

**EASA / FAA Workshop CGN**

# **Metal AM from a MRO perspective**

**Simon Steven**

[simon.steven@lht.dlh.de](mailto:simon.steven@lht.dlh.de)



# Agenda

Facts and figures	3
AM Center of Competence	5
AM potentials for LHT	8
Repair strategies	10
Spotlight on AM Hybrid Repair	11



# Lufthansa Technik – Facts and figures



850+

customers  
worldwide



23,219

employees  
worldwide\*



5,131

aircraft under  
exclusive contracts



5.918  
billion €

in revenue\*



36\*\*

subsidiaries and  
affiliates worldwide

\*Lufthansa Technik AG Germany and 21 consolidated companies of Lufthansa Technik Group in 2018; employees as of 31.12.2018; \*\*XEOS is in preparation

# Lufthansa Technik – Product divisions

## PD ACS Aircraft Systems



## PD ENG Engine Services



## PD COM Component Services



## PD Base Maintenance Services



## PD VIP VIP & Special Mission



## PD Fleet Services



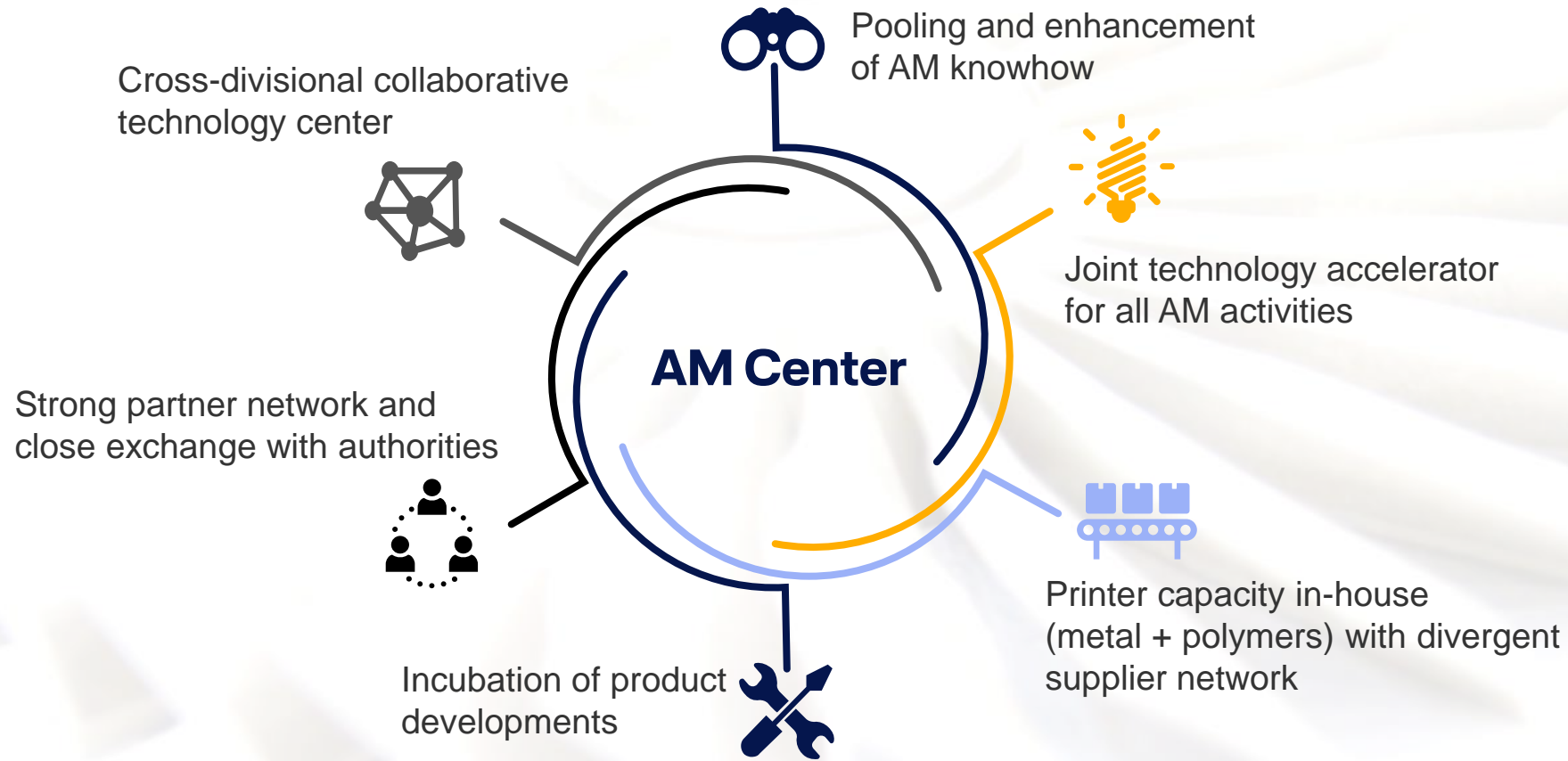
## PD OEI Original Equipment Innovation



## PD Digital Fleet Solutions



# AM Center of Competence



# AM Center focuses on 4 clusters



## PROTOTYPING

- Immediate design support
- Establishing technology
- Mockups and fit checks



## TOOLING

- Use case identification
- Design optimization
- Production and support



## FLYING

- Repair development
- Metal and polymers
- Approval and certification



## DEVELOPMENT

- Process development
- Standards and committees
- Research projects



Repairs are less  
expensive than  
replacements



# Flying Potentials



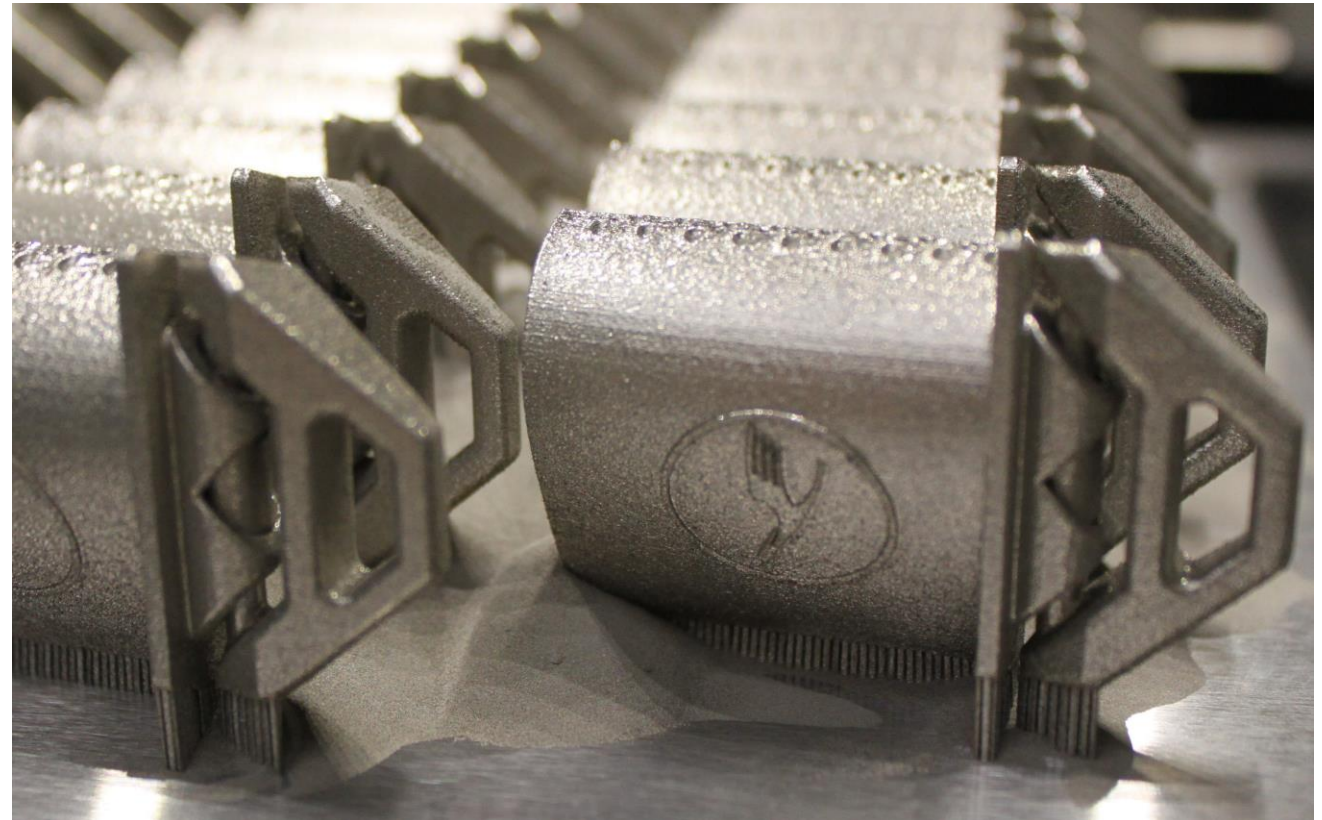
# Metal AM Technologies at LHT

## Laser Powder Bed Fusion

- „welding“ process
- high accuracy
- netshape geometries for repairs
- possibility for batch repair
- Materials
  - Nickel-based alloys
  - Titanium-based alloys
  - Aluminium-based alloys

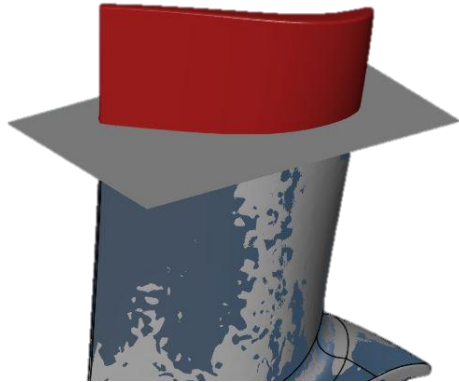
## Metal FDM for tooling

- inexpensive + fast technology

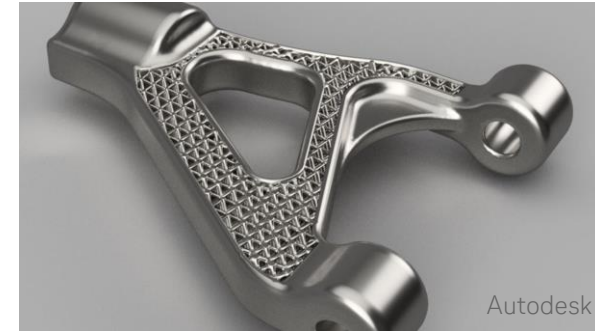


Keychain give-aways built with LPBF

# Metal AM itinerary for LHT



mock-up geometry during diagnosis



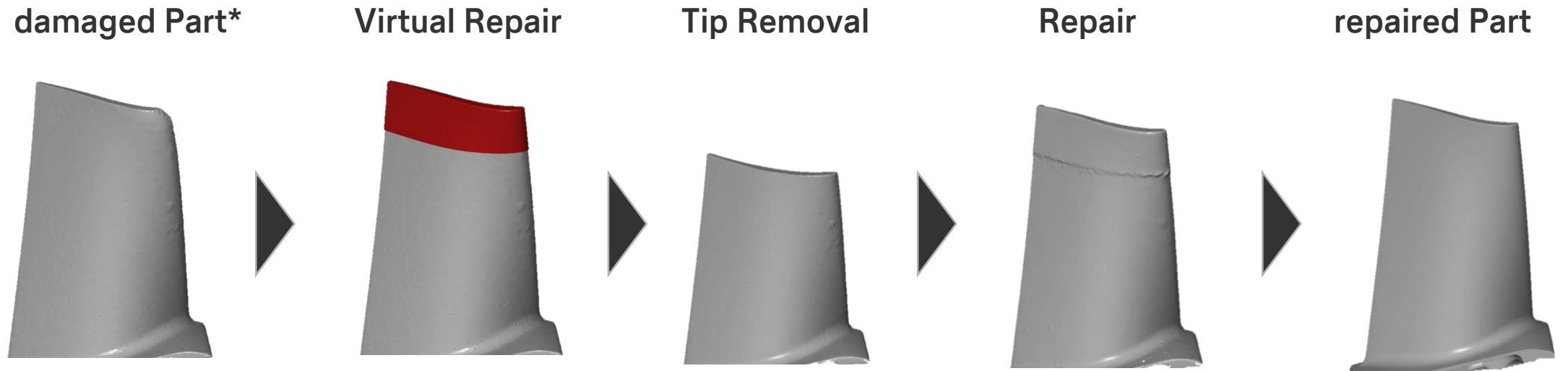
## AM as an enabler

- Repair originally AM parts
- AM evokes new repair methods

## AM as a cost saver

- AM Hybrid Repair
- 1to1 substitution

# Principle of Additive Hybrid Repair



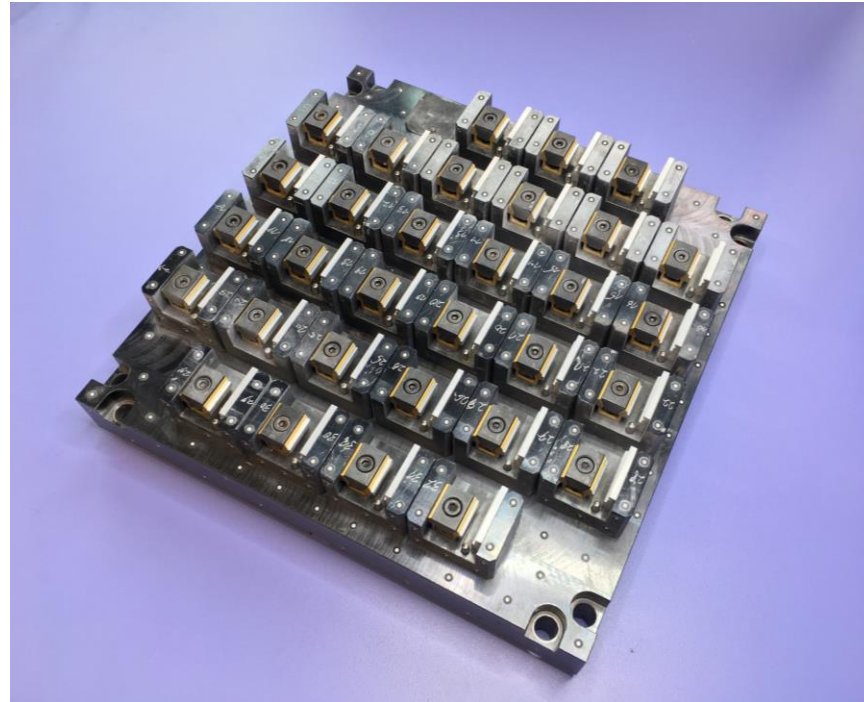
\*displayed geometry is a mock-up

**Scalable Methodology for other part families**

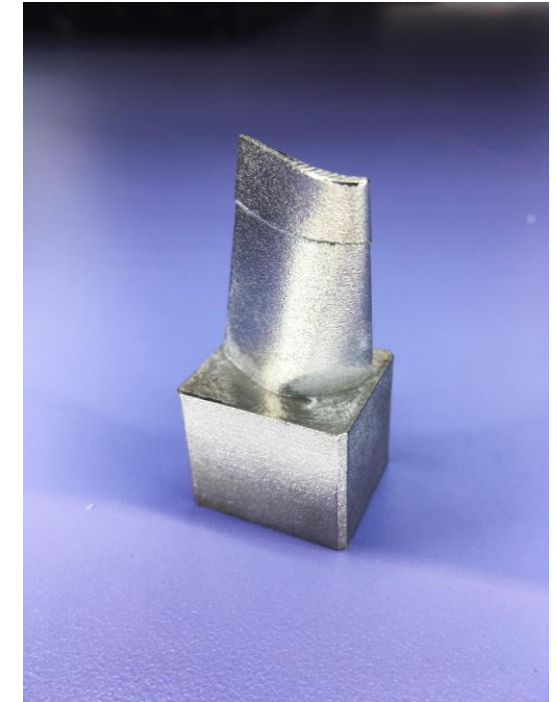
# Added value using LPBF for hybrid repairs

## Added value using hybrid repair

- Scalable repair approach to a wide range of parts
  - batch repair
- High feature resolution facilitates repair of more complex parts
- Netshape repair reduces post processing
- Automated part diagnosis integrated in process chain
- Comprehensive digitalisation of repair process



Clamping device on build plate



Hybrid Repair mock-up

# Challenges using LPBF for hybrid repairs

## Huge technical development potential

- **Niche application** for AM-equipment OEMs
  - calibration procedures are not ready for serial production
  - alignment accuracy in serial config has to be optimized
  - need for automated leveling of build plate
  - fragmentation of software in process chain
- **Additional qualification effort** for interface
- **Special process** for suppliers
  - complex knowledge transfer





# Lufthansa Technik



Copyright © 2019 Lufthansa Technik. All rights reserved.

Disclaimer in respect of statements and information. Nothing contained in this publication shall constitute any warranty, guarantee or liability for Lufthansa Technik AG, its subsidiaries and affiliates but is for information purposes only. Accordingly, Lufthansa Technik AG, its subsidiaries and affiliates neither expressly nor con-exclusively accept responsibility or liability for the actuality, accuracy and completeness of the statements and information contained in this publication.