Trilateral German-Japanese thin-ply automation project

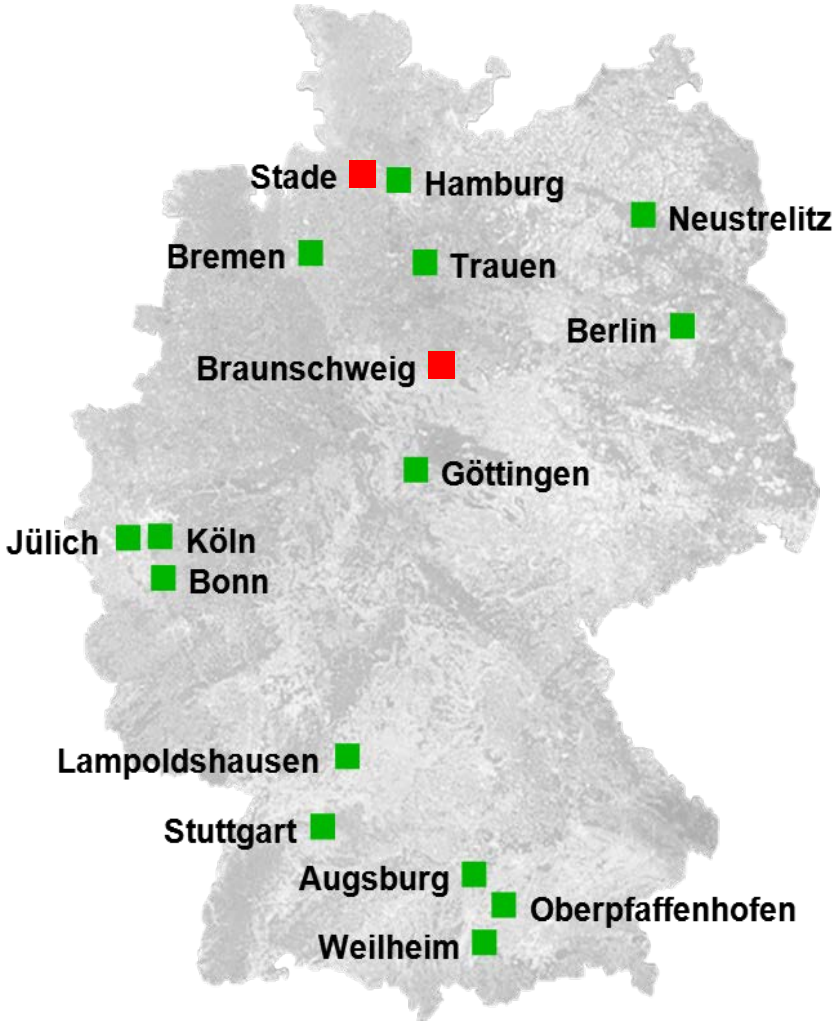
German Aerospace Center
Center for Lightweight-Production-Technology, Stade

Dipl.-Ing. Christian Buelow

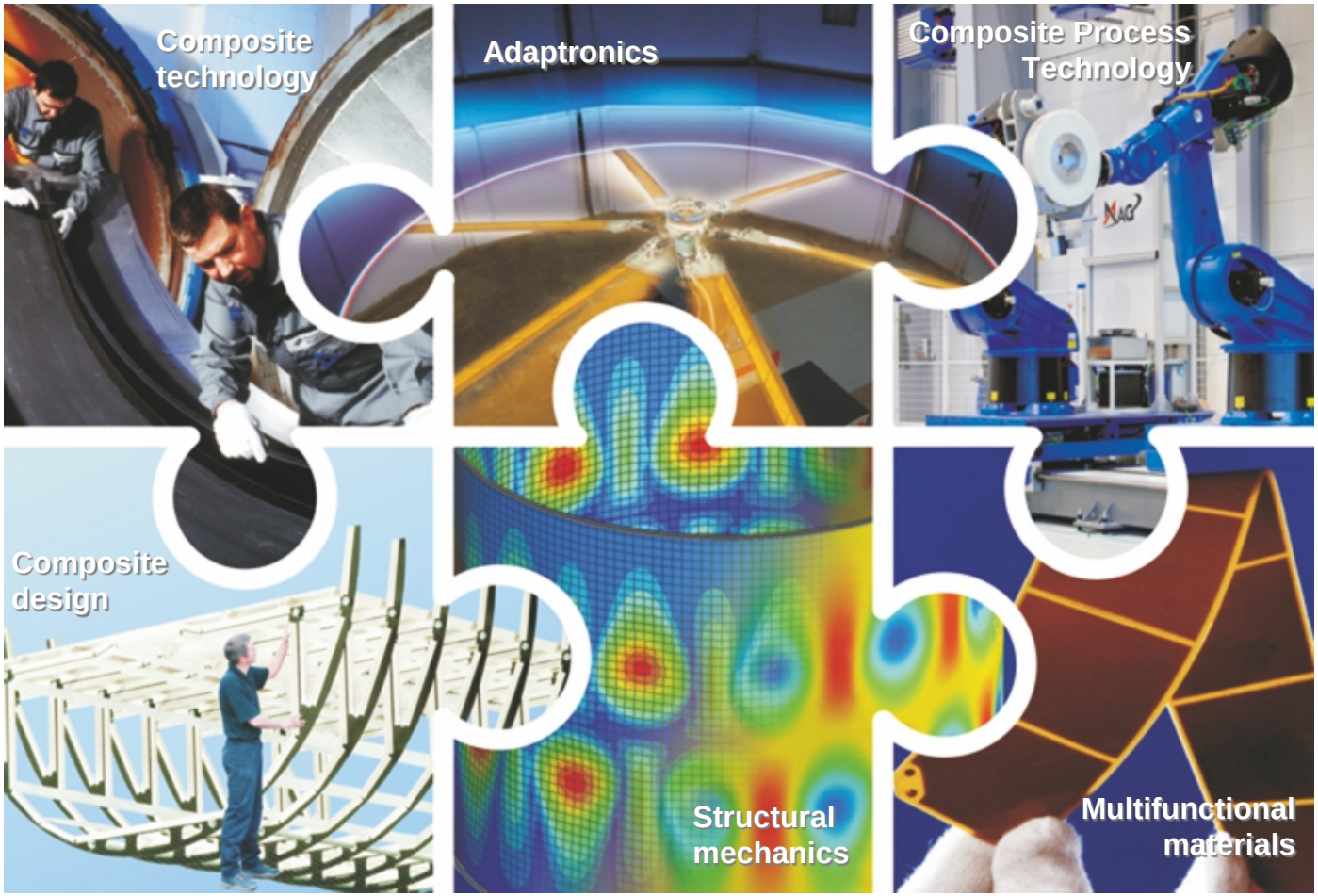
DLR

Overview of the DLR

- 8000 employees on 32 institutes or facilities at 16 sites
- Offices in Brussels, Paris, Tokyo, Singapur und Washington DC.
- Budget 2014
  - 870 MM € Research and operation
  - 460 MM € Space budget



DLR - Institute of Composite Structures and Adaptive Systems : 6 Departments



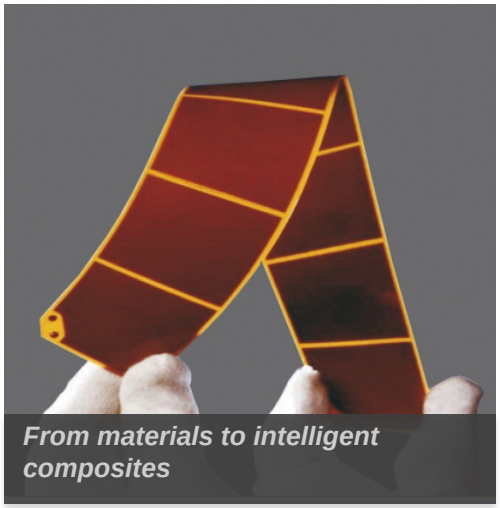
DLR

FA Professional Competences

Multifunctional Materials

Dr. P. Wierach

We increase the ability of the materials!



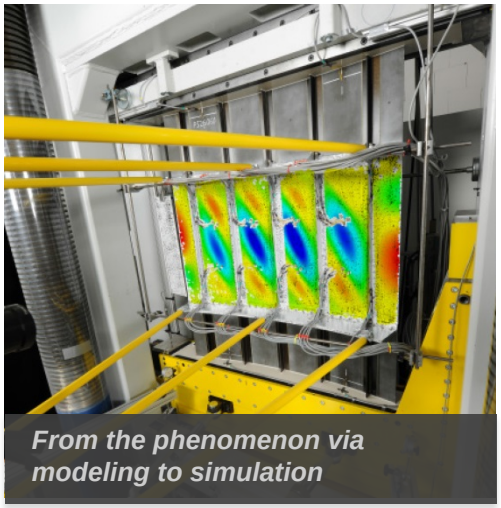
From materials to intelligent composites

- Fiber- and nanocomposites
- Smart materials
- Structural health monitoring
- Material characterization

Structural Mechanics

Dr. T. Wille

With high fidelity to virtual reality for the entire life cycle!



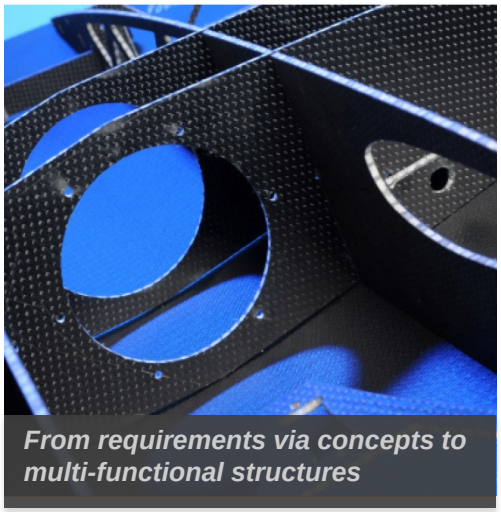
From the phenomenon via modeling to simulation

- Global design methods
- Stability and damage tolerance
- Structural dynamics
- Thermal analysis
- Multi-scale analysis
- Process simulation

Composite Design

Dr. C. Hühne

Our design for your structures!



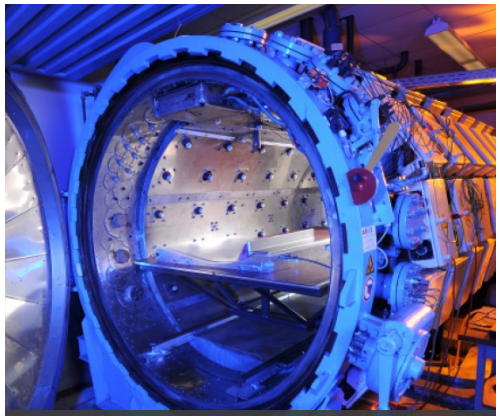
From requirements via concepts to multi-functional structures

- Design and Sizing
- Structure concepts and assessment
- Multi-functional structures
- Shape-variable structures
- Hybrid structures

Composite Technology

Dr. M. Kleineberg

Tailored manufacturing concepts



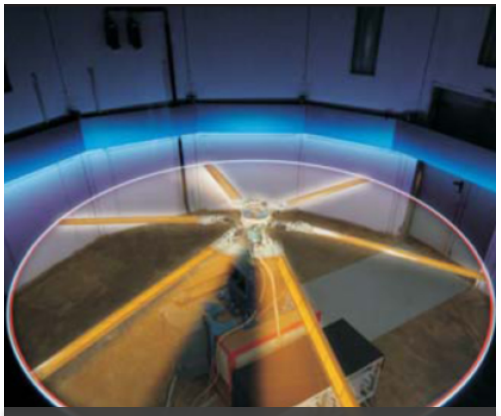
From the idea via processes to prototypes

- New technologies for manufacturing
- Hybrid manufacturing
- Assembly
- Repair
- Process automation

Adaptronics

Dr. H. P. Monner

The adaptronics pioneers in Europe



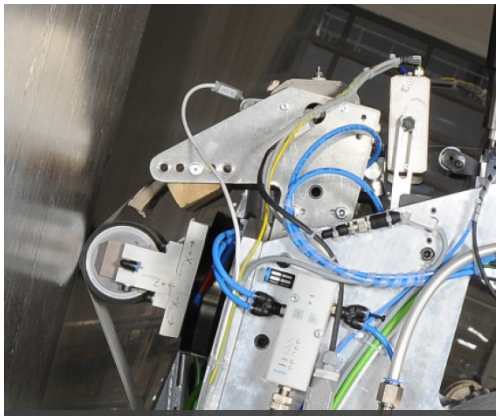
From functional composites to adaptive systems

- Simulation and demonstration of adaptive systems
- Active vibration control
- Active noise control
- Active shape control
- Autarkic systems

Composite Process Technology (ZLP)

Dr. J. Stüve

Research with industrial dimension



For sustainable processes

- Automated FP, TL and DFP
- Online QA within autoclaves
- Automated manufacturing for mass-production
- Simulation methods for maximum process reliability and process assessment

ZLP Site Stade

„CFK-Nord“: 20.000 m² for cooperation and innovation

DLR

- ProductionTechnology Single Components
- Virtual Composite Product Development

Fraunhofer IFAM

- Assembly Technology
- Joining Technology
- Prototype Assembly

AIRBUS GROUP INNOVATIONS

- Textile Technology Process Engineering
- Lightweight Design

DOW

- Fundamental Materials Research (e.g. novel resins)

Profile NTH

TECHNISCHE UNIVERSITÄT CAROLO-WILHELMINA ZU BRAUNSCHWEIG

TU Clausthal

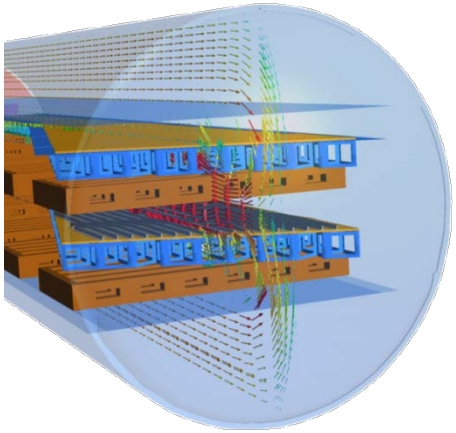
Leibniz Universität Hannover

20.000 qm for cooperation and innovation

DLR

ZLP Site Stade

Team OnQA – Online QA for the autoclave



Goals:

- Higher part quality
- Monitoring of all relevant parameters
- Control of the autoclave according to part condition

Research focus:

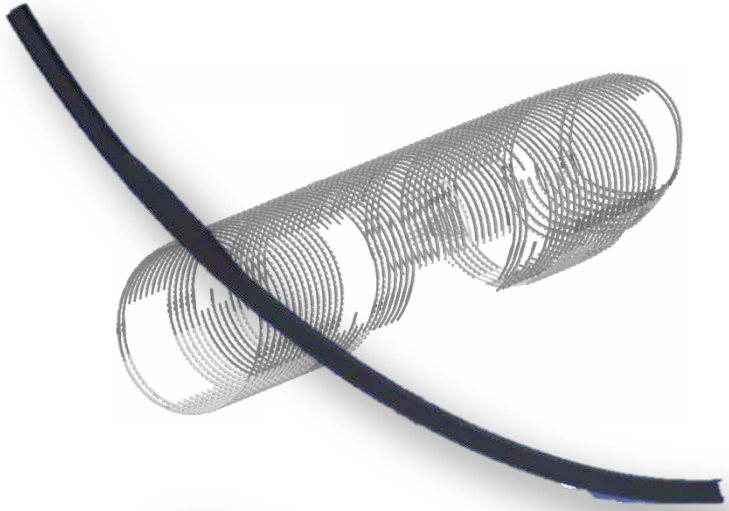
- Design and test of new sensor technologies
- Virtual autoclave for simulation
- Intelligent control (Masterbox)

Key Facts:

- Length: 20m, diameter: 5.8m,
- Tmax: 420°, pmax: 10 bar

ZLP Site Stade

Team EVo – Netshape RTM parts in high volumes



Goals:

- Automated production of complex RTM parts
- 100,000 Parts/year
- Net-shape production

Research focus:

- Design and test of new Draping technologies
- Injection concepts and Simulation
- High precision trimming (< 0.1 mm)
- Integrated QA (Preforming and RTM)

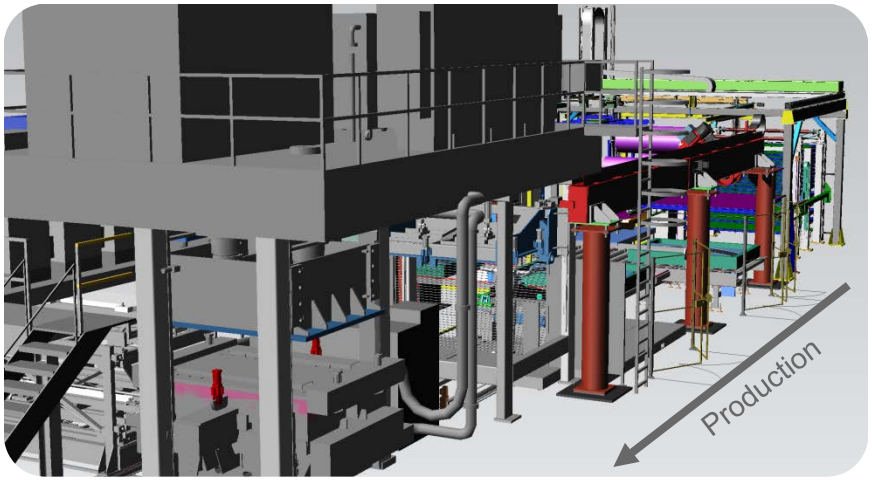
Key Facts:

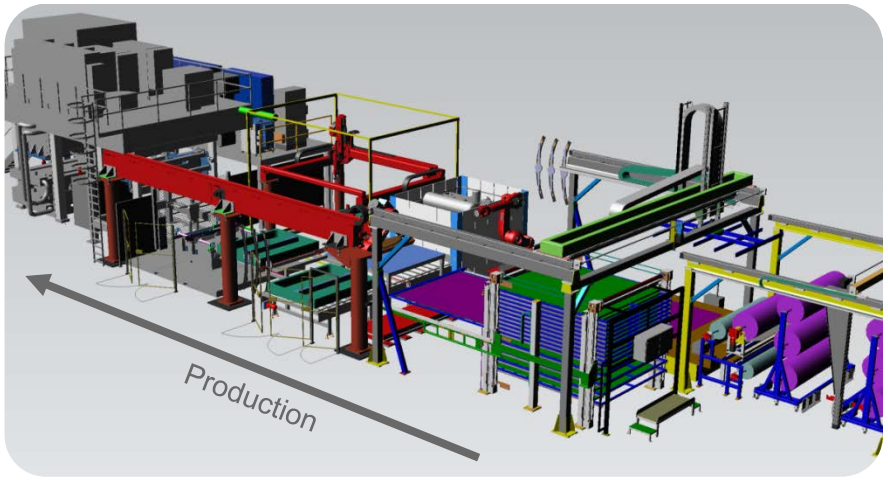
- Production line: 40 x 8m
- Max. part size: 2 x 2.5m
- RTM press: 500 tons

DLR

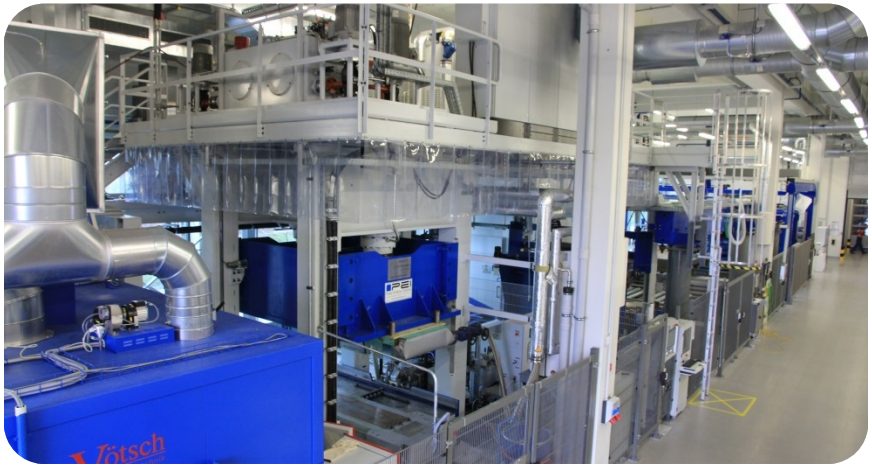
ZLP Site Stade

Overview EVo





RTM-Area	Preforming Area	Ply Preparation Area



ZLP Site Stade

Team GroFi – Advanced Fiber Placement

Goals:

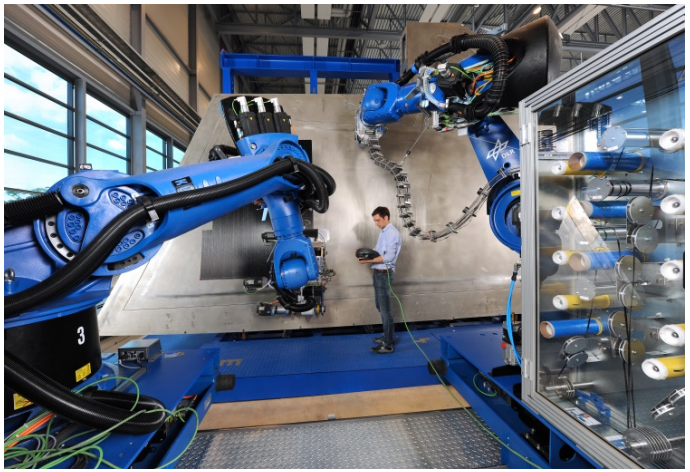
- Higher mass throughput (factor 10)
- Coordination: maximum 8 robots
- Combination of Tapelaying and Fiberplacement
- Online-QA

Research focus:

- Workshare and Active production control
- Design for production
- Sensors

Key Facts:

- Max. part dimension: 18m x 5.5m
- Layup-rate: 150 kg/h
- Actual: 2 ATL-, 2 AFP- and 1 DFP-Unit

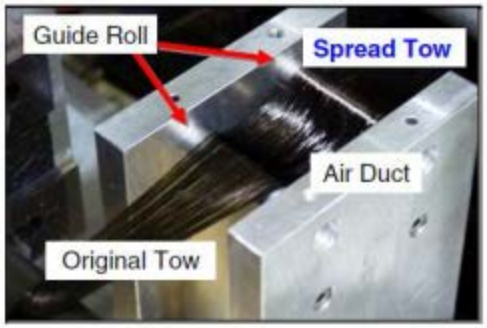


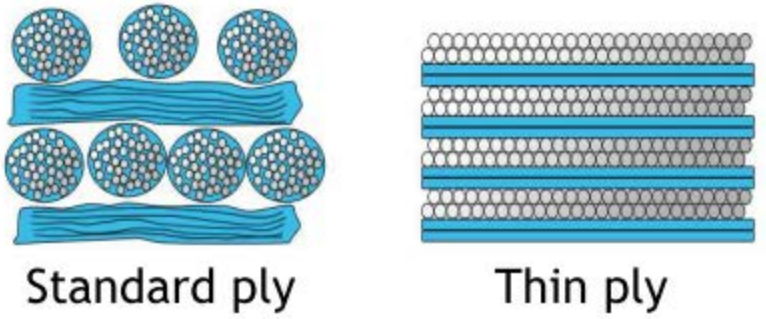
ZLP Site Stade

Project GroFi – Advanced Fiber Placement

Background of Thin-plies

- “FUKUI method Tow-spreading Technology” enables producing thinner plies





Benefits

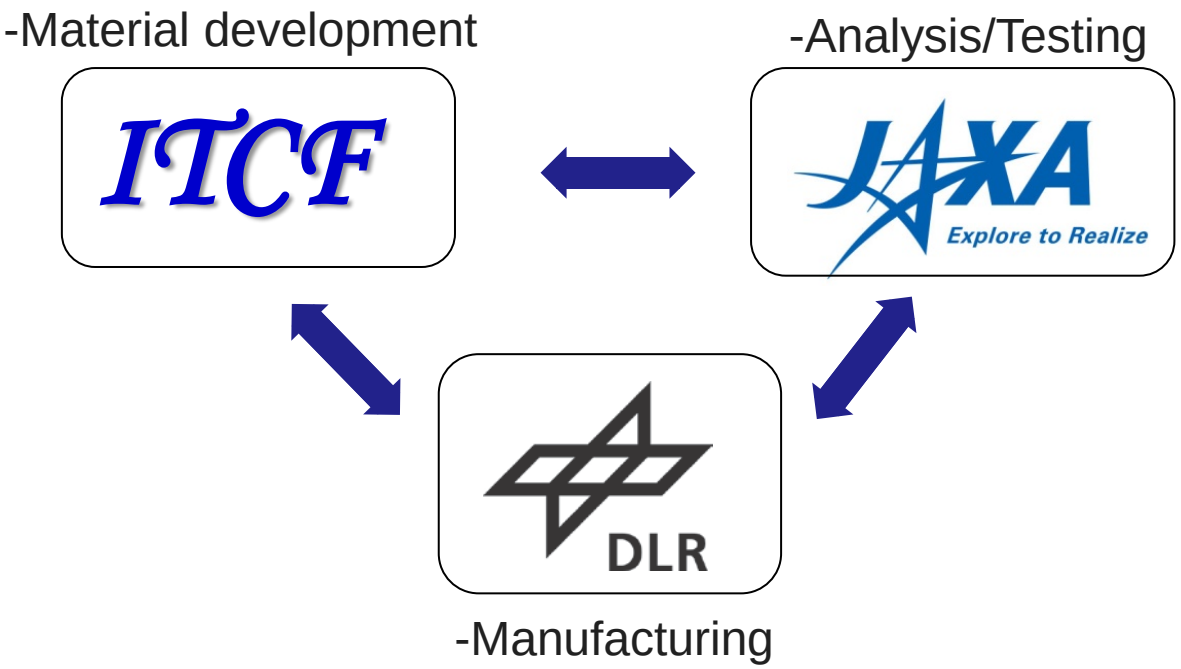
- Suppression of microcracks and de-lamination → good impact behavior
- Thinner lamina at QI design
- Slight improvement of mechanical properties

Drawbacks

- Increase of manufactoring time and cost

→ Application of automated lay-up is necessary

Trilateral project: Partner and Tasks



-Project start: 07/2016

-Project duration: 2.5 years

-Project financing: every partner finances his own expenses

Cooperation up to now

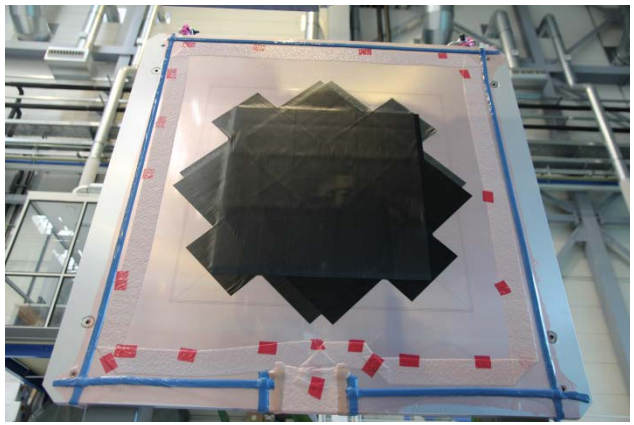
ITCF

- Provision of thin-ply material for ATL lay up trials in Stade
- Manual and automatic lay up of CAI laminates with thin ply prepreg
- DLR provide information about the processability to Fukui

JAXA

- Exchange of personal

→ Basis for the coming project



Future perspective

Start of a bigger, funded thin-ply project

- Involvement of industrial partners from aerospace industry
- Funded by:
  - EU (CHATT-project successor)
  - German-Japanese research support

THANK YOU FOR YOUR ATTENTION!

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