Trilateral German-Japanese thin-ply automation project

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

Dipl.-Ing. Christian Buelow
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

- Composite technology
- Adaptronics
- Composite Process Technology
- Composite design
- Structural mechanics
- Multifunctional materials
Multifunctional Materials
Dr. P. Wierach
We increase the ability of the materials!

- 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!

- 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!

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

Dr. M. Kleineberg

Tailored manufacturing concepts

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

Adaptronics

Dr. H. P. Monner

The adaptronics pioneers in Europe

- 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

- 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

20,000 qm for cooperation and innovation
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
ZLP Site Stade
Overview EVo
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 delamination → good impact behavior
- Thinner lamina at QI design
- Slight improvement of mechanical properties

Drawbacks
- Increase of manufacturing time and cost
- Application of automated lay-up is necessary
Trilateral project: Partner and Tasks

- Material development
  - ITCF

- Analysis/Testing
  - JAXA

- Manufacturing
  - DLR

- 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