Solutions from BCT
Adaptive composites machining

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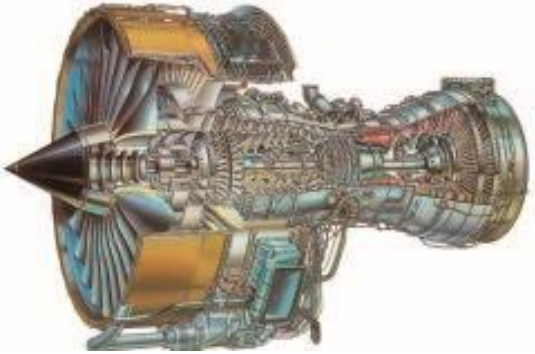
BCT GmbH, Dortmund

- **Established in 1986**
- **Locations:**
  Dortmund, Germany
  - Software development
  - Engineering
  - Research & development projects
  - **Subsidiary in Singapore for Asia - BCT Asia**
    - Sales/Service for Asian Market
    - Fixture design and manufacturing
- **BCT‘s core know-how:**
  - Software solutions for automated manufacture and repair of individually shaped parts
  - Adaptive machining
  - Post-machining of AM parts
  - In-process 3D line scanning
  - Fast LMD process set-up
  - In-process sensor data acquisition

References (selection)



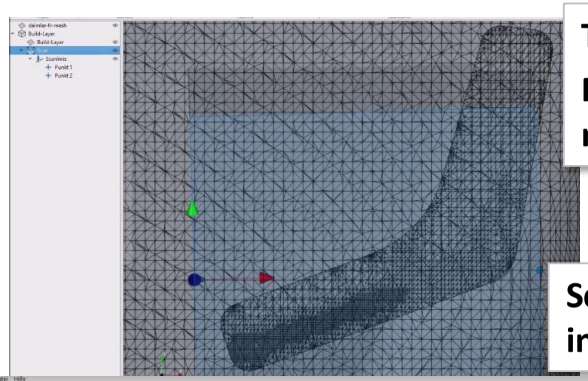
Aeroengine and power generation

- ABB, Switzerland
- Air France-KLM/Safran, France
- Aviadvigatel, Russia
- AVIC, China
- BTL, Israel
- Chromalloy, USA
- GE/Alstom, Switzerland
- GE Aviation, Singapore
- Holy, China
- Honeywell, USA
- IHI, Japan
- Leistritz, Germany
- Lufthansa Technik, Germany
- MTU Aero Engines, Germany
- MTU Maintenance, Germany
- MTU MRO, Serbia
- Rolls Royce, UK
- SAESL (RR), Singapore
- Siemens Energy, Germany
- Safran MRO, France
- TACR, Germany
- Safran Aero Boosters, Belgium
- Safran Helicopter Engines, France
- TOS (P&W), Singapore
- XAE, China
- …

Aerostructures / composites

- Airbus, Germany
- Boeing, Australia/USA
- German Army
- MotorSich, Ukraine
- …

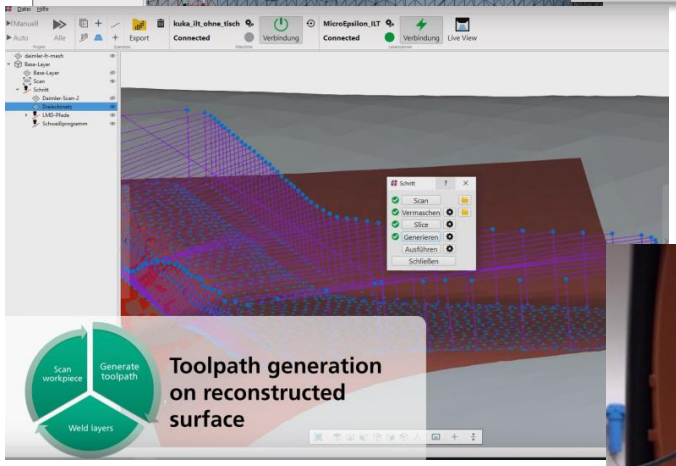
Mould process chains: Local modification of tools

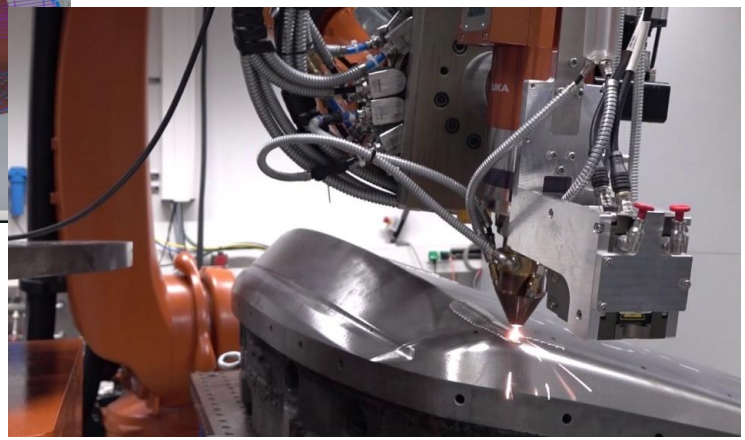


TASK:

Modify tool geometry locally to repair or change geometry.

Scan path definition with visual interface (Point and click)





- Application: Localized repair and/or geometry alteration of tooling. Improve properties e.g. by adding hardfacing or other functional materials (Demonstrator of project partner Mercedes Benz: Localized geometry modification)
- Workflow with automated repeat scan & adaption possible (Video: https://youtu.be/eKXdKkGE_fg)
- Path planning possible without nominal CAD of part to be processed – user-friendly and processing of individual components with graphical interface

Automatic program execution with suitable parameters and adapted paths. Consideration of local geometry and surface normals

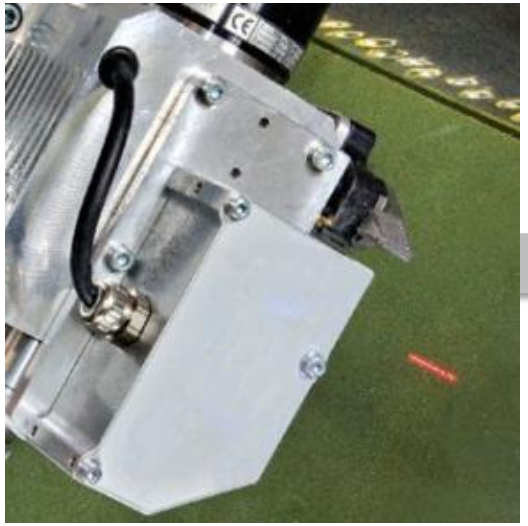
PROLMD

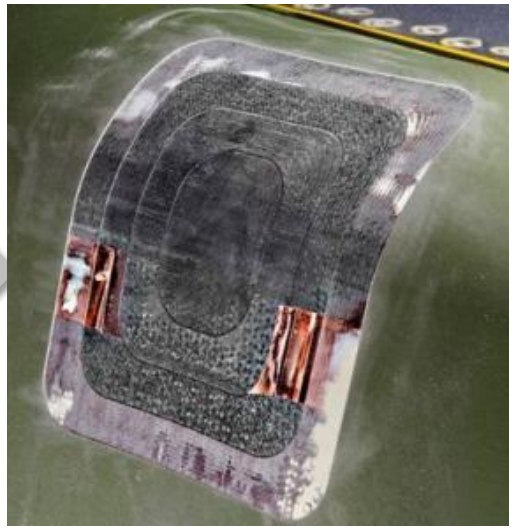
GEFÖRDERT VOM

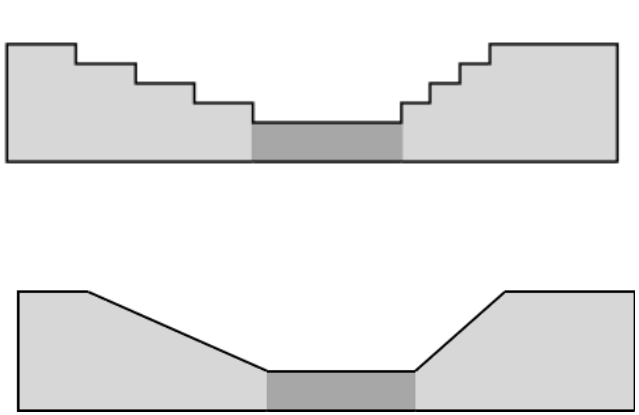
Bundesministerium für Bildung und Forschung

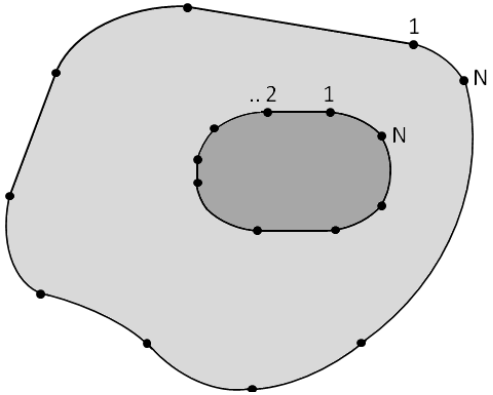
The shown application was demonstrated in the ProLMD project (www.ProLMD.com) with the project partners. The project has been funded by the German Ministry of Education and Research

Principle: Adaptive milling paths on scan data









- General workflow :
  - Calculation and execution of scanning program
  - Scan execution and data processing
  - Selection of required scarfing geometry, Positioning (manual, wizard or database)
  - Generation of adapted milling / grinding program
  - Automatic repetition possible

→ Process always conforms to individual part

Challenge: Machine selection

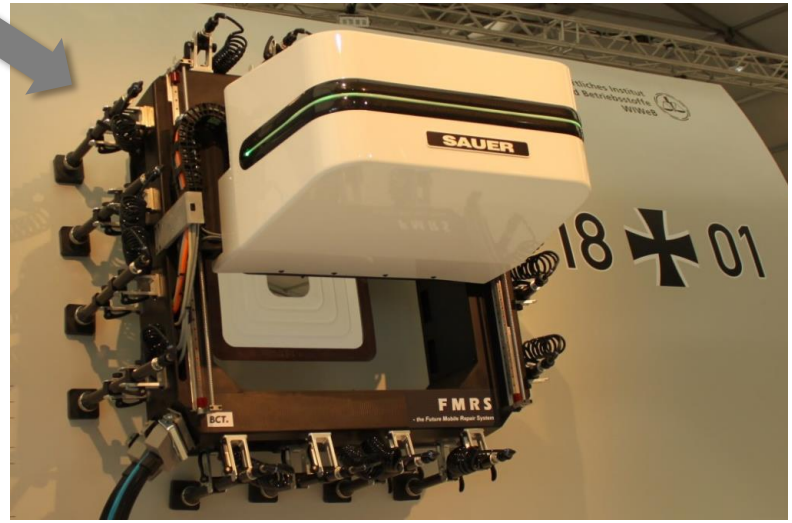
Rework

- To save new components from scrap
  - Stationary machine for parts of smaller size
  - Mobile machine for parts which do not fit into a reasonable machine tool

- Broad variety of stationary machines available

On-aircraft repair

- To minimize AOG:
  mobile machine is a must



Research: Flexible solutions and new possibilities

- Measurement-enabled processing permits significantly more flexible approaches
  - Kinematic solutions can be more flexible, mobile precision machining becomes possible
  - Integration of additional sensors is possible (e.g. NDT, cutting forces etc.) to improve QA
  - Flexible software interfaces enables additional processes: 3D printing / milling of moulds during scarfing
- New process chain design: Flexible machines, fewer fixtures, better data on parts
- Think data driven, think adaptive!

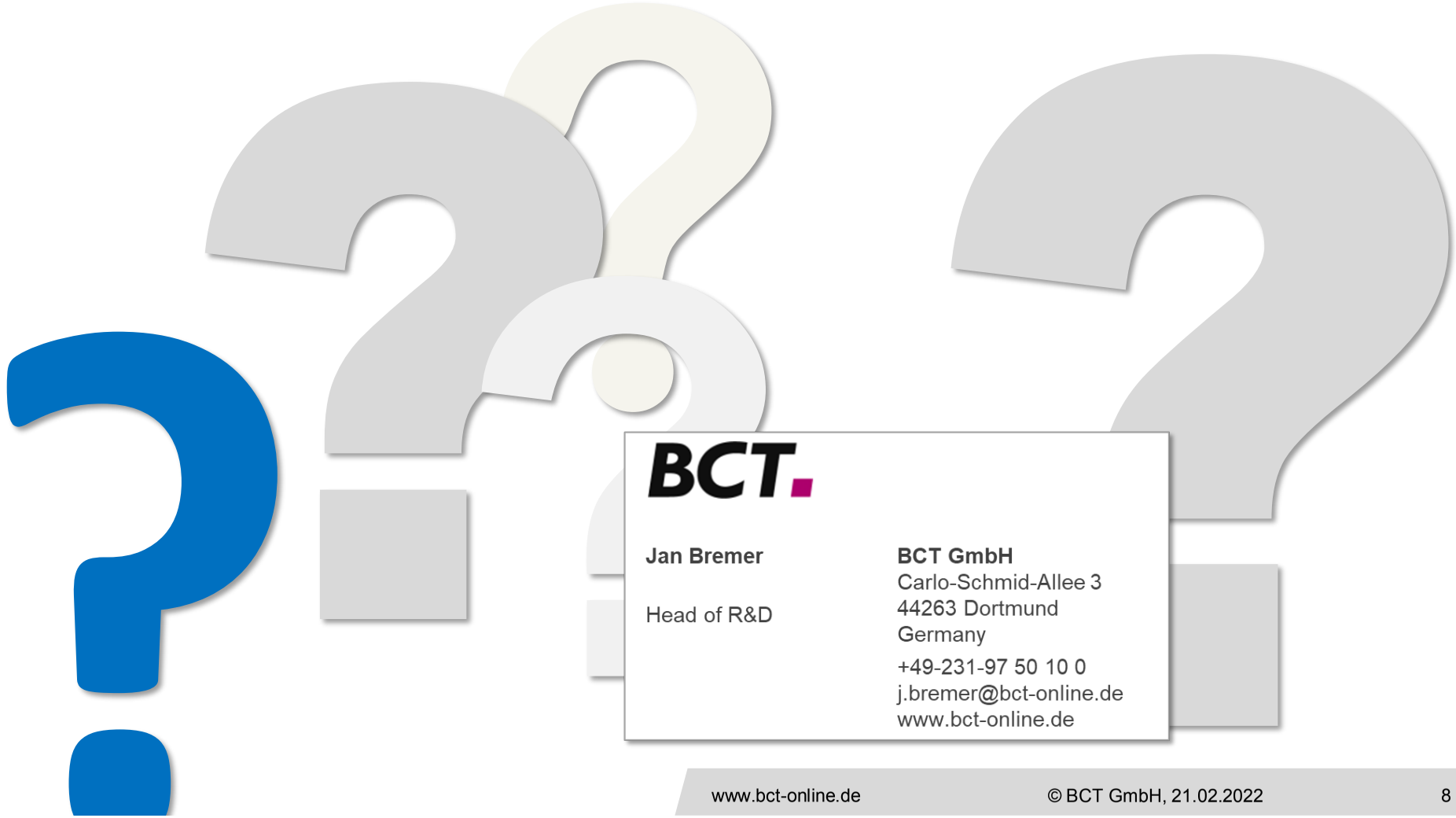
Mobile Machining of Large CFRP Structures 2018

MB FAST 18

a joint project of

FFT SICK Sensor Intelligence. SAUER DMG MORI BCT. Fraunhofer IFAM

Questions



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