

DLR - Center for lightweight production technology (Augsburg)

Florian Krebs, 29.11.2019



DLR German Aerospace Center



- Research Institution
- Space Agency
- Project Management Agency



Institutes Materials and High Performance Structures



Institute of Material Research

Cologne / Porz

Employees: 99

Turn over: 10,3 M€



Institute of Structures and Design

Stuttgart

Employees: 91

Turn over: 10,8 M€

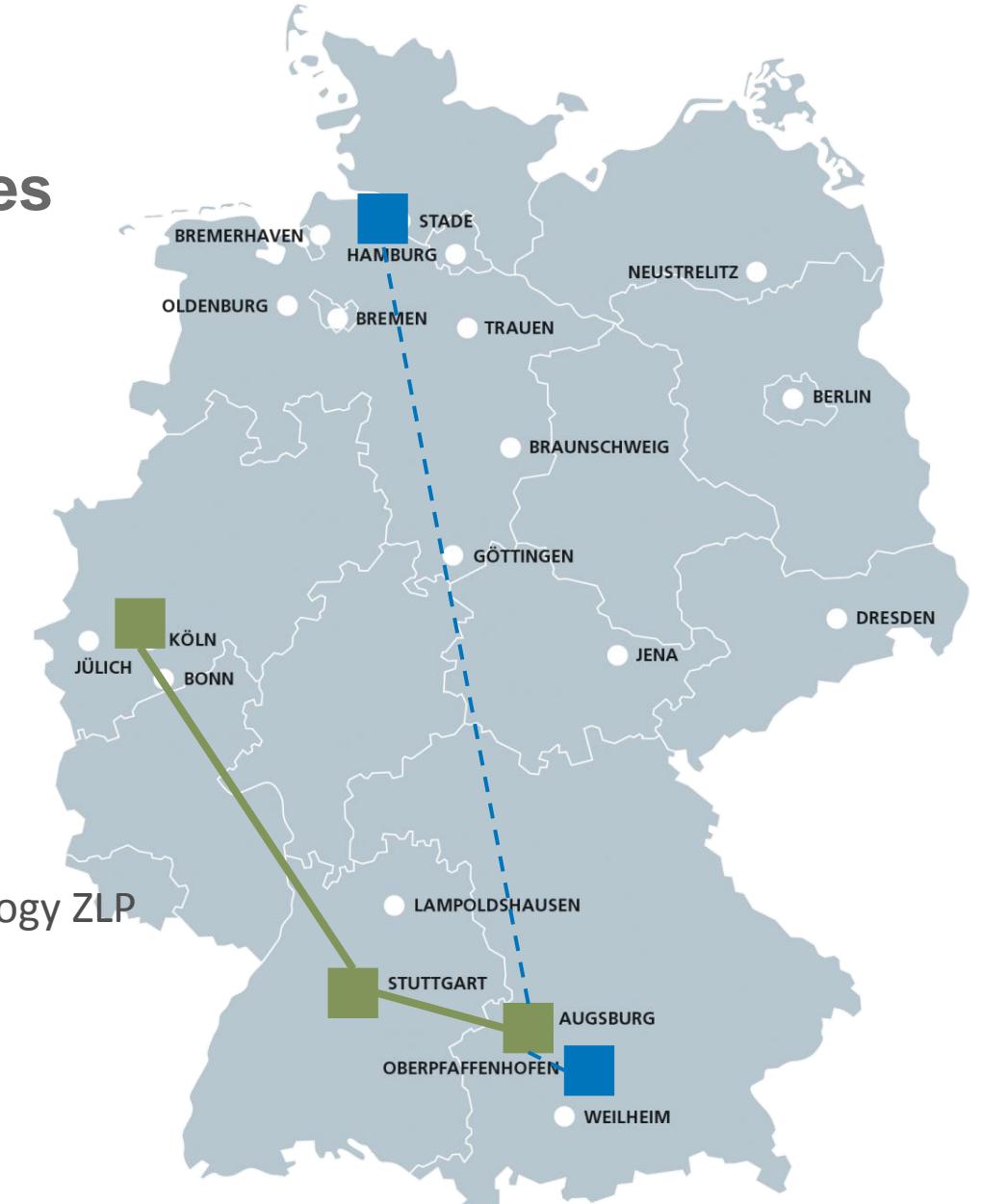


Center for Lightweight-Production Technology ZLP

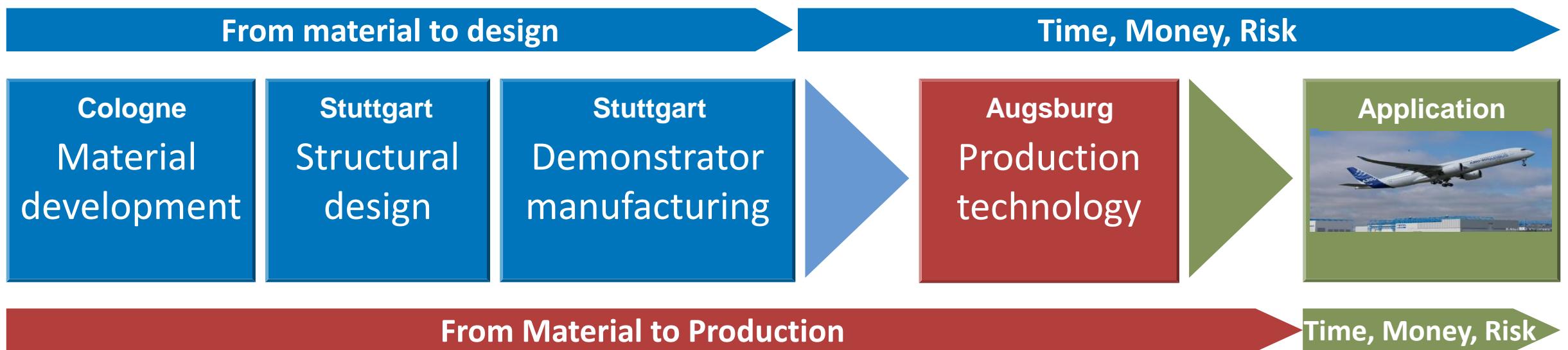
ZLP Site Augsburg

Employees: 40

Turn over: 6,0 M€



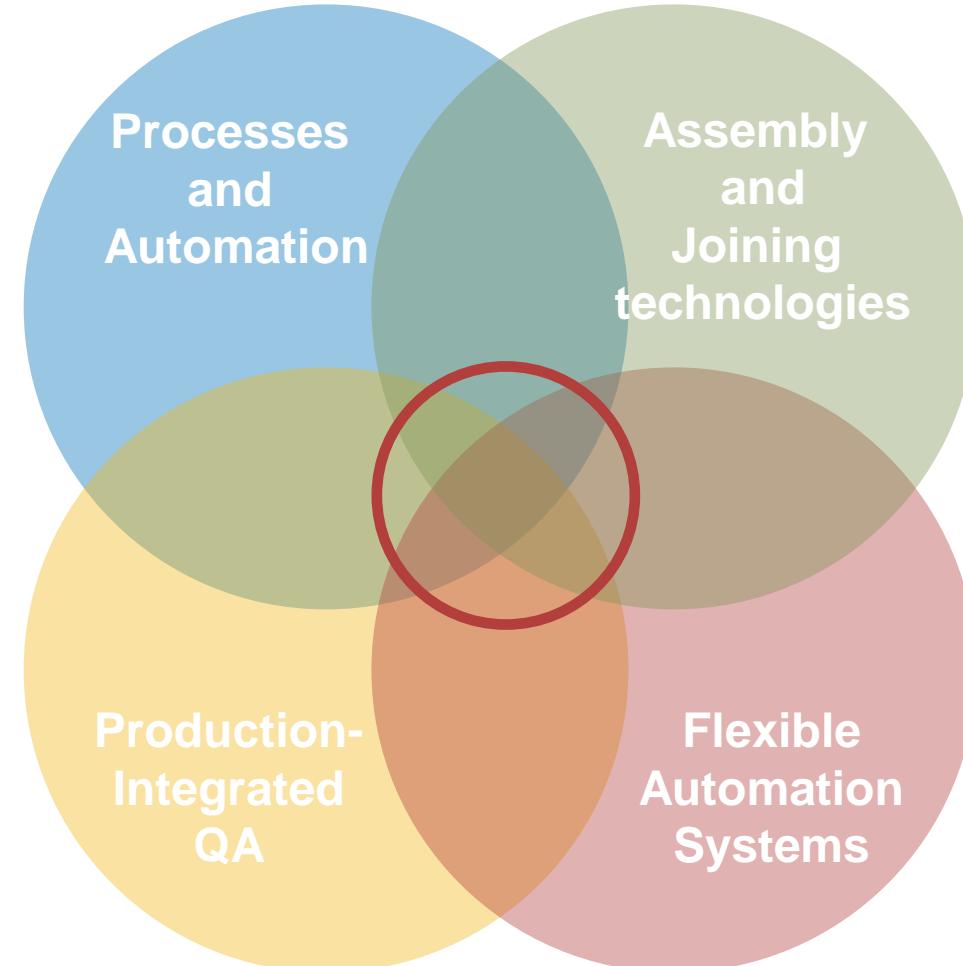
ZLP Augsburg mission statement



- Overcome technological „valley of death“
- Lower development risk and shorter time to market
- Sustainable research and development in key technologies

Integrated production technology development – way of working

- Manufacturing engineering
- CFRP Preforming technologies
- CFRP in-situ technologies
- Consolidation / Infusion and curing
- Development of QA strategies
- Process integrated assessment and data acquistion
- Data management and digital twins



- Joining technologies
- Mechanical joints
- Gluing & Shimming
- Surface preparation
- Assembly
- Multifunctional platforms and integration
- Intelligent program generation
- Human-Machine interaction

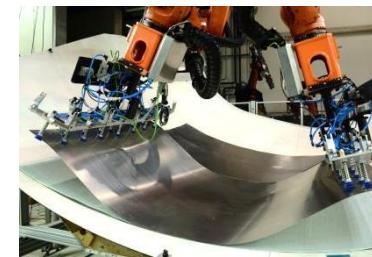
Processes and Automation – Preforming-Technologies

Automated Preforming

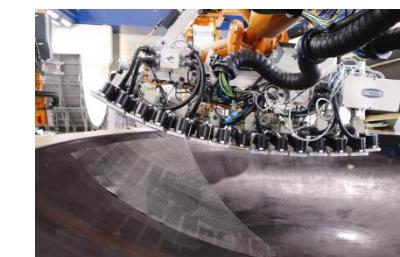
Pick & Place



Thermoplastic
layup



Fiber Metal
Laminates



CFRP Layup
(NCF)



Cooperating
NCF layup

Continuous
Processes



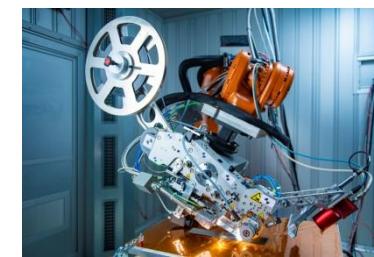
Wide DFP layup



Wide Prepreg layup



Winding & DFP



Thermoplastic AFP

Assembly and Joining technologies – Joining technologies

- Welding (e.g. thermoplastic)
mainly resistance welding, US welding of CFRPs; other technologies (e.g. Induction) in evaluation
- Gluing and surface activation
Surface pre-processing with atmospheric plasma treatment and surface activation assessment
- Mechanical joining technologies & machining challenges



Production-Integrated QA – Process integrated assessment



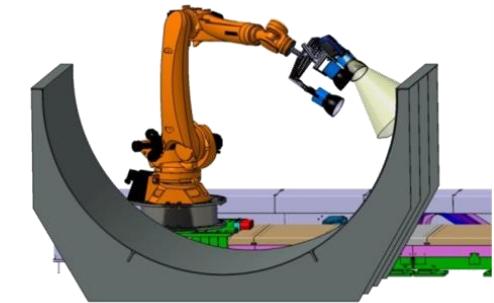
Cutpiece edge & FO
detection



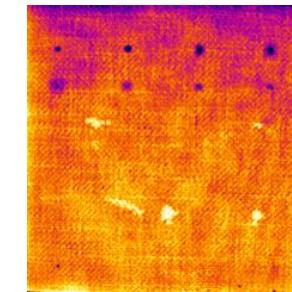
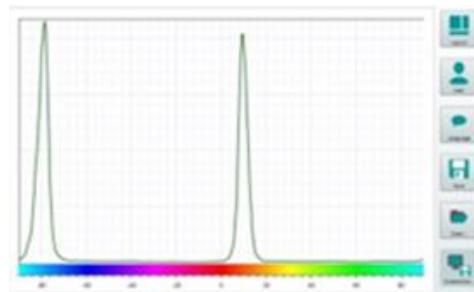
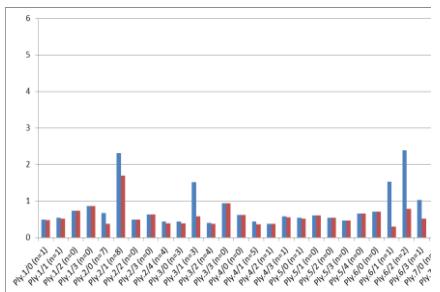
Fiber angle
measurement



Air induced US
inspection



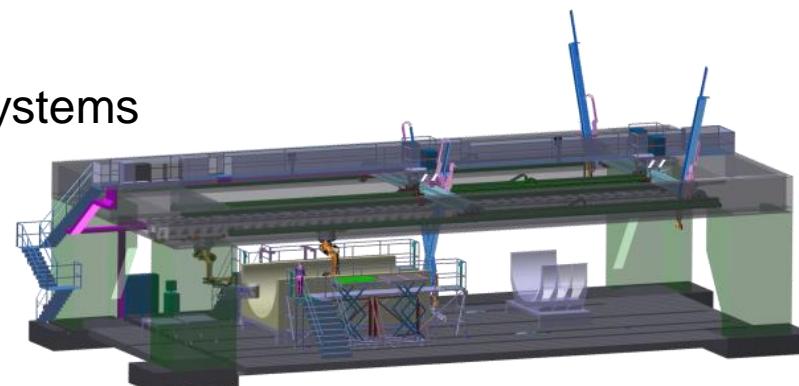
Thermography
(US & optical)



Comprehensive data acquisition and analysis

Flexible Automations Systems – Multifunctional Platforms

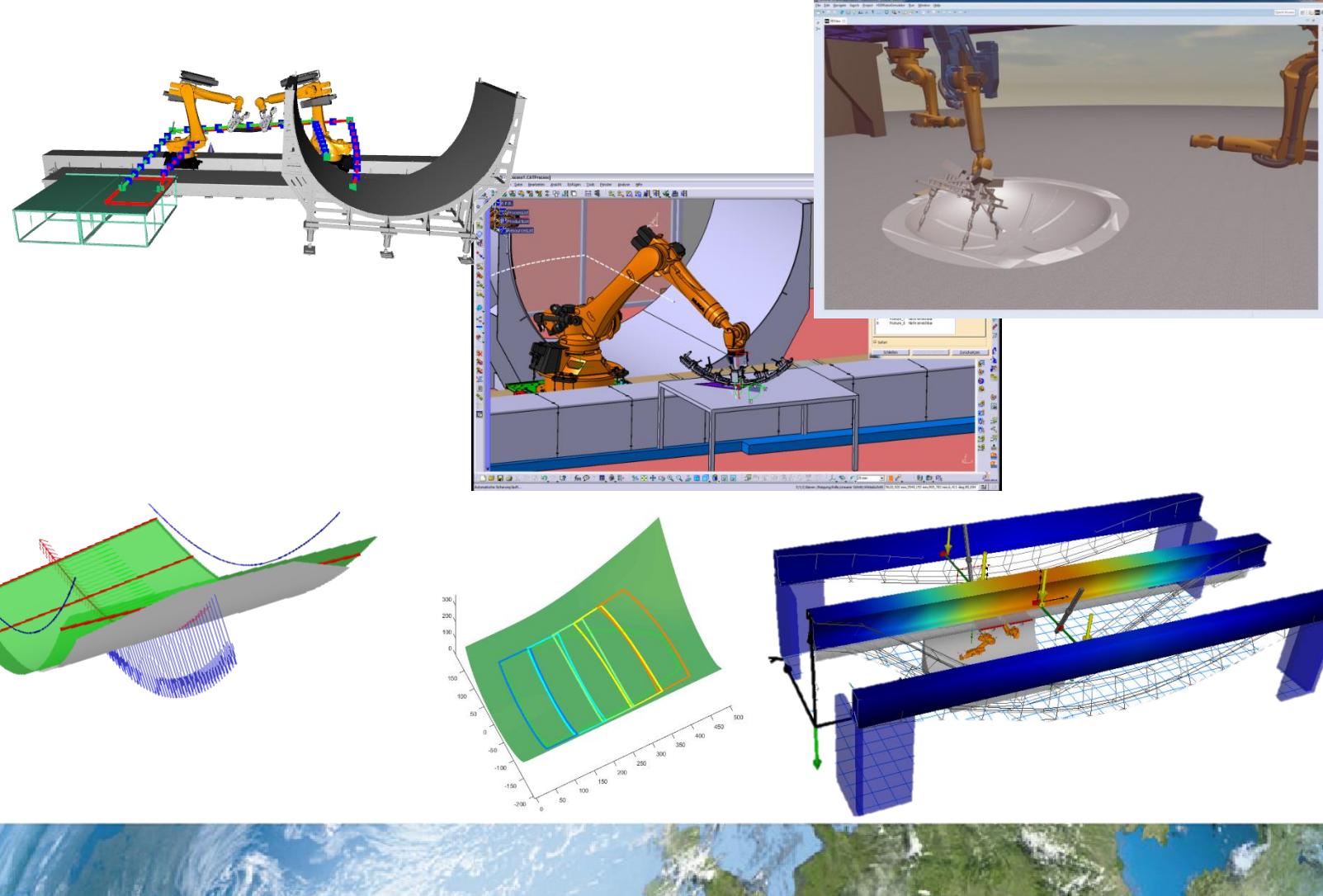
- Flexible production platforms
 - Cooperating robot teams
 - Cobots (collaborative robots)
 - Next step: Mobile robotics
- Software platforms
 - Usage of existing data resources
 - Automated data acquisition and meta-data annotation (→ IIoT)
 - Intelligent manufacturing execution systems (M2M Communication and planning)



Quelle: PAG / KUKA / DLR

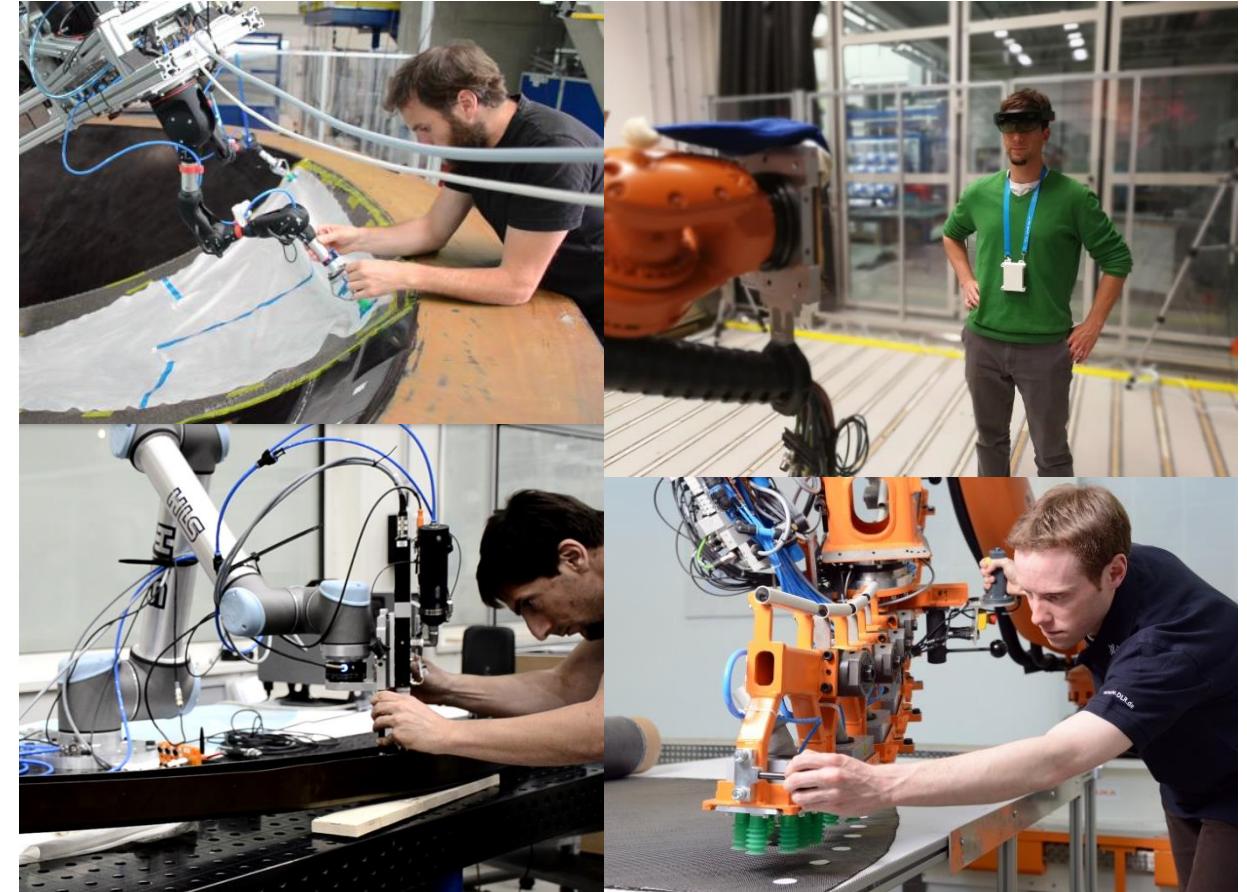
Flexible Automations Systems – Intelligent program generation

- Process oriented generation of machine programs
From: classical off-line programming
To: sensor based solutions
- Process simulation concerning production technology



Flexible Automations Systems – Human-Machine Interaction

- Workers as central element of future production
 - Collaboration between worker and machine(s)
 - Leverage of synergies between worker and machine
 - Enhanced ergonomics
 - Intuitive process controls
 - Visualisation technologies



Research platforms

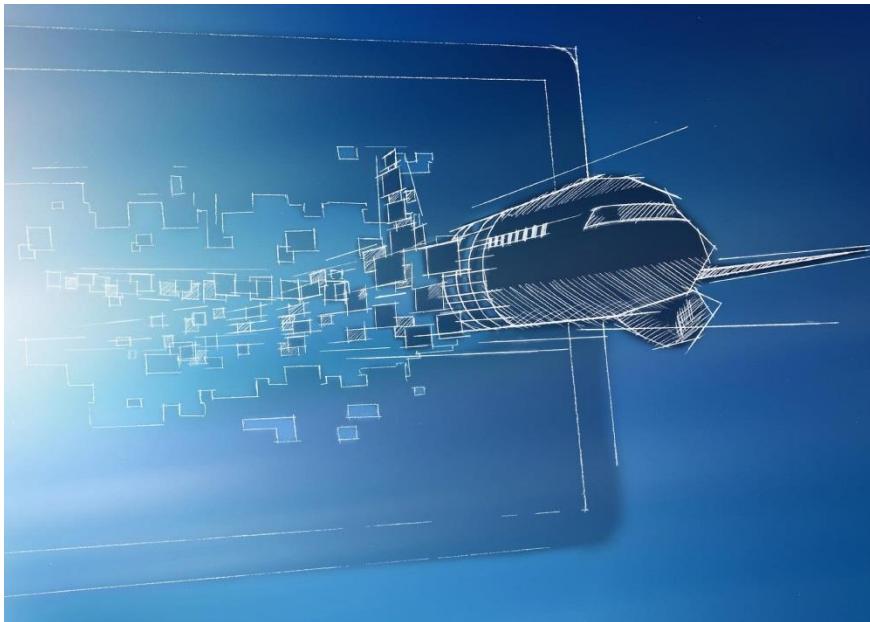
- 4 robotic work cells for diverse spectrum of application development
- **Multifunctional Cell (MFZ)**
 - 3 industrial robots on common linear track + 3 gantry portals for maximum reach
 - Approx. 28 x 12 x 6 m joint workspace
 - Suitable for full-scale production R&D
 - Partitionable in up to 4 independent robotic cells
- **Technology development cell (TEZ)**
 - 2 cooperating industrial robots on common track
- **In-line-Quality assurance cell (IQZ)**
 - High accuracy industrial robot
 - Separate indoor climate
- **Thermoplastic cell (TPZ)**
 - High temperature resistant industrial robot
 - Integrated with hot forming press



Summary & Possible collaboration partners

Our research in a nutshell ...

... providing agile production solutions in challenging industrial environments (e.g. Aerospace).

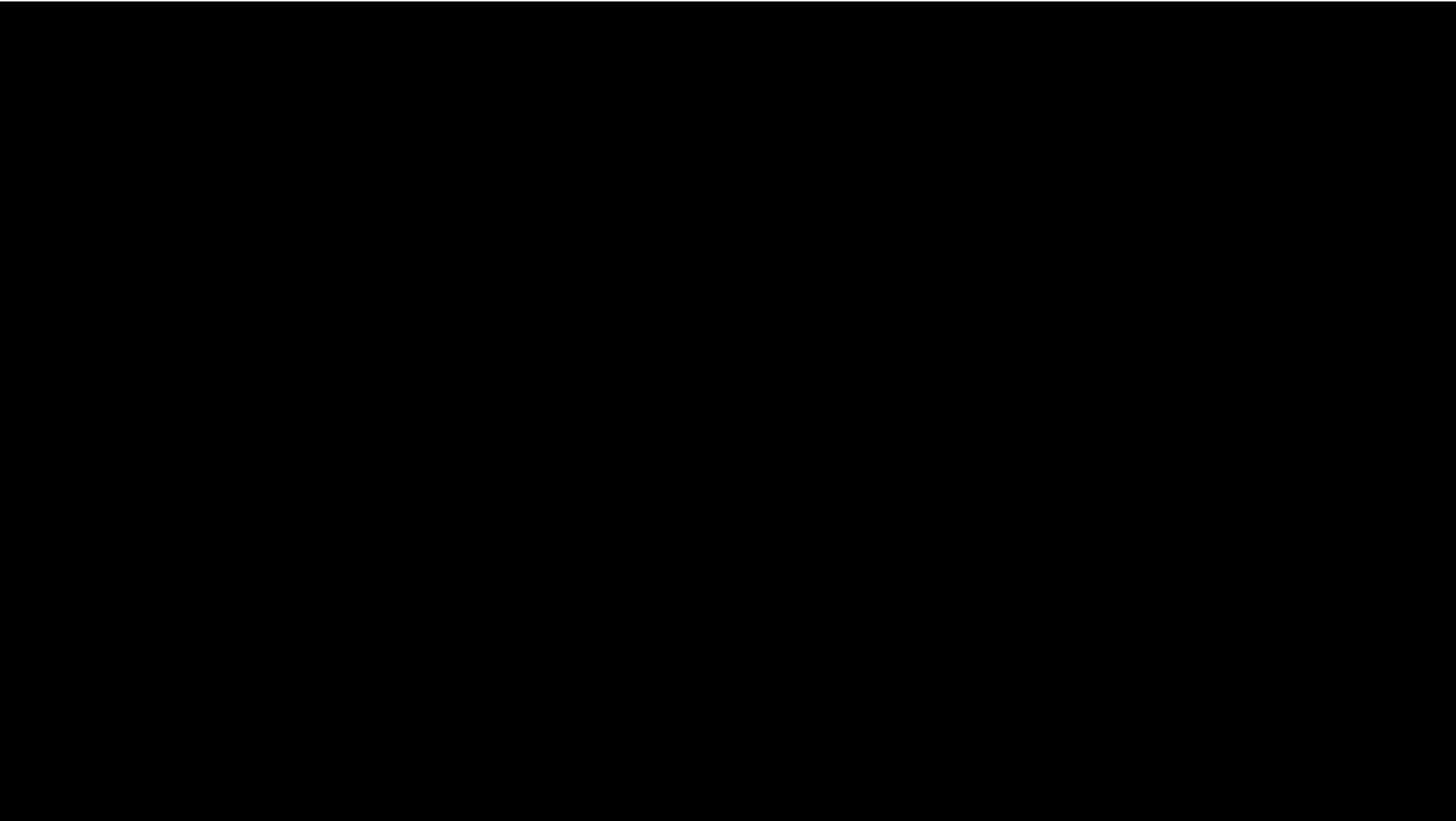


Possible partners include:

- OEMs and suppliers of lightweight components
- Machine suppliers
- Machine integrators
- Software-solution providers (e.g. OLP, process simulation)
- Certification Agencies
- Basically everyone along the value chain of automation system regarding lightweight components



Video



Thank you...

