AM parts for a process qualification
  - part categories for AM of TCHs
  - aligned AM part families with similar material, post-processing



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# Questions for Type Certificate Holders

- Is it planned to release guidelines and requirements for replacing parts previously qualified by conventionell manufacturing processes?
- Process capability
  - What kind of quality assurance/ control is required for what kind of part category?
- Part Quality
  - What are the KPIs AM producers have to provide
  - What additional logging data has to be provided for airworthy parts
    - AM machine
    - Powder conditions
    - Ambient conditions
- Maintaining AM part supplier status
  - What are audit requirements to prove production to prove quality

# Questions for authorities

- Certification routes

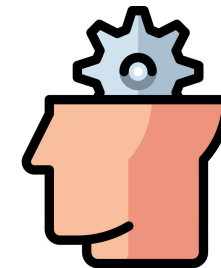
- high interest in an overview of certification approaches for AM parts



- designated part qualification vs. process qualification
- Difference between AM processes in terms of qualification and certification (e.g. FDM, SLS, SLM, HDR...)?

- Employee qualification

- sourcing AM parts from sub contractors:  
necessary in-depth AM knowledge for 21G, 21J, 145 employees?



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- Will there be mandatory requirements for AM employee qualifications

Design engineer

Process engineer

machine operator

operator for pre/post-processing



# Questions for authorities

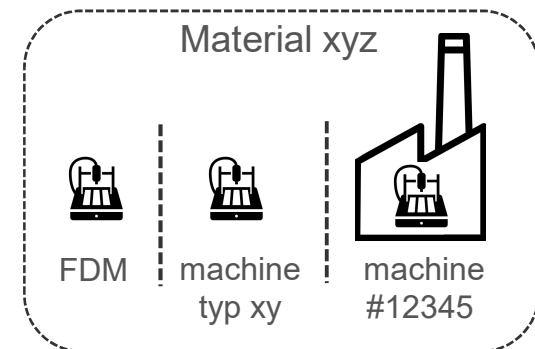
- Material Design Values

material design values to be generated by every single PO?



What about industry available databases (e.g. Senvol)?

- EASAs opinion about creating material design values
  - Material and Machine type specific?
  - Site specific?
  - Machine serial number specific?



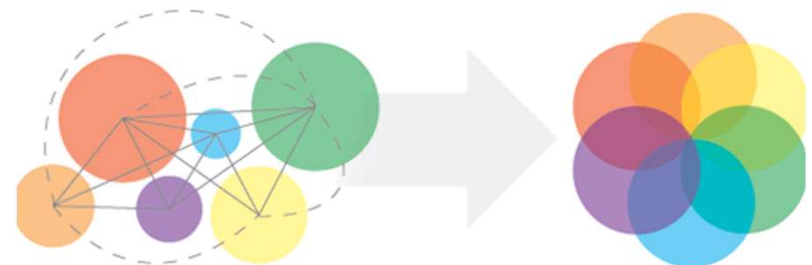
- What level of SPC data has to be maintained by AM part suppliers?
- EASAs opinion of aligned criticality and application classes
  - ➡ characterize extend of process qualification

# Questions for standardization organizations

- Catalogue of AM standards
  - What AM standards exist or are under development?
  - What are relevant aerospace and AM standards for part suppliers?
  - What AM standards are used by Aerospace industry?
- Communication
  - Overview about communication channels for standardation topics
- Updates
  - How frequent are standards to be updated to account for AM technology evolution?
- Harmonization
  - We are interested in harmonization of standards for AM and it's process chain



<http://www.cactusprofiles.com/company-overview/>



<http://regulatoryworld.blogspot.com/2015/03/international-conference-on.html>

# Thank you for Listening

## Enjoy your day!

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